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THE NEW INTERNATIONAL ENCYCLOPÆDIA

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KEY TO PRONUNCIATION.

ā	as in ale, fate. Also see **ĕ**, below.
ā̇	“ “ senate, chaotic. Also see **ĕ**, below.
â	“ “ glare, care.
ă	“ “ am, at.
ä	“ “ arm, father.
ȧ	“ “ ant, and final *a* in America, armada, etc. In rapid speech this vowel readily becomes more or less obscured and like the neutral vowel or a short u (ŭ).
a	“ “ final, regal, where it is of a neutral or obscure quality.
a̤	“ “ all, fall.
ē	“ “ eve.
ē̇	“ “ elate, evade.
ĕ	“ “ end, pet. The characters *ĕ*, *ā*, and *ā̇* are used for *ä* in German, as in Gärtner, Gräfe, Hähnel, to the values of which they are the nearest English vowel sounds. The sound of Swedish *ä* is also indicated by *ĕ*.
ẽ	“ “ fern, her, and as *i* in sir. Also for *ö*, *oe*, in German, as in Göthe, Goethe, Ortel, Oertel, and for *eu* and *oeu* in French, as in Neufchâtel, Crèvecœur; to which it is the nearest English vowel sound.
e	“ “ agency, judgment, where it is of a neutral or obscure quality.
ī	“ “ ice, quiet.
ī̇	“ “ quiescent.
ĭ	“ “ ill, fit.
ō	“ “ old, sober.
ō̇	“ “ obey, sobriety.
ô	“ “ orb, nor.
ŏ	“ “ odd, forest, not.
o	“ “ atom, carol, where it has a neutral or obscure quality.
oi	“ “ oil, boil, and for *eu* in German, as in Feuerbach.
o͞o	“ “ food, fool, and as *u* in rude, rule.
ou	“ “ house, mouse.
ū	“ “ use, mule.
ū̇	“ “ unite.
ŭ	“ “ cut, but.
ụ	“ “ full, put, or as *oo* in foot, book. Also for *ü* in German, as in München, Müller, and *u* in French, as in Buchez, Budé; to which it is the nearest English vowel sound.
û	“ “ urn, burn.
y	“ “ yet, yield.
B	“ “ the Spanish Habana, Cordoba, where it is like a *v* made with the lips alone, instead of with the teeth and lips.
ch	“ “ chair, cheese.
D	as in the Spanish Almodovar, pulgada, where it is nearly like *th* in English then, this.
g	“ “ go, get.
G	“ “ the German Landtag, and *ch* in Feuerbach, buch; where it is a guttural sound made with the back part of the tongue raised toward the soft palate, as in the sound made in clearing the throat.
H	as *j* in the Spanish Jijona, *g* in the Spanish gila; where it is a fricative somewhat resembling the sound of *h* in English hue or *y* in yet, but stronger.
hw	“ *wh* in which.
K	“ *ch* in the German ich, Albrecht, and *g* in the German Arensberg, Mecklenburg; where it is a fricative sound made between the tongue and the hard palate toward which the tongue is raised. It resembles the sound of *h* in hue, or *y* in yet; or the sound made by beginning to pronounce a *k*, but not completing the stoppage of the breath. The character K is also used to indicate the rough aspirates or fricatives of some of the Oriental languages, as of kh in the word Khan.
n̲	as in sinker, longer.
ng	“ “ sing, long.
N	“ “ the French bon, Bourbon, and *m* in the French Etampes; where it is equivalent to a nasalizing of the preceding vowel. This effect is approximately produced by attempting to pronounce ‘onion’ without touching the tip of the tongue to the roof of the mouth. The corresponding nasal of Portuguese is also indicated by N, as in the case of São Antão.
sh	“ “ shine, shut.
th	“ “ thrust, thin.
TH	“ “ then, this.
zh	as *z* in azure, and *s* in pleasure.

An apostrophe ['] is sometimes used to denote a glide or neutral connecting vowel, as in tā'b'l (table), kăz″m (chasm).

Otherwise than as noted above, the letters used in the respellings for pronunciation are to receive their ordinary English sounds.

When the pronunciation is sufficiently shown by indicating the accented syllables, this is done without respelling; as in the case of very common English words, and words which are so spelled as to insure their correct pronunciation if they are correctly accented. See the article on PRONUNCIATION.

THE NEW INTERNATIONAL ENCYCLOPÆDIA

SOUTH AUSTRALIA. A State of the Commonwealth of Australia occupying the central part of the continent, and bounded on the north by the Timor and Arafura Seas, on the east by Queensland, New South Wales, and Victoria, on the south by the Indian Ocean (Great Australian Bight), and on the west by Western Australia (Map: Australia, F 5). It crosses the continent from the north to the south coast in a band for the most part 550 to 700 miles wide, with a length of 1850 miles. Its area is 903,690 square miles. It is the second in size among the Australian States, and nearly one-third as large as the United States, excluding Alaska. It is divided into South Australia proper and the Northern Territory, the latter having an area of 523,620 square miles.

Physical Features. The State has no sharply differentiated geographical divisions. It is, as a whole, a vast plain of no great elevation, in some places lying even at or below sea-level. A mountain range but slightly exceeding 3000 feet in its highest summits runs north from Cape Jervis, near Adelaide, and minor ranges or isolated hills are found in the interior and northern portions, becoming quite rugged, though not high, in the extreme north. The State has practically no drainage system. The Murray enters the southeastern corner, but from its mouth in Encounter Bay to the western boundary not a single river reaches the ocean. In the interior there are a number of river-courses which are dry for a great part of the year, and even in the wet season are lost in marshes or salt lakes. The extreme northern portion, however, is comparatively well watered. In the great depression north of Spencer Gulf there are a number of large lakes, several of them being 100 miles in length. They are brackish and shallow, being reduced during the dry season to marshes or mud-flats, covered with salt crusts.

Climate, Soil, and Flora. Considering the fact that the State has a range of nearly 27 degrees of latitude, its climate is remarkably uniform. It is in general very hot and dry; the temperature even on the south coast may remain at 110° or 115° for several days at a time. The annual rainfall in the southeast, at Adelaide, is about 24 inches, but may in some years fall to 15 inches. In the interior it is always very scanty, but on the north coast it is more abundant, sometimes reaching 60 to 70 inches. Rain is generally confined to the winter, which is mild and pleasant. There are considerable areas of good agricultural and pastural land in the south. The interior, however, consists largely of treeless plains in some parts absolutely barren, stony or sandy, or covered with a dry scrub, but here and there producing good pasture grass during the wet season. Large areas are covered with spiny grass wholly unfit for pasture. Trees are found only in the neighborhood of the mountains or larger river courses, but the hilly region east of the southern range is well timbered. The flora is not as rich as that of the eastern States. The main timber trees are Eucalyptus and Acacia, with some pines, while the Pandanus and palms are found in the north.

Geology. The greater part of the surface is covered with recent formations, Cretaceous in the east, but in the main Tertiary. There are, however, numerous outcrops and some extensive areas of ancient rocks. Thus the mountain region from Spencer Gulf northward consists mainly of Silurian strata. Granite crops out in numerous places in the mountains of the interior, and the extreme northern portion, between the Roper and Victoria Rivers, is a complex of granites and metamorphic and Paleozoic rocks, with numerous intrusions of trap and recent volcanic rocks. The Paleozoic limestones are very rich in copper, and argentiferous lead, bismuth, and gold are also found. Iron is known to exist in large quantities, but it cannot be worked, as there are no coal beds.

Mining. Copper is the chief mineral mined, the average annual output of which was a little less than 100,000 hundredweight between 1894 and 1900, the value in the latter year being £371,920.

Agriculture. South Australia ranks second among the Commonwealth States in respect to acreage under cultivation. It amounted in 1900-01 to 3,279,406 acres. Of this, 1,913,247 acres were devoted to wheat, this crop constituting the chief source of wealth. In the same year there were 15,352 acres of barley, 27,988 acres of oats, 341,330 acres of hay, 35,323 of green fodder, 6628 of potatoes, and 31,841 of minor crops, including fruits. Vine cultivation is a prosperous industry, the area having increased from 12,314 acres in 1891 to 20,158 in 1901, the wine production in the latter year amounting to 1,388,847 gallons. The small rainfall confines farming mainly to the southeastern part of the State. The disposal of the public land by perpetual lease has become common. The State has adopted the policy of repurchasing large estates and leasing them to farmers. Some progress has been made in irrigation, the water supply being drawn from both rivers and artesian wells. The number of sheep has declined from about 7,000,000 in 1890 to 5,283,247 in 1901. The number of cattle increased during that period, being 472,428 in 1901. In the latter year there were 179,352 horses.

MANUFACTURES. In 1901 there were 17,513 people employed in 1047 factories. The manufacturing industry is confined mainly to production for local consumption, or of food products, especially flour, for export.

COMMERCE. Almost from the beginning railroads were constructed and operated by the Government, and in 1901 all but 14 miles of the 1916 total mileage were in the hands of the State. The greater part of this was in the southeastern part of the State, only 166 miles being in the Northern Territory. The Government realizes a profit of about 3 per cent. upon its railways. The imports and exports are of about equal value and have each amounted for more than a decade to about eight million pounds sterling in annual value. Adelaide, the chief port, ranks third among the Australian ports. Less than half the exports are of domestic produce. The most valuable export is wool, after which rank wheat and flour, and minerals. The other Australian colonies and the United Kingdom handle nearly all the trade. There are considerable imports from the United States.

GOVERNMENT. The Governor of the State is appointed by the British Government. The Executive Council is composed of six members. The Legislature consists of a Legislative Council of 18 elected members and a House of Assembly of 42 elected members. The State has extended the right of suffrage to women. The northern half of the State is called the Northern Territory, and its government is administered by a commissioner delegated by the State. Adelaide (q.v.) is the capital.

FINANCE. There is a progressive land and income tax. The tax levy is increased upon land held by absentees. The State also collects death duties and stamp duties. The total revenue in 1902 was £2,667,560, and the expenditure £2,650,876. The customs revenue for the fiscal year 1901-02 was £605,000. The public debt in 1902 amounted to £27,272,545, the bulk of which is represented by assets of productive public utilities.

STATE ACTIVITIES. The Government has been very progressive in undertaking enterprises that are generally left to private initiative. The telegraph and telephone lines, including the transcontinental line from Adelaide to Port Darwin, also the postal system and water works, are owned and operated by the Government. The State has tried to foster industries by the establishment of produce depots, and by performing the function of agent in order to facilitate the marketing of produce; and also by the establishment of cyanide works and smelters to facilitate mining. A State bank supplies capital to farmers on easy terms. Laws have been passed to secure the compulsory settlement of industrial disputes.

POPULATION. The population increased from 14,600 in 1840 to 319,145 in 1890 and 362,604 in 1901. The greater part of the population is located in the southeastern part of the State. Only 4096 persons were reported in the last census for the Northern Territory. Nearly the whole population is of British origin. In 1901 Adelaide and its suburbs had a population of about 162,200, and Port Pirie had 7983.

RELIGION. In 1901 the membership of the principal churches was as follows: Church of England, 106,987; Roman Catholic, 52,193; Methodist, 90,125; Lutheran, 26,140; Baptist, 21,764; Presbyterian, 18,357; and Congregationalist, 13,338.

EDUCATION. Primary education is free, and is compulsory between the ages of 7 and 13. Religious instruction may be given, but not during ordinary school hours. In 1901 there were 69,115 scholars enrolled at the State schools. The public school teachers are paid from the general revenue. There is a secondary school for girls at Adelaide, and fees are charged. All other secondary schools are private or denominational. In 1901 there were 11,310 scholars enrolled at private schools. The University of Adelaide and a number of technical schools are aided by the State.

HISTORY. The explorations of Flinders in 1802 and of Sturt in 1830 first called attention to South Australia. Its real settlement is due to an association formed to put into practical operation the colonization theories of Edward G. Wakefield (q.v.); but its early application for a charter, in 1831, was rejected, and it was not until 1835 that permission was given for the formation measuring 190 miles in a straight line fronting should attach to the home Government. A year later settlers landed and founded the town of Adelaide. South Australia became a crown colony in 1841. The early basis for the prosperity of South Australia was agricultural, though in 1841 galena deposits were discovered, followed in 1842 by the discovery of copper. The population of 19,000 in 1844 became 92,500 ten years later, while the exports increased from £100,000 to £1,300,000 during the same period. The Torrens land system was adopted in 1858. A separate colonial constitution dates from 1856, the year of the opening of the first railway from Adelaide to its port. The explorations of Eyre in 1840 opened up the cattle region of the interior, and those of Stewart in 1859-62 the way to the Indian Ocean and to the annexation, in 1863, of the Northern Territory. The telegraph line, opened in 1872, followed substantially the line of Stewart's explorations and gave Australia cable communication with the rest of the world. The connection between South Australia and the Northern Territory, that of a temperate with a tropic region separated by hundreds of miles of desert, has not been wholly to the advantage of either.

Bibliography. Hodder, *The History of South Australia* (London, 1893); Woods, *The Province of South Australia* (Adelaide, 1894); Gouger, *The Founding of South Australia*, ed. by Hodder (London, 1898); H. Y. L. Brown, *A Record of the Mines of South Australia* (Adelaide, 1899); Gill, *Bibliography of South Australia* (ib., 1888).

SOUTH BEND. The county-seat of Saint Joseph County, Ind., 86 miles east by south of Chicago, Ill.; on the Saint Joseph River, and on the Lake Shore and Michigan Southern, the Chicago and Grand Trunk, the Indiana, Illinois and Iowa, the Terre Haute and Indiana, and other railroads (Map: Indiana, C 1). Notre Dame, two miles north of the city, is the seat of the University of Notre Dame (q.v.), a Roman Catholic institution opened in 1842, and of Saint Mary's Academy. Saint Joseph's Academy is within the city limits. Noteworthy are the court house, city hall, Oliver Hotel, Epwerp Hospital, Saint Joseph's Hospital, and the Northern Indiana Medical and Surgical Institute. South Bend is the centre of a rich farming section, and is an important industrial city. In the census year 1900 its various industries had an invested capital of $18,156,638 and an output valued at $14,236,331. The Studebaker Wagon Works and the Oliver Plow Works are among the most noted concerns of their kind in the world. There are lumber and flouring mills, foundries and machine shops, wood-turning plants, and manufactories of shirts, sewing machines, agricultural implements, toys, patent medicines, woolens, and paper and wood pulp. The government is vested in a mayor chosen every two years and a unicameral council, and in administrative officials nearly all of whom are appointed by the mayor. The city spends annually for maintenance and operation about $306,000. The water works, which represent an expenditure of $457,974, are owned by the municipality. Population, in 1890, 21,819; in 1900, 35,999.

The site of South Bend was occupied by the Miami and Potawatami Indians and was a favorite resting place for French traders and explorers. In 1824 Alexis Coquillard established a trading post here; in 1831 a town was laid out, which in 1835 was incorporated; and in 1865 South Bend was chartered as a city.

SOUTH BETH'LEHEM. A borough in Northampton County, Pa., 56 miles north by west of Philadelphia; on the Lehigh River, opposite Bethlehem, and on the Lehigh Valley and the Philadelphia and Reading railroads (Map: Pennsylvania, F 3). Lehigh University (q.v.), a non-sectarian institution opened in 1866, occupies a site overlooking the borough. Noteworthy are the Bishop Thorp Seminary for Girls and Saint Luke's Hospital. South Bethlehem is known for its iron and steel manufactures. The total capital invested in the various industries in the census year 1900 was $8,713,185, and the value of their output was $10,964,911. There are the large establishment of the Bethlehem Iron Company, and brass works, zinc works, and manufactories of silk, knit goods, brick, etc. Population, in 1890, 10,302; in 1900, 13,241.

SOUTH'BRIDGE. A town, including two villages, in Worcester County, Mass., 20 miles south by west of Worcester; on the Quinebaug River, and on the New York, New Haven and Hartford Railroad (Map: Massachusetts, C 3). It has manufactories of spectacles and eyeglasses, shuttles and shuttle-irons, knives, and cotton and woolen goods. The government is administered by town meetings. Population, in 1890, 7665; in 1900, 10,025. Originally a part of Charlton and popularly called 'Honest Town,' Southbridge became a parish in 1801 and was incorporated as a town, under its present name, in 1816. Consult Davis, *A Historical Sketch of Sturbridge and Southbridge* (Brookfield, 1856).

SOUTH CAR'OLI'NA (popularly called the 'Palmetto State'). A South Atlantic State of the United States. It lies between latitudes 32° 4′ and 35° 19′ N., and between longitudes 78° 28′ and 83° 18′ W., and is bounded on the north by North Carolina, on the southeast by the Atlantic Ocean, and on the southwest by Georgia. It is triangular in shape, with a base measuring 190 miles in a straight line fronting the ocean, and an apex 240 miles inland. Its area is 30,570 square miles, of which 30,170 square miles, or 19,308,800 acres, are land surface. It ranks thirty-sixth in size among the States.

Topography. South Carolina is divided about equally between the coastal and Piedmont plains, the line of division running nearly parallel with the coast and presenting an abrupt transition between the distinctive features of the two regions. The coast presents first a continuous firm, sandy beach from the northern boundary to Winyah Bay. South of that point it becomes more and more broken by inlets and estuaries, and is fringed with sandy islands (the Sea Islands), inclosing irregular lagoons lined with salt marshes. The coastal plain, extending 100 miles inland, is low, being everywhere less than 500 feet above the sea, and consists in general of a light sandy soil. Large areas are swampy, and pine forests predominate. Along its western margin runs a particularly sandy belt known as the Sand Hills or Pine Barrens, consisting of loose sand dunes partly covered with pine forests. To the west of this belt the land rises abruptly to the upland or Piedmont Plain, which rises gradually from an altitude of 500 feet at its eastern margin to 1000 feet in the extreme northwest. Here the Blue Ridge, whose crest forms the northwestern boundary, rises abruptly 2000 feet higher, Mount Pinnacle, the highest point in the State, being 3436 feet.

Hydrography. Several large rivers traverse the State from northwest to southeast, all the larger ones rising in the mountains of North Carolina. They are the Great Pedee, which, with the Little Pedee and the Lynches, flows into Winyah Bay in the north; the Santee, formed by the Wateree and the Congaree, traversing the centre; and the Savannah, marking the entire boundary between South Carolina and Georgia. The rivers cross the upland or Piedmont Plain as rapid and turbid streams; they generally have falls or rapids as they descend from the hard upland rock over the 'fall line' into the alluvial coastal plain. In the latter they become clear and sluggish, frequently overflowing wide areas. The larger rivers are navigable for steamers to the 'fall line,' and at the line they furnish considerable water-power.

Climate. The climate is mild, resembling that of Southern Europe. It is especially healthful in the uplands and pine barrens, but unhealthful in the low swamp regions. The mean annual temperature for the State is 61°; the mean for January is 44.6°, and for July 79.5°. The maximum is about 106°, and a temperature of 1° was observed in the northwestern highlands in 1900. Snow in measurable amounts generally does not fall on more than two or three days in a year, except in the mountains, where there is a considerable snowfall. The average annual rainfall is 47 inches, fairly evenly distributed both as to localities and seasons, though there is a maximum in summer and a minimum in autumn. Hurricanes visit the coast occasionally, and sometimes do considerable damage. In 1886 the State suffered from a severe earthquake which caused great destruction at Charleston.

Flora. The coast islands present a distinct semi-tropical aspect, the palmetto, live oak, and magnolia being here the characteristic plants. In the coastal plain the long-leaf pine is the predominating species in the great forests, covering the sandy regions, while the cypress grows in the swamp lands. In the upper pine belt, except in the sand hills, oaks and hickories begin to appear, and these, together with elms, maples, chestnuts, and other deciduous trees common to the Northern States, predominate in the upland. The persimmon, locust, and plane tree grow in this State. Wild grapes are abundant, as well as strawberries and fruit shrubs and trees common to the Eastern States.

For Fauna, see paragraph under United States.

Geology and Mining. South Carolina is nearly equally divided between the most ancient and the most recent of geological systems, the division corresponding to the topographical division into the Piedmont and coastal plains. The western half or Piedmont Plain belongs to the great Archæan belt, which flanks the eastern slope of the Appalachians. Granite predominates here, with gneiss and mica-slate in the higher regions. The eastern half belongs to the coastal plain formation, consisting of unindurated Tertiary and recent sands and clays. The granite industry is the most important of the mining industries, the output having increased rapidly from $37,820 in 1897 to $996,084 in 1901, the production in the latter year having been exceeded in only four States. Limestones are also quarried, but the mineral next in importance is rock phosphate, used as an artificial fertilizer, in the production of which the State ranked first until 1894, when larger beds were exploited in Florida. The product in 1893 was 502,564 long tons, valued at $2,157,014; in 1901 it had decreased to 321,181 tons, with a value of $961,840. Clay products rank next in value. Gold and silver are mined in small quantities, and the iron ores, though existing in considerable quantities, are but little worked.

Fisheries. In 1897 there were 2139 persons engaged in the fisheries, of whom 1865 were employed on inshore or boat fisheries. The figures for the yield for that year were $210,456. The most valuable species are oysters, whiting, shad, and sea-bass.

Agriculture. In 1900, 72.4 per cent. of the land area was included in farms, and of this 41.3 per cent. (5,775,741 acres) was improved—a large increase over all earlier years. The average size of farms in 1900 (90 acres) was only one-sixth as large as the average size in 1850. In 1900, 36.7 per cent. of the farms were let for cash rent, and 24.3 per cent. share rent. Considerably over half of the farms are operated by negroes, and only 18.2 per cent. of these properties are owned by them. In probably no State is the cotton crop so predominant as in South Carolina. In area it annually exceeds every other crop and is several times as important as any other crop with respect to value. The acreage in 1900 was larger than for any other census year, as was also the number of bales produced (881,422), the crop being nearly three times as great as in 1850. Of the total area of cotton, 23,902 acres were in the sea-island variety.

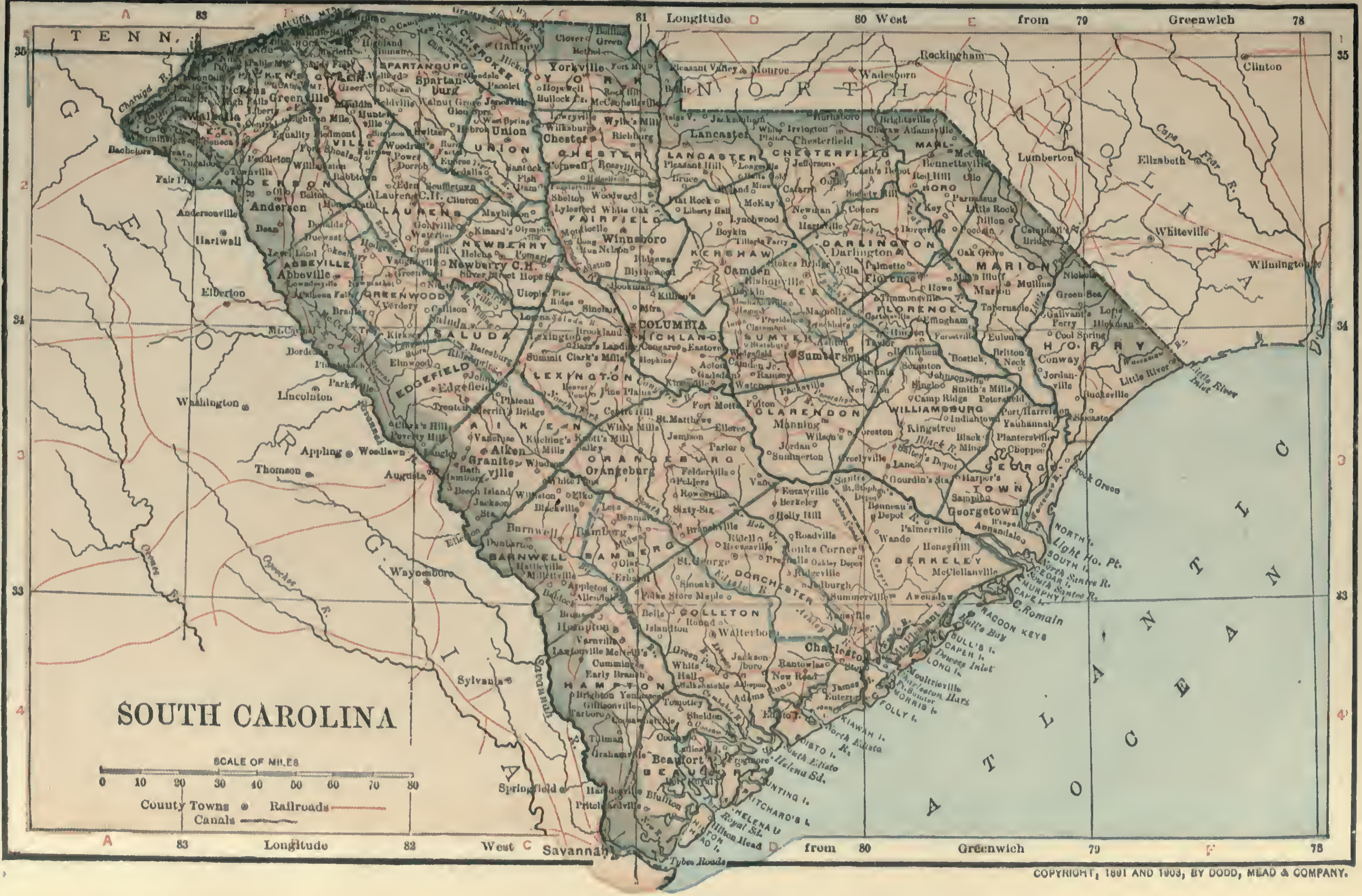
Corn, the second crop in importance, made large gains in the decade 1890-1900. During that period there was also a revival in wheat culture and a decrease in the cultivation of oats, but neither crop is of great importance. Rice is the only other cereal worthy of mention. It has been grown in South Carolina since 1700, and the State took first rank in its cultivation until 1861. The increasing destructiveness of the freshets since the deforestation of the mountain slopes has greatly hampered the growth of the industry. However, in the decade 1890-1900 it almost regained the ground which it had lost in the preceding ten years. The State is now exceeded by Louisiana alone in rice production. The acreage in hay increased 264.3 per cent. in the decade 1890-1900. Considerable attention is given to the raising of peas, and tobacco and sweet potatoes are products of some importance. The area devoted to tobacco in 1900 was 65 times as great as in 1890. The following table shows the acreage of the leading crops:

CROPS	1900	1890
Cotton	2,074,081	1,987,469
Corn	1,772,057	1,345,990
Oats	222,544	308,056
Wheat	174,245	115,510
Rice	77,657	42,238
Dry pease	143,070	....
Hay and forage	106,124	29,132
Sweet potatoes	48,831	46,086
Tobacco	25,993	394

Stock-Raising. In 1890-1900 there was a large increase in the number of all kinds of domestic animals except sheep. There is a smaller number of all varieties of live stock (except mules) than in 1850—less than half as many cattle and less than one-fifth as many sheep. The following table shows the number of domestic animals on farms:

ANIMALS	1900	1890
Dairy cows	126,684	107,184
Other cattle	216,214	161,109
Horses	78,419	59,888
Mules and asses	117,616	86,306
Sheep	52,436	79,421
Swine	618,995	494,696

Manufactures. Prior to 1880 the manufacturing industry had been quite insignificant. Its growth has since been rapid. The total value of products increased 90.7 per cent. from 1880 to 1890, and 84 per cent. in the following decade, being estimated in 1900 at $58,748,731. The



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AREA AND POPULATION OF SOUTH CAROLINA BY COUNTIES.

County.	Map Index.	County Seat.	Area in square miles.	Population.	
				1890.	1900.
Abbeville	B 2	Abbeville	682	46,854	33,400
Aiken	C 3	Aiken	1,096	31,822	39,032
Anderson	B 2	Anderson	756	43,696	55,728
Bamberg	C 3	Bamberg	363	.....	17,296
Barnwell	C 3	Barnwell	870	44,613	35,504
Beaufort	D 4	Beaufort	943	34,119	35,495
Berkeley	D 4	Monks Corner	1,316	55,428	30,454
Charleston	E 4	Charleston	687	59,903	88,006
Cherokee	C 2	Gaffney	361	......	21,359
Chester	C 2	Chester	592	26,660	28,616
Chesterfield	D 2	Chesterfield	823	18,468	20,401
Clarendon	D 3	Manning	710	23,233	28,184
Colleton	D 4	Walterboro	1,351	40.293	33,452
Darlington	D 2	Darlington	649	29,134	32,388
Dorchester	D 3	St. George	564	.....	16,294
Edgefield	D 2	Edgefield	715	49,259	25,478
Fairfield	C 2	Winnsboro	776	28,599	29,425
Florence	E 2	Florence	630	25,027	28,474
Georgetown	E 3	Georgetown	827	20,857	22,846
Greenville	B 2	Greenville	745	44,310	53,490
Greenwood	B 2	Greenwood	495	......	28,343
Hampton	C 4	Hampton	936	20,544	23,738
Horry	E 3	Conway	1,075	19,256	23,364
Kershaw	D 2	Camden	705	22,361	24,696
Lancaster	D 2	Lancaster	501	20,761	24.311
Laurens	B 2	Laurens	684	31,610	37,382
Lexington	C 3	Lexington	885	22,181	27,264
Marion	E 2	Marion	993	29,976	35,181
Marlboro	E 2	Bennettsville	509	23,500	27,639
Newberry	C 2	Newberry	594	26,434	30,182
Oconee	A 2	Walhalla	641	18,687	23,634
Orangeburg	D 3	Orangeburg	1,345	49,393	59,663
Pickens	B 2	Pickens	531	16,389	19,375
Richland	D 2	Columbia	605	36,821	45,589
Saluda	C 3	Saluda	438	......	18,966
Spartanburg	B 2	Spartanburg	762	55,385	65,560
Sumter	D 3	Sumter	860	43,605	51,237
Union	C 2	Union	495	25,363	25,501
Williamsburg	E 3	Kingstree	991	27,777	31,685
York	C 2	Yorkville	669	38,831	41,684

NOTE.—Lee County (D 2), with Bishopville as county seat, has been established, since the census was taken in 1900, from parts of Sumter, Darlington, and Kershaw counties.

wage-earners engaged in manufactures in the latter year numbered 48,135 (3.6 per cent. of the total population), of whom 8,560 were children under 16 years of age. The State's abundant supply of raw materials, its excellent water-power, facilities for transportation, and low cost of living, are greatly to the advantage of the manufacturing industry. The recent development is confined largely to manufactures of cotton. Absolute increase in value of cotton products between 1890 and 1900 exceeded that in any other State, and gave South Carolina first rank among the Southern States and second in the Union. In 1900 the amount of cotton used by the local mills was considerably over half the total yield of the State. The manufacture of cottonseed oil and cake also made a marked gain in the decade 1890-1900. The State's supply of phosphate rock and cottonseed meal has given rise to the manufacture of fertilizers, and Charleston is the second largest manufacturing centre of this product in the country. Flour-milling scarcely meets the local demand.

The following table shows the figures for the leading industries:

INDUSTRIES	Year	Number of establishments	Average number wage-earners	Value of products, including custom work and repairing
Total for selected industries in the State	1900	1,640	39,066	$48,041,940
	1890	1,169	15,565	21,927,098
Increase, 1890 to 1900	......	471	23,501	$26,114,842
Per cent. of increase	......	40.3	151.0	119.1
Per cent. of total of all industries in the State	1900	43.6	81.2	81.8
	1890	49.1	68.4	68.7
Cotton goods	1900	80	30,201	29,723,919
	1890	34	8,071	9,800,798
Fertilizers	1900	22	1,772	4,882,506
	1890	20	1,102	4,417,658
Flouring and grist mill products	1900	556	281	2,347,790
	1890	512	630	2,083,126
Lumber and timber products	1900	729	4,585	5,207,184
	1890	352	2,590	2,146,750
Lumber, planing mill products	1900	53	490	1,016,328
	1890	27	370	711,838
Oil, cottonseed, and cake	1900	50	734	3,103,425
	1890	17	416	927,772
Rice, cleaning and polishing	1900	18	112	973,132
	1890	6	143	315,056
Turpentine and rosin	1900	132	886	787,656
	1890	201	2,243	1,524,100

Forests. It is estimated that the woodland covers 20,500 square miles, or 68 per cent. of the State's area. In the Piedmont region the hard woods predominate. South of this region lies an extensive belt of yellow pine. Cypress covers the low coast lands. Lumbering made little progress prior to the decade 1890-1900. The increase for that period is shown in the above table. The greater part of the timber cut is of the yellow-pine variety. The value of planing-mill products is increasing, but the manufacture of turpentine and rosin is decreasing in consequence of the exhaustion of the timber from which the product is obtained.

Transportation and Commerce. The coast waters and navigable rivers offer excellent advantages for water transportation. The Savannah River is navigable for 158 miles; the Santee, for its entire length; the Pedee, for 120 miles; the Congaree, nearly to the city of Columbia; and the Wateree, to Camden. Railroad mileage has increased from 973 miles in 1860 to 1427 in 1880, 2289 in 1890, and 2919 in 1900. The railroads are mostly owned or controlled by three large systems—the Southern, the Seaboard Air Line, and the Atlantic Coast Line. A considerable foreign trade, principally exports, passes through the port of Charleston, which ranks tenth among the Atlantic coast ports.

Banks. The State Bank of South Carolina had an exceptionally successful career. It was established in 1812 to remedy the financial disturbances caused by the impending war with England. It was entirely under State control, and its president and directors were chosen by the Legislature. The capital was furnished by the State and the bank was the repository for all State funds. All State expenditures were paid through the medium of the bank. It was free to do a regular banking business, but its debts could not exceed twice the capital exclusive of deposits. Branch banks were established at Columbia, Camden, and Georgetown. The work of the bank is best illustrated by the official report of 1848, which showed that it had received and paid out State moneys to the amount of $28,000,000 without any loss. In 1852 its charter was renewed and it continued to do a most satisfactory business until 1870, when it was put in liquidation. The following table gives the State banking statistics as reported as to principal items in 1902:

	National banks	State and stock savings banks
Number	18	46
Capital	$2,048,000	$2,269,000
Surplus	691,000	451,000
Cash, etc	510,000	708,000
Loans	8,346,000	9,400,000
Deposits	5,810,000	9,828,000

Government. The Constitution now in force was ratified in convention December 4, 1895. Voters must have resided in the State two years, in the county one year, in the polling precinct four months, and must have paid all taxes collectible during the previous year. A residence of only six months in the State, however, is required of ministers and of teachers in the public schools. Every elector must enroll once in ten years, but enrollment may be secured in any year for those not previously registered. It was required of those registering prior to January 1, 1898, that they should be able to read any section of the State Constitution or understand and explain it when read to them. Those applying for registration after that date must be able to read and write any section of the State Constitution or to show that they own and have paid all taxes collectible during the previous year on property in the State assessed at $300 or more. The capital is Columbia.

Legislature. There are 124 Representatives elected upon the basis of population from county districts every two years. Each county elects a Senator, who serves four years. Elections are held on the Tuesday after the first Monday in November of even years. Revenue bills must originate in the Lower House. Sessions of the Legislature are held annually.

Executive. A Governor, Lieutenant-Governor, Secretary, Comptroller-General, Attorney-General, Treasurer, Adjutant and Inspector-General, and Superintendent of Education are elected for terms of two years each. The Lieutenant-Governor and president pro tem. of the Senate are in the line of succession to the Governorship in case of vacancy. The Governor is given the usual pardoning power and the authority to call extra sessions of the Legislature. The Governor's veto of a bill or of any item of an appropriation bill may be overridden by a two-thirds vote of each House. An act of the Legislature becomes a law if not returned within three days.

Judicial. The Supreme Court consists of the Chief Justice and three associate justices, who are all elected by the General Assembly for terms of eight years. The State is divided into judicial circuits and for each a judge is elected by the General Assembly to serve for four years. There are two circuit courts, namely, a Court of Common Pleas and a Court of General Session. There is a Court of Probate at Charleston.

Finances. The debt of South Carolina at the outbreak of the Civil War amounted to but $3,814,862 and the State was on a firm financial basis. In 1867 the debt had increased to about $5,500,000. This debt was increased until in 1870 it reached $6,314,000. At this time there were also outstanding against the State bonds to the amount of $20,827,608 and a railroad debt of $6,787,608. The financial condition of this period is also shown by the fact that in 1872-73 appropriations aggregating $2,418,872 had been made, while the receipts from all sources were but $1,719,728. An act authorizing an annual tax sufficiently large to pay the interest on the State debt failed to have the desired effect. In 1880, however, it was enacted that holders of consolidated bonds, stock, or interest-bearing coupons which were due and unpaid before July 1, 1878, might exchange them for new bonds with interest at 6 per cent. and in every respect equal to the value of the bonds, stock, or interest coupons surrendered. This proved to be an efficient remedy, and the credit of the State was restored. In 1880 the public debt was $7,175,454 and in 1902 it had been reduced to $6,514,674. In the latter year the total receipts were $3,976,659 and the expenditures $3,783,605, which, together with the money on hand at the beginning of the year, left a total cash balance of $430,797.

State Dispensary. The State abolished the old saloon system for the sale of liquors and substituted in its place a State dispensary system. At the dispensaries sealed packages of liquor containing not less than one-half pint are sold, but cannot be opened at the dispensary. Profits accruing are divided between the State, county, and municipality. In 1902 the dispensaries sold liquors (exclusive of fresh beer) to the amount of $2,406,213, and purchased liquors to the amount of $1,664,870. The total net earnings were $566,898. Of this amount $443,198 was divided equally between towns and counties, and $142,755 was paid into the school fund.

Militia. In 1900 there were 236,767 men of militia age. The militia in 1901 numbered 3029.

Population. The population increased from 249,073 in 1790 to 502,741 in 1820; 668,507 in 1850; 703,708 in 1860; 705,606 in 1870; 995,577 in 1880; 1,151,149 in 1890; and 1,340,316 in 1900. In the last year the State ranked twenty-fourth in population. There were 44.4 persons to the square mile. Only one other State in the Union had a smaller foreign-born population, this element numbering only 5528 in 1900. South Carolina ranks fourth in negro population, it having been increased from 688,934 in 1890 to 782,321 in 1900. The number of towns exceeding 4000 inhabitants increased from 4 in 1890 to 16 in 1900, constituting in the latter year 11.7 per cent. of the total population. In 1900 the largest cities were as follows: Charleston, 55,807; Columbia, 21,108; Greenville, 11,860; and Spartanburg, 11,395. South Carolina sends 7 members to the National House of Representatives.

Religion. The Methodist Church is the largest, followed closely by the Baptist. These two represent the bulk of the church membership of the State.

Education. South Carolina has a negro population greatly in excess of the white, and has consequently had to deal with most serious problems in the matter of providing adequate educational facilities. The considerable success attained is shown by the decrease in illiteracy. In 1900, 35.9 per cent. of the total population above ten years of age could not read, as against 55.4 per cent. in 1880. The percentage of illiteracy among the native whites is only 13.6, as compared with 52.8 for the colored population; but the colored illiteracy has been reduced from 78.5 per cent. in 1880. The length of the school term is short, but is becoming longer. In 1901 the average term for the white schools was 21.17 weeks, for the negro schools 14.12 weeks. No compulsory attendance law has been passed. The State Governor appoints the State Board of Education. This board appoints the county boards, and the latter in turn appoint the trustees in the small districts. Educational progress is seriously handicapped by a lack of financial support and the resulting inadequacy of teachers' wages. In 1901 white teachers received an average annual wage of $188.91 and the negro teachers $80.30. The new Constitution increased the State school tax from two to three mills, and in the school year 1900-01 the receipts from this source amounted to $520,294. In 1900-01 the expenditure for white schools was $726,825 and for negro schools $211,287. Any school district may levy special taxes for schools, but only a small number have availed themselves of this privilege. In 1900 there were 281,891 pupils enrolled and 201,295 in average attendance. There were 2422 male and 3142 female teachers. Normal school education for females is provided by the State at the Winthrop Normal and Industrial College at Rock Hill. The State provides higher education for both sexes at the South Carolina College (q.v.), located at Columbia. There are also a number of small denominational and coeducational colleges. Of the nine colleges and seminaries for females Converse College, a non-sectarian institution at Spartanburg, is the largest. The State has an agricultural college at Clemson College, at which also courses in civil, electrical, mechanical, and textile engineering are given.

CHARITABLE AND PENAL INSTITUTIONS. The State hospital for the insane, the orphan asylum, the institution for the deaf and the blind, and the State penitentiary are at Columbia. The State maintains farms for convict labor.

HISTORY. In 1562 Jean Ribault (q.v.), acting for Admiral Coligny, attempted to form a colony of French Huguenots at Port Royal. The colony, however, was abandoned the next year, and other attempts were made farther south. Charles I. granted in 1630 to Sir Robert Heath all the territory between 31° and 36° extending from sea to sea. No settlement was made, and in 1663 Charles II. granted the same to eight Lords Proprietors, favorites at Court. In 1665 the limits were extended to 29° and 36° 30′. Full proprietary rights were given, but the Proprietors were to legislate "by and with the advice, assent, and approbation of the freemen." Permission to grant religious freedom was given, and subinfeudation was allowed. The terms to settlers were at first liberal, but in 1669 the attempt was made to put into effect the 'Fundamental Constitution' drawn by John Locke. (See NORTH CAROLINA.) An expedition consisting of 200 persons under William Sayle settled upon the Ashley River in 1670. A 'parliament' consisting of the five deputies of the Proprietors and twenty members elected by the freeholders was established in 1671. In 1680 the settlement was removed to the present site of Charleston. Immigration was rapid, and by 1700 the colony contained 5500 inhabitants.

The colony was turbulent from the beginning. It refused to adopt the Fundamental Constitutions, quarreled over the quit-rents, and in 1693 secured the right of initiative in legislation. In May, 1704, the Proprietors ordered the enforcement of the Test Act requiring conformity to the Church of England, but an appeal to the Whig House of Lords led to the annulment of the Test Act in the colony in 1706, though the Church was still established. The colony was divided into North and South Carolina in 1710. The Yemassee Indians, instigated by the Spanish at Saint Augustine, attacked the settlements in 1715, and the Proprietors refused to grant aid. When appeal was made to the Crown it was shown that no aid could be given unless the government was vested in the King. Numerous other grievances led to the assembling of a convention which assumed the powers of government, and James Moore (q.v.) was chosen to act as Governor until the King's pleasure was known. The Royal Governor, Sir Francis Nicholson, arrived in 1721 and in 1729 the Crown purchased the proprietary rights. From this time the assembly never relinquished a single right it gained, and before the Revolution claimed all the rights and privileges of the British Parliament. The first printing press was set up in 1730, and the *South Carolina Gazette* was established two years later. The colony joined Oglethorpe's unsuccessful expedition against the Spaniards in 1740, and was occupied with Indian troubles in 1755, 1760, and 1765. The Cherokees ceded their lands in 1755, and the Scotch-Irish began to fill them up. The colony was prompt in its resistance to the Stamp Act, and troops were quartered in Charleston. It agreed to the non-importation agreement in 1769-70, and sent money and supplies to Boston in 1774. Delegates were sent to the Continental Congress in 1774 and the Provincial Congress met January 11, 1775. At the second session in June, 1775, troops were voted, and Lord William Campbell tried in vain to restore royal authority. In March, 1776, sovereignty was claimed and a government was established. Fort Moultrie (q.v.) was unsuccessfully attacked by the British June 28th. Several battles (among them Camden, King's Mountain, Cowpens, and Eutaw Springs) were fought during the Revolution within the State. Famous leaders of irregular bands of patriots were Sumter and Marion. Charleston was captured by the British in 1780, and held until 1782. The State adopted the Federal Constitution May 23, 1788, Columbia was made the capital in 1790, and a new constitution was adopted which gave the Legislature practically all power. The differences between the sections began to be apparent. The eastern part of the State had the wealth and was strongly Federalist. The western part had the population and was strongly Anti-Federalist. In 1808 a compromise was effected which lasted until 1868. By its terms the Lower House of the Legislature was to consist of 124 members, 62 to represent population and 62 wealth. Each district was given as many Representatives as it had sixty-seconds of population and wealth. With the adoption of this compromise State politics practically ceased.

The State early became dissatisfied with the tariff policy of the general Government, and as early as 1828 the 'South Carolina Exposition' was adopted by the Legislature. On the passage of the Clay Tariff Bill in 1832, a convention was called which declared, November 24th, that no duties should be collected after February 1, 1833. President Jackson was resolved to enforce the law, but an actual conflict was averted by a compromise. (See CALHOUN, JOHN C.; NULLIFICATION.) On the election of President Lincoln in 1860, a convention was called on December 20th, which unanimously passed an ordinance of secession. The attack on Fort Sumter in April, 1861, precipitated the Civil War. (See CIVIL WAR.) The State furnished 60,000 soldiers to the Confederate armies, though her voting population was only about 47,000. Charleston withstood the Federal attacks until February, 1865, when the Confederates were finally compelled to evacuate it. South Carolina suffered from Sherman's march northward. A provisional Governor was appointed at the close of the war and a new constitution adopted. On the refusal of the State to ratify the Fourteenth Amendment, a military government was established. In 1868 another constitution allowing negro suffrage was adopted and the State was re-admitted June 25th. The next years were a carnival of official crime and corruption. Illiterate negroes and carpetbaggers filled the highest offices and the debt increased from $5,407,306 in 1868 to $20,333,901 in 1873. The campaign of 1876 was of unexampled bitterness. Intimidation and bloodshed were called into play. Both sides claimed the victory, and there were for a time rival State governments. When President Hayes withdrew the Federal troops from the State the Republican claimant, Governor Chamberlain, gave up the contest and Wade Hampton (q.v.) was recognized as Governor. Several of the State officers were tried on charges of malfeasance and sentenced to varying terms of imprisonment. Since this time, by various methods, the negro majority in the State has been kept powerless in all elections. A severe earthquake, of which Charleston seemed to be the centre, destroyed property valued at $5,000,000, August 31, 1886. In 1893 a great storm on the coast caused the loss of more than 1000 lives. The growth and development of the Farmers' Alliance led to the capture of the Democratic Party in 1890, when B. R. Tillman was elected Governor after a campaign of bitterness second only to that of 1876. In 1901-02 the South Carolina Interstate and West Indian Exposition was held at Charleston. In national elections the State has been always Democratic, except in 1792, when the Federalists secured the electors, and during the Reconstruction period, 1868-76, when the vote was given for the Republican candidates. See ELECTORAL COMMISSION.

GOVERNORS OF SOUTH CAROLINA

UNDER THE PROPRIETORS

Sir John Yeamans, Lieutenant-General and Gov.	1665
William Sayle	1669-70
Joseph West (acting)	1670-72
Sir John Yeamans	1672-74
Joseph West	1674-82
Joseph Morton	1682-84
Richard Kyrle	1684
Robert Quarry (acting)	1684-85
Joseph West	1685
Joseph Morton	1685-86
James Colleton	1686-90
Seth Sothell (Southwell)	1690-91
Philip Ludwell	1691-93
Thomas Smith	1693-94
Joseph Blake (acting)	1694
John Archdale	1694-96
Joseph Blake	1696-1700
James Moore (acting)	1700-02
Sir Nathaniel Johnson	1702-08
Edward Tynte	1708-09
Robert Gibbes (acting)	1709-12
Edward Craven	1712-16
Robert Daniel (acting)	1716-17
Robert Johnson	1717-19
James Moore (chosen by convention)	1719-21

UNDER THE CROWN

Sir Francis Nicholson	1721-25
Arthur Middleton (acting)	1725-30
Robert Johnson	1730-35
Thomas Broughton (Lieutenant-Governor)	1735-37
William Bull (acting and Lieutenant-Governor)	1737-43
James Glen	1743-56
William Henry Littleton	1756-60
William Bull, 2d, (Lieutenant-Governor)	1760-61
Thomas Boone	1761-64
William Bull, 2d, (Lieutenant-Governor)	1764-66
Lord Charles Greville Montagu	1766-68
William Bull, 2d, (Lieutenant-Governor)	1768
Lord Charles Greville Montagu	1768-69
William Bull, 2d, (Lieutenant-Governor)	1769-71
Lord Charles Greville Montagu	1771-73
William Bull, 2d, (Lieutenant-Governor)	1773-75
Lord William Campbell	1775

STATE

John Rutledge	President	1776-78
Rawlins Lowndes	"	1778-79
John Rutledge	Governor	1779-83
John Mathews		1782-85
Benjamin Guerard		1783-87
William Moultrie		1785-89
Thomas Pinckney	Democrat-Republican	1787-82
Charles Pinckney	" "	1789-94
Arnoldus Vanderhorst		1792-96
William Moultrie		1794-98
Charles Pinckney	Democrat-Republican	1796-90
Edward Rutledge	Federalist	1798-1802
John Drayton	Democrat-Republican	1800-02
James B. Richardson.	" "	1802-04
Paul Hamilton	" "	1804-06
Charles Pinckney	" "	1806-08
John Drayton	" "	1808-10
Henry Middleton	" "	1810-12
Joseph Alston	" "	1812-14
David R. Williams	" "	1814-16
Andrew Pickens	" "	1816-18
John Geddes	" "	1818-20
Thomas Bennett	" "	1820-22
John L. Wilson	" "	1822-24
Richard I. Manning	" "	1824-26
John Taylor	" "	1826-28
Stephen D. Miller	Democrat	1828-30
James Hamilton	"	1830-32
Robert Y. Hayne	"	1832-34
George McDuffie	"	1834-36
Pierce M. Butler	"	1836-38
Patrick Noble	"	1838-40
B. K. Hennegan (acting)		1840
John P. Richardson	Democrat	1840-42
James H. Hammond	"	1842-44
William Aiken	"	1844-46
David Johnson	"	1846-48
W. B. Seabrook	"	1848-50
John H. Means	"	1850-52
John L. Manning	"	1852-54
James H. Adams	"	1854-56
Robert F. W. Allston	"	1856-58
William H. Gist	"	1858-60
Francis W. Pickens	"	1860-62
M. L. Bonham	"	1862-64
A. G. Magrath	"	1864-65
Benjamin F. Perry	Provisional	1865
James L. Orr	Democrat	1865-68
Robert K. Scott	Republican	1868-72
Franklin J. Moses, Jr.	"	1872-74
Daniel H. Chamberlain	"	1874-77
Wade Hampton	Democrat	1877-79
W. D. Simpson (acting)	"	1879-80
T. D. Jeter (acting)	"	1880
Johnson Hagood	"	1880-82
Hugh S. Thompson	"	1882-86
John C. Sheppard (acting)		1886
John P. Richardson	Democrat	1886-90
Benjamin R. Tillman	"	1890-94
John Gary Evans	"	1894-97
William H. Ellerbe	"	1897-99
M. B. McSweeney	"	1899-1903
Duncan C. Heyward	"	1903 —

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SOUTH CAROLINA COLLEGE. A nonsectarian, coeducational college in Columbia, S. C., chartered in 1801 and opened in 1805. It was closed in 1863 and was reopened in 1866 as the University of South Carolina. In 1878 the university was divided into two branches; one the South Carolina College, the other Claflin College, for negroes, at Orangeburg. Its charter was again amended in 1887 and 1890, and in 1894 women were admitted to all courses. It has a system of accredited schools, the certificate of which admits students without examination. The college has a department of law. In 1902 the students numbered 215, with a faculty of 18. The library contained 33,783 volumes. Its income was $35,454.

SOUTH CAROLINA INTER-STATE AND WEST INDIAN EXPOSITION. An exposition held in Charleston, South Carolina, from December 1, 1901, to June 2, 1902. The site chosen covered an area of about 250 acres. The principal buildings were: Administration, Agriculture, Art, Auditorium, Commerce, Cotton Palace, Fisheries, Machinery, Mines and Forestry, Negro, Transportation, and Women's. The larger buildings were constructed in the Spanish Renaissance style of architecture, and were finished in staff, coated with a dull white tint that gave the name of Ivory City to the grounds. There were also State buildings erected by Illinois, Maryland, Missouri, New York, and Pennsylvania, city buildings representing Cincinnati and Philadelphia, and special structures devoted to the exhibits of Cuba, Porto Rico, and Guatemala. The grounds were adorned with statuary, among them six original historical groups, situated in the Court of Palaces, and including "The Aztec," by Louis A. Gudebrod; "The Negro," by Charles A. Lopez; and "The Huguenot," by Miss Elsie Ward. The total attendance was 674,086; the cost of the exposition was $1,250,000, while the receipts were $313,000.

SOUTH'COTT, Joanna (1750-1814). A religious visionary, born at Gittisham, in Devonshire, England, of humble parentage. In youth she was a domestic servant, chiefly in Exeter. In 1792 she declared herself to be the woman driven into the wilderness, the subject of the prophecy in Rev. xii., and began to claim the gift of prophecy. She gave forth predictions in prose and verse, and, although very illiterate, wrote numerous letters and pamphlets. When over sixty years of age she imagined that she was destined to give birth miraculously to a second Shiloh or prince of peace. Her writings include *The Strange Effects of Faith* (1801), with continuations (1802-20); books of *Prophecies and Visions* (1803); *Letters* (1804); *The True Explanation of the Bible* (1804-10); the *Book of Wonders* (1813-14). Consult her *Memoirs* (London, 1814).

SOUTH DAKO'TA. Popularly called the 'Coyote State.' A north central State of the United States, lying on either side of the middle Missouri, between latitudes 42° 28′ and 45° 57′ north and between longitudes 96° 26′ and 104° 3′ west. It is bounded on the north by North Dakota, on the east by Minnesota and Iowa, on the south by Nebraska, and on the west by Wyoming and Montana. With the exception of an irregular salient angle in the southeast between the Missouri and Big Sioux Rivers, and a reëntering angle in the northeast formed by Lakes Bigstone and Traverse, the boundaries of the State are straight lines running along meridians and parallels, and forming a rectangle 200 miles wide and 380 miles long. The area is 77,650 square miles, of which 76,850 square miles, or 49,184,000 acres, are land surface. South Dakota ranks twelfth in size among the States.

Topography. The State lies within the region of the Great Plains, and, broadly considered, consists of a rolling upland plain sloping gradually from an altitude of 3500 feet in the west to about 1400 feet in the southeast. The entire State lies above 1000 feet, with the exception of a very narrow belt along the shores of Lakes Bigstone and Traverse in the extreme northeastern corner. The eastern half is smooth, with the broad, gently sloping valley of the James River traversing it from north to south. In the western half denudation by running water has been very active compared with atmospheric erosion, so that numerous buttes and ridges remain to show the former level of the plateau. In the southwestern part the effect of denudation is especially shown in the remarkable region known as the Bad Lands. They consist of a labyrinth of deep ravines, steep hills, and precipitous bluffs of white clay carved out by rapid erosion, and are in parts almost destitute of vegetation. The most prominent diversifying feature of the State, however, is the elliptical, dome-like uplift of the Black Hills, rising near the western boundary between the two forks of the Cheyenne River, and covering about 5000 square miles. The highest point is Harney Peak, with an altitude of 7216 feet.

Hydrography. The Missouri River traverses the State in a winding course from the middle of the northern boundary to the southeastern corner, forming for some distance a part of the southern boundary. Its valley is comparatively narrow, and rises in terraces (which are more abrupt on the eastern bank) to the general level of the plain, which lies 200 to 300 feet above the stream. The western tributaries, chief of which are the Grand, Moreau, Big Cheyenne, and White Rivers, flow nearly due east in similar narrow terraced valleys. On the other hand, the two eastern tributaries, the James and the Big Sioux, flow southward parallel with the main stream, and their valleys are broad and gently sloping. In the eastern half of the State there are numerous glacial lakes, none of which, however, are of great size except the above mentioned Lakes Bigstone and Traverse on the northeastern boundary.

Climate, Soil, and Vegetation. South Dakota, occupying almost the very centre of the continent, has, of course, a continental climate with great extremes of temperature. The mean annual temperature is 44.3° F. The mean for January is 15° and for July 72.2°, while the absolute extremes may rise to more than 115° above or fall to more than 40° below zero. But the heat of summer and the cold of winter are much more endurable than the more moderate temperatures of the Eastern States, owing to the dryness of the atmosphere, which renders the climate bracing and pleasant. The winter is often tempered by the dry and warm chinooks, but occasionally, though fortunately not often, the State is visited by blizzards—severe northern gales laden with fine floating snow. The snowfall is less than that of New York or New England. The average annual rainfall for the State is 20 inches, being 30 to 40 inches in the eastern third, 20 to 30 inches in the centre, and 15 to 20 inches in the west, where it is insufficient for agriculture. The other parts of the State also suffer occasionally from drought. The soil in the greater part of the State is of excellent quality, and when sufficiently watered is rendered highly productive. In the east there is a subsoil of glacial till covered with a dark alluvial loam rich in nitrogen and again covered with many inches of black vegetable mold. A large part of the west has also a fine alluvial soil, but large areas here are stony and barren. The bottomlands of the Missouri and the terraced floors of its valley are very fertile. The State is as a whole a treeless prairie country. Forests are found only in the Black Hills above an altitude of 4000 feet, where there is a good growth of pine. Here and there along the river valleys there are more or less extensive groves of cottonwood, ash, elm, and maple.

Geology. Although the geological structure of the State is nearly homogeneous over the greater part of its area, there is nevertheless found represented every age from the Archæan to the Pleistocene except the Devonian. There are two Archæan nuclei, one in the east and one in the west. The former is a broad tongue of Sioux quartzite belonging to the Huronian system and extending westward to the James River from the neighborhood of Sioux Falls. To the north near Bigstone Lake is a smaller area of Laurentian granite. In the centre of the Black Hills is exposed the core of schists, slates, and granite. This is surrounded by narrow bands forming the denuded sections of the upturned Paleozoic strata, successively Potsdam sandstone of the Cambrian, Silurian limestone, and a broader band of Carboniferous limestone. Around this appear the sand and limestones, clays and marls of the Jura-Trias, and the whole is enveloped in the Cretaceous strata which cover four-fifths of the area of the State. The principal members are the Colorado marls, clays, and limestones covering nearly the whole of the eastern half, the Laramie formation occupying the northwestern quarter, and the Dakota sandstone underlying the valley of the James. The southwestern quarter of the State is covered with Miocene clays and conglomerates. Igneous rocks in the form of dikes of diabase and porphyry occur in both the eastern and western Archæan areas. The Pleistocene age is represented by the immense sheet of glacial drift covering the eastern half of the State to a line nearly coinciding with the Missouri River, and veiling the older formations. West of this line the Pleistocene deposits consist of aqueous drift.

Mining. The mineral wealth of the State appears chiefly in the Archæan area of the Black Hills, where there are more or less extensive deposits of copper, gold, silver, argentiferous lead, iron ores, manganese, nickel, tin, mica, and some graphite. The Triassic clays contain beds of gypsum, and beds of lignite as well as reservoirs of natural gas have recently been found. The Archæan and Paleozoic areas also yield a great variety of building and ornamental stone such as the red quartzite or jasper in the east. The Dakota sandstone of the James Valley is especially noticeable as a water-bearing stratum supplying powerful artesian wells. The mining activities consist mainly of quartz gold mining carried on in the southwest corner of the State. Difficulties in securing water have operated against the development of gold-mining, but elaborate and expensive schemes have been undertaken to secure adequate water supplies, and the output of gold is becoming larger. The value of the product increased from $4,006,400 in 1893 to $6,479,500 in 1901. The granite production in 1901 was valued at $99,941. Limestone and sandstone are also quarried. Portland cement was produced in 1900 to the value of $76,000, and clay products in the following year represented a value of $59,365.

Agriculture. Agriculture is almost wholly confined to the eastern half of the State. Facilities for irrigation are not extensive. In 1899, 43,676 acres were irrigated, principally from the tributaries of the Cheyenne River. In 1900, the total farm area was 19,070,616 acres, or 38.8 per cent. of the State's land area. Of the farm land 59.2 per cent. was improved, and about two-fifths of this amount was brought under improvement in the decade 1890-1900. South Dakota is one of the few States in which the size of farms is increasing, the average size in 1890 being 227.2 acres, and in 1900, 362.4 acres. In 1900, 3.4 per cent. of the farms were rented on the cash system, and 18.4 per cent. on shares. South Dakota is in the great wheat belt, and the cultivation of this crop has rapidly advanced until the State ranks among the first wheat States in the Union. The acreage in corn is also rapidly increasing, but the production of this crop is largely confined to the southeastern section. Oats are grown throughout the farming region, as is also barley, the latter crop being three times as great in 1900 as in 1890. The State stands third in the area devoted to flax. The acreage in hay and forage increased 47.1 per cent. in the decade 1890-1900. Potatoes are the principal vegetable grown. The following table embraces the leading crops:

CROPS	1900	1890
Wheat	3,984,659	2,259,846
Corn	1,196,381	753,309
Oats	691,167	580,289
Barley	299,510	97,370
Rye	39,253	9,229
Flaxseed	302,010	354,951
Hay and forage	2,287,875	1,554,913
Potatoes	33,567	35,440

Stock-Raising. The State has excellent grazing facilities. The number of cattle in 1900 was more than twice as great as in 1890, and there was a large increase in the number of horses, sheep, and swine, as shown in the following table:

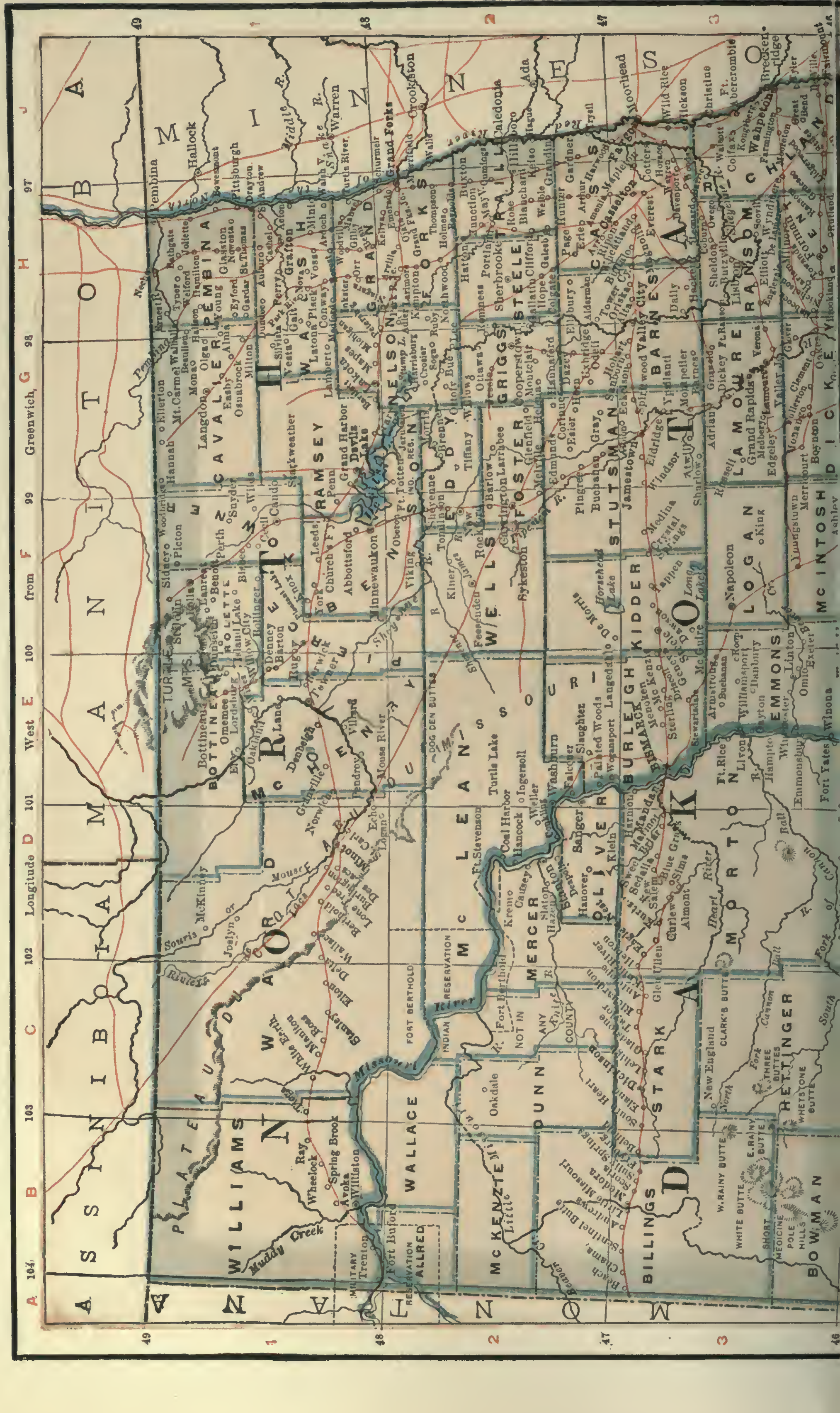
ANIMALS	1900	1890
Dairy cows	270,634	210,240
Other cattle	1,276,166	477,679
Horses	480,768	250,305
Mules and asses	6,999	7,671
Sheep	507,338	238,448
Swine	823,120	590,465

Manufactures. Manufactures are limited mainly to neighborhood industries. In 1900, $7,578,895 was invested as capital and 3121 persons were engaged as wage-earners in the manufactures of the State.

Transportation. The railroads are confined to the region east of the Missouri River and to the mining region in the southwest corner, there

AREA AND POPULATION OF NORTH DAKOTA BY COUNTIES.

County.	Map Index.	County Seat.	Area in square miles.	Population.	
				1890.	1900.
Barnes	G 3	Valley City	1,506	7,045	13,159
Benson	F 1	Minnewankon	1,380	2,460	8,320
Billings	B 3	Medora	6,150	170	975
Bottineau	E 1	Bottinean	1,137	2.893	7,532
Bowman	....	....	.....	6	.....
Buford	....	....	.....	803	.....
Burleigh	E 3	Bismarck	1,680	4,247	6,081
Cass	H 2	Fargo	1,752	19.613	28,625
Cavalier	G 1	Langdon	1,512	6,471	12,580
Church	....	....	.....	74	.....
Dickey	G 3	Ellendale	1,146	5,573	6,061
Dunn	....	....	.....	159	.....
Eddy	F 2	New Rockford	648	1,377	3.330
Emmons	E 3	Williamsport	1,550	1,971	4,349
Flannery	....	....	.....	72	.....
Foster	F 2	Carrington	641	1,210	3,770
Garfield	....	....	.....	33	.....
Grand Forks	H 1	Grand Forks	1,432	18.357	24.459
Griggs	G 2	Cooperstown	730	2,817	4,744
Hettinger	....	....	.....	81	.....
Kidder	F 3	Steele	1,398	1,211	1,754
Lamonre	G 3	Lamoure	1,148	3,187	6,048
Logan	F 3	Napoleon	980	597	1,625
McHenry	E 1	Towner	1,468	1.584	5.253
McIntosh	F 3	Ashley	1,000	3,248	4,818
McKenzie	....	....	.....	3	.....
McLean	D 2	Washburn	3,348	860	4,791
Mercer	C 2	Mannhaven	1,930	428	1,778
Morton	D 3	Mandan	4,740	4,728	8,069
Mountraille	....	....	.....	122	.....
Nelson	G 2	Lakota	990	4,293	7,316
Oliver	D 2	Sanger	727	464	990
Pembina	H 1	Pembina	1.134	14,334	17,869
Pierce	F 1	Rugby	1,008	905	4,765
Ramsey	F 1	Devils Lake	1,200	4,418	9,198
Ransom	H 3	Lisbon	864	5,393	6,919
Renville	....	....	.....	99	.....
Richland	H 3	Wahpeton	1,445	10.751	17.387
Rolette	F 1	Rolla	943	2.427	7.995
Sargent	H 3	Forman	864	5,076	6,039
Sheridan	....	....	.....	5	.....
Stark	C 3	Dickinson	6,002	2,304	7,621
Steele	H 2	Sherbrooke	720	3,777	5,888
Stevens	....	....	.....	16	.....
Stutsman	F 2	Jamestown	2,296	5,266	9,143
Towner	F 1	Cando	1,048	1,450	6,491
Traill	H 2	Hillsboro	872	10,217	13,107
Wallace	....	Grafton	.....	24	.....
Walsh	G 1	....	1.308	16,587	20.288
Ward	C 1	Minot	6,690	1,681	7,961
Wells	F 2	Fessenden	1.296	1,212	8.310
Williams	B 1	Williston	3,512	109	1,530
Standing Rock Indian reservation	D 3	....	....	.....	2,208
Unorganized territory	....	....	.....	511	.....


Longitude West from Greenwich
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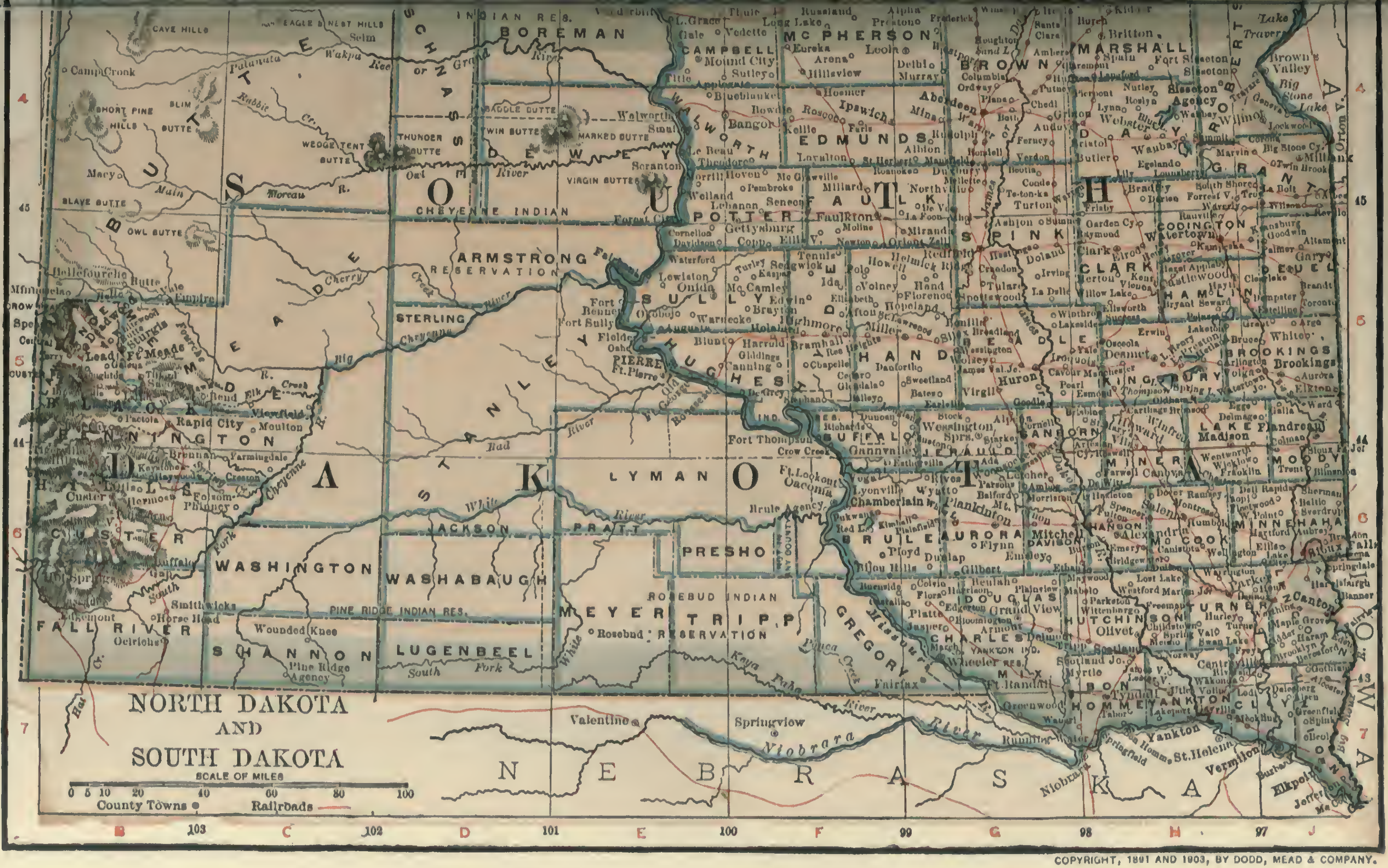
ASSINIBOIA
MANITOBA
MINNESOTA
NORTH DAKOTA
MONTANA
TURTLE MTS.
PLATEAU DU COTEAU
WILLIAMS
BOTTINEAU
ROLETTE
TOWNER
CAVALIER
PEMBINA
WALSH
RAMSEY
BENSON
NELSON
GRAND FORKS
EDDY
FOSTER
GRIGGS
STEELE
TRAILL
CASS
BARNES
STUTSMAN
KIDDER
BURLEIGH
WELLS
SHERIDAN
McLEAN
MERCER
OLIVER
MORTON
STARK
BILLINGS
DUNN
McKENZIE
WALLACE
ALLRED
BOWMAN
HETTINGER
EMMONS
LOGAN
LA MOURE
RANSOM
RICHLAND
DICKEY
McINTOSH
SARGENT
WARD
McHENRY
PIERCE
FORT BERTHOLD INDIAN RESERVATION
MILITARY RESERVATION
NOT IN ANY COUNTY
DEVILS LAKE
DOG DEN BUTTES
CLARK'S BUTTE
THREE BUTTES
WHETSTONE BUTTE
W. RAINY BUTTE
E. RAINY BUTTE
WHITE BUTTE
SHORT PINE HILLS
MEDICINE POLE HILLS
Missouri River
Mouse River
Souris River
Sheyenne R.
Red R.
James R.
Heart River
Cannon Ball R.
Knife R.
Little Missouri
Muddy Creek
Pembina
Grand Forks
Fargo
Jamestown
Bismarck
Mandan
Devils Lake
Valley City
Minot
Williston
Dickinson
Moorhead
Crookston
Wahpeton
Breckenridge



NORTH DAKOTA
AND
SOUTH DAKOTA

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AREA AND POPULATION OF SOUTH DAKOTA BY COUNTIES.

County.	Map Index.	County Seat.	Area in square miles.	Population.	
				1890.	1900.
*Armstrong	D 5		1,460	.....	.....
Aurora	G 6	Plankinton	724	5,045	4,011
Beadle	G 5	Huron	1,270	9,586	8.081
Bonhomme	H 7	Tyndall	569	9,057	10,379
*Boreman	D 4		1,231	.....	.....
Brookings	J 5	Brookings	817	10,132	12,561
Brown	G 4	Aberdeen	1,745	16,855	15,286
Brule	F 6	Chamberlain	808	6,737	5,401
Buffalo	F 5	Gannvalley	483	993	1,790
Butte	B 5	Bellefourche	7,834	1,037	2,907
Campbell	E 4	Mound City	765	3,510	4,527
Charles Mix	G 6	Wheeler	1,123	4,178	8,498
Choteau	....	Now belongs to Butte Co.	.....	8	.....
Clark	H 5	Clark	973	6,728	6,942
Clay	H 7	Vermilion	408	7,509	9,316
Codington	H 4	Watertown	786	7,037	8,770
Custer	B 6	Custer	1,612	4,891	2,728
Davison	G 6	Mitchell	486	5,449	7,483
Day	H 4	Webster	1,077	9,168	12,254
Deuel	J 5	Clearlake	621	4,574	6,656
*Dewey	D 4		2,219	....	.....
Douglas	G 6	Armour	445	4,600	5,012
Edmunds	F 4	Ipswich	1,176	4,399	4,916
Ewing	....	Now belongs to Butte Co.	.....	16	.....
Fall River	B 6	Hot Springs	1,757	4,478	3,541
Faulk	F 4	Faulkton	1,010	4,062	3.547
Grant	J 4	Millbank	694	6,814	9,103
Gregory	F 6	Fairfax	1,004	295	2,211
Hamlin	H 5	Castlewood	543	4,625	5,945
Hand	F 5	Miller	1,418	6,546	4,525
Hanson	H 6	Alexandria	486	4,267	4,947
Hughes	E 5	Pierre	765	5,044	3,681
Hutchinson	H 6	Olivet	817	10,469	11,897
Hyde	F 5	Highmore	875	1,860	1,492
*Jackson	D 6		...	30	.....
Jerauld	G 5	Wessington Springs	548	3,605	2,798
Kingsbury	H 5	Desmet	834	8,562	9,866
Lake	H 5	Madison	549	7,508	9,137
Lawrence	B 5	Deadwood	814	11,673	17,897
Lincoln	J 6	Canton	579	9,143	12,161
*Lugenbeel	D 6		1,066	....	....
Lyman	F 6	Oacoma	3,456	233	2,632
McCook	H 6	Salem	575	6,448	8,682
McPherson	F 4	Leola	1,146	5.940	6,327
Marshall	H 4	Britton	880	4,544	5,942
Meade	B 5	Sturgis	3,003	4,640	4,907
*Meyer	E 6		1,407	.....	.....
Miner	H 6	Howard	569	5,165	5,864
Minnehaha	J 6	Sioux Falls	802	21,879	23,926
Moody	J 6	Flandreau	517	5,941	8,326
Pennington	B 5	Rapid City	2,596	6,540	5.610
Potter	E 4	Gettysburg	900	2,910	2,988
*Pratt	....		.....	23	.....
Presho	....		.....	181	.....
*Pratt	....		....	34	.....
Roberts	J 4	Sisseton Agency	1,102	1,997	12,216
Sanborn	G 5	Woonsocket	576	4,610	4,464
Schnasse	D 4		1,563	.....	.....
*Shannon	C 6		1,066	.....	....
Spink	C 5	Redfield	1.518	10,581	9,487
Stanley	E 5	Fort Pierre	4,882	1,028	1,319
*Sterling	D 5		.....	96	.....
Sully	E 5	Onida	1,052	2,412	1,715
Todd	....		....	188	.....
*Tripp	E 6		1,480	.....	.....
Turner	H 6	Parker	624	10,256	13,175
Union	J 7	Elkpoint	447	9,130	11,163
Walworth	E 4	Bangor	745	2,153	3,839
*Washabaugh	....		1,228	.....	.....
*Washington	C 6		1,540	40	.....
Yankton	H 7	Yankton	515	10,444	12,649
Ziebach	C 5		....	510	.....
Cheyenne River Indian reservation	D 4		....	.....	2,357
Pine Ridge Indian reservation	C 6		....	.....	6,827
Rosebud Indian reservation	E 6		....	.....	5,201
Standing Rock Indian reservation	D 3		....	.....	1,658

*Counties as yet not fully organized; parts of Indian reservations.

being no line crossing the State from east to west. Railway construction was greatest in the decade 1880-1890. The mileage in the latter year was 2610, which figure had increased in 1900 to 2961 miles. The Chicago, Milwaukee and Saint Paul, the Great Northern, and the Chicago and Northwestern have the greatest mileage.

Banking. In 1872 the first national bank was organized in Yankton. In the following twenty years banks multiplied, and in 1889, when division came and the Territory was organized as a State, South Dakota had 33 national and over one hundred private banks, which figures included also the banks organized under the general incorporation law. This rapid organization of small banks was due to the high rate of interest on mortgages, often amounting to 14 per cent. and 15 per cent. The bad crops of 1889-91 reduced the value of real estate, made foreclosure of many mortgages necessary, and caused the failure of many banks. The necessity of some regulation of the banking business became evident, and in 1891, the first banking law of the State was passed, making the shareholders responsible for an amount equal to their stock in addition to their actual investment, allowing dividends on net profits only, etc. Between 1890 and 1900 the national banks diminished both in number and in the volume of transactions, and the State banks have now the larger part of the business. The condition of the banks in 1902 is shown in the following table:

	National banks	State and private banks
Number	47	229
Capital	$1,958,000	$2,579,000
Surplus	253,000	398,000
Cash, etc	791,000	1,552,000
Deposits	10,899,000	17,089,000
Loans	8,409,000	12,574,000

Government. The State Constitution was adopted by popular vote in October, 1889. Proposed amendments must secure the approval of a majority of the members elected to each House, and a majority of the electors voting at a popular election. Upon the approval of two-thirds of the members elected to each House and a majority of the people voting at a popular election the Legislature shall call a constitutional convention. Voters must be citizens, or foreigners who have declared their intention of becoming citizens and have resided in the United States one year, in the State six months, in the county thirty days, and in the election precinct ten days, Pierre is the capital.

Legislative. The Legislature convenes on the first Tuesday after the first Monday of January in the odd years. It consists of a Senate of 45 members and a House of 87 members. The people have the right to propose measures, which the Legislature must submit to a vote of the electors. The people may further require that, with certain exceptions, any laws enacted must be submitted to the people, and not more than five per cent. of the electors are required to invoke these initiative or referendum rights. The Governor's veto does not extend to matters referred to the people.

Executive. The executive power is vested in a Governor and Lieutenant-Governor, elected for two years, the latter being, *ex officio*, president of the Senate. The Governor has a veto power on legislation, which may be overridden by a two-thirds vote of both Houses. He may veto items of an appropriation bill and approve the rest. The other officers are a Secretary of State, Auditor, Treasurer, Superintendent of Instruction, Commissioner of School and Public Lands, and Attorney-General—all holding office for two years.

Judicial. There are five Supreme Court judges, elected for four years. The State is divided into judicial court districts, in each of which a judge is elected for four years.

Finances. The larger part of the public debt was incurred in 1883-89, before the admission to Statehood, and for the construction of hospitals, normal schools, and college buildings. At the time of admission the debt amounted to $710,200 in 4½ per cent. and 5½ per cent. bonds, but in addition South Dakota was obliged to pay to North Dakota in settlement of accounts more than $150,000. The Constitution limited the borrowing power of legislation to $100,000, but this limit was soon reached. In 1892 the debt was more than one million dollars, and in 1895 $1,562,800, of which $424,000 were in warrants. In 1902 the bonded indebtedness was $417,500 and the outstanding warrants were $250,000, making a total debt of $667,500. The income in the beginning came mainly (almost 85 per cent.) from a State tax. Later the sale and lease of public lands developed into an important source of income, which by a special provision of the Constitution must go into the permanent school fund, while the interest on deferred payments must be devoted to current school expenses. During the fiscal year 1901-02 the total income was $2,174,257, and the total expenditure $2,098,620, almost 60 per cent. of which was for school purposes. There was a balance of $840,525 in the treasury, of which $633.000 lay in the school fund.

Militia. In 1900 there were 87,505 men of militia age. The organized militia in 1901 numbered 949.

Population. The population in 1890, according to the first State census, was 328,808, and the figure increased in 1900 to 401,570. In the latter year South Dakota ranked thirty-seventh in population. The foreign-born population was 88,508, among whom the Norwegians, Germans, Russians, and Swedes were the most numerous. There were 9293 Indians taxed and 10,932 not taxed. There were only 5.2 persons to the square mile in the State. There are five towns having (1904) more than 5000 inhabitants each. In 1900 Sioux Falls had a population of 10,266, Lead City 6210, Yankton 4125, Aberdeen 4087, and Mitchell 4055. South Dakota sends two members to the National House of Representatives.

Religion. The Catholic Church includes about one-thirteenth of the inhabitants. The Lutherans are the strongest Protestant denomination.

Education. In 1900 only five per cent. of the population over ten years of age were illiterate. There were then 129 days in the school year. Owing to the large scattered rural population, the educational difficulties have been extreme. In 1900 there were only 176 graded schools, as against 3191 ungraded, the former being almost wholly in the towns. Only the towns have high schools. In 1900 there were 96,822 pupils enrolled, of whom 68,000 were in average attendance. There were in that year 1172 male and 3630 female teachers. The average monthly wage received was $33 for the male teacher and $30.25 for the female teacher. The cost of the public schools was $1,598,757, of which $1,026,126 was paid as salaries to teachers and superintendents. The most important source of financial support is the district tax. The State has the advantage of large Congressional land grants, which aggregated 2,823,320 acres. There are three State normal schools located respectively at Madison, Spearfish, and Springfield. Higher education is provided at the State University, situated at Vermillion, and at the following denominational co-educational institutions: Huron College (Presbyterian), at Huron; Dakota University (Methodist Episcopal), at Mitchell; Redfield College (Congregational), at Redfield; and Yankton College (Congregational), at Yankton. There are a school of mines at Rapid City and an agricultural college at Brookings.

Charitable and Penal Institutions. A State insane asylum is situated at Yankton, a school for the deaf at Sioux Falls, an institution for the blind at Gary, and a soldiers' home at Hot Springs. The State penitentiary is at Sioux Falls, and the Reform School at Plankinton.

History. The State was formed on the division of Dakota Teritory and was admitted to the Union November 3, 1889. (For early history, see North Dakota.) The convention which met July 4th adopted the 'Sioux Falls Constitution,' framed in 1885, with a few necessary changes. A prohibitory amendment was adopted at the first election in October, 1889, but, on account of the 'original package decision' of the United States Supreme Court, did not go into effect. The Sioux Indians by treaty ceded large tracts of land, which were opened for settlement in February, 1890. Other reservations were opened in 1892 and 1895.

GOVERNORS OF SOUTH DAKOTA

Arthur C. Mellette	Republican	1889-93
Charles H. Sheldon	"	1893-97
Andrew E. Lee	Populist	1897-1901
Charles N. Herreld	Republican	1901—

Bibliography. Child, *South Dakota: Resources, People, Statehood* (New York, 1888); Hagerty, *The State of South Dakota; a Statistical, Historical, and Political Abstract* (Aberdeen, S. D., 1889); Beadle, *Dakota* (Saint Paul, 1889); Finerty, *War Path and Bivouac* (2d ed., Chicago, 1890); Todd, "Hydrographic History of South Dakota," in *Geological Society of America Bulletin*, vol. xiii. (Rochester, 1902).

SOUTH DAKOTA, University of. A coeducational State institution at Vermillion, S. D., organized in 1882, and maintained almost wholly by appropriations of the Legislature. Its endowment consists of 86,000 acres of land, yielding in 1902-03 an income of $5600, the total income of the university being $60,000. The tuition is $6 per semester, except to students who have served in the Spanish War, who are exempted from tuition charges. The university has established a loan fund for the assistance of needy students. Military science and tactics form part of the course. The degrees conferred are those of Bachelor of Arts, Law, Commerce, and Music. The estimated value of the property under control of the university in 1903 was $300,000, its grounds, buildings, and equipment being valued at $295,000. The institution carries on the State geological survey. The faculty in 1903 numbered 34 and the students 450, distributed as follows: College of Arts and Sciences, 150; Law, 30; Music, 50; Commerce, 40; Engineering, 30; Preparatory, 150. The library contained about 8000 volumes.

SOUTHDOWN. An English breed of sheep, bred for their superior mutton. See Sheep.

SOUTH DOWNS. A ridge of hills in England. See under Downs.

SOUTHEND-ON-SEA, sŭth′end-. A municipal borough and seaside resort in Essex, England; at the mouth of the Thames, 42 miles east of London (Map: England, G 5). It is a popular holiday and residential resort of Londoners. The town owns fine municipal buildings, promenade piers, a concert pavilion, electric street railways, pleasure grounds, and a cemetery, and maintains technical schools, a sanatorium, and an isolation hospital. Population, in 1901, 28,850.

SOUTHERN CROSS. A famous constellation near the South Pole. Of its four principal stars, one, the southernmost, is of the first magnitude; two, the eastern and northern, of the second; and one, the western, of the third. The stars are not arranged very accurately in a cruciform position; and, on the whole, it must be said the constellation is much overrated.

SOUTHERN CROSS, Order of the. The highest Brazilian order, founded by Dom Pedro I. in 1822, in commemoration of his accession to the throne. The order has four classes, and until 1889 the members received pensions. The decoration is a white enameled cross of five arms, with a wreath of coffee and tobacco leaves. The effigy of Dom Pedro on the medallion is surrounded by the inscription *Petrus I., Brasiliæ Imperator.* On the reverse is a cross composed of nineteen stars, with the words *Bene Merentium Præmium.* The decoration is suspended from a crown and is worn on a blue ribbon.

SOUTHERNE, sŭth′ẽrn, Thomas (1660-1746). An English playwright. He was born in Ireland, and was educated at Trinity College, Dublin. Entered at the Middle Temple in London, he abandoned law to write for the stage, his first play being *The Loyal Brother, or the Persian Prince* (1682). His two best known pieces are the tragedies of *The Fatal Marriage* (1694), which was afterwards revised by Garrick, and *Oroonoko, or the Royal Slave* (1696), founded on a novel of the time and remarkable as including one of the earliest English condemnations of the slave trade.

SOUTHEY, south′ĭ *or* sŭth′ĭ, Caroline Anne (1786-1854). An English poet, daughter of Capt. Charles Bowles, a retired officer. She was born at Lymington, Hampshire. After the death of her mother (1816) and the loss of her property, she turned to literature. She sent the manuscript of a narrative poem, *Ellen Fitzarthur* (published 1820), to Robert Southey, who approved of it. A correspondence followed which led to marriage (1839). In the meantime Miss Bowles wrote *Tales of the Factories* (1823) in verse; *Solitary Hours* (1826) in verse and prose; *Chapters on Churchyards* (1829), a group of tales which gained for her wide attention; and *The Birthday* (1836), a poem recalling Cowper. She also collaborated with Southey on a poem entitled *Robin Hood* (never completed). Soon after her marriage, Southey's mind completely broke down, and she passed three miserable years. After his death (1843), she lived in retirement. Consult the interesting *Correspondence of Robert Southey with Caroline Bowles*, ed. by Dowden (Dublin, 1881).

SOUTHEY, ROBERT (1774-1843). An English poet and miscellaneous writer, born August 12, 1774, at Bristol, where his father was a linendraper. Southey passed much of his boyhood with an aunt at Bath, read through her library, containing Spenser, Sidney, Shakespeare, and many other writers, and tried his own hand at the drama. In 1788 he was sent to Westminster School, from which he was expelled four years later, on account of an essay against flogging. Aided by an uncle living at Lisbon, he entered Balliol College, Oxford (1792), where he remained for only two years. He met Coleridge in 1794; and in conjunction with another friend, Robert Lovell, they formed a socialistic scheme, which they called 'pantisocracy.' They were to take wives and emigrate to the banks of the Susquehanna. They all married sisters, but the scheme went no further. After secretly marrying Edith Fricker, at Bristol (November 14, 1795), Southey immediately left to visit his uncle at Lisbon. On returning (1797) he studied law at Gray's Inn, but soon abandoned the pursuit. He settled with his wife first at Westbury, between Bath and Salisbury, and then at Burton, in Hampshire; and after another trip to Portugal and a short period at Bristol, he joined Coleridge at Keswick in the Lake district (1803). Here at Greta Hall he passed the rest of his life amid his books. Besides the income from his pen, which eventually became large, he received, between 1796 and 1806, an annuity of £160 from a school friend named Wynn. Its place was soon filled by a Government pension of the same amount, to which was added, in 1835, another pension of £300. In 1813, then as strongly conservative as he had once been republican, he was appointed poet laureate. In this capacity he wrote *The Vision of Judgment* (1821), an apotheosis of George III. in hexameter verse. The incident is made memorable by Byron's brilliant parody under the same title. Southey's wife died in 1837, and two years later he married Caroline Anne Bowles. His mind was already giving way and soon became a blank. He died at Keswick, March 21, 1843, and was buried in the Crosthwaite churchyard. A recumbent statue was placed in the church. When a schoolboy Southey formed the plan of a series of narrative poems on the mythologies of the world. Under the inspiration of this idea, subsequently modified, he wrote a number of epics, comprising *Joan of Arc* (1796); *Thalaba, the Destroyer* (1801), an Oriental tale; *Madoc* (1805); *The Curse of Kehama* (1810), founded on Hindu legend; and *Roderick, the Last of the Goths* (1814). Though they contain many noble passages and interesting experiments in versification, they are in the main only rhetorical. His prose is best represented by *Letters from England by Don Manuel Alvarez Espriella* (1807), a view of England from the assumed standpoint of a Spanish gentleman; *The Doctor* (1834-37), containing the nursery classic, "The Three Bears," the lives of Wesley (1820) and of Nelson (1813); and his delightful letters. Of his other miscellaneous work may be cited *History of Brazil* (1810-19), part of a contemplated history of Portugal; *History of the Peninsular War* (1823-32); *Colloquies on Society* (1829), unnecessarily ridiculed by Macaulay; *Naval History* (1833-40); and a revolutionary drama, *Wat Tyler* (written in 1794, and surreptitiously published in 1817). As a conservative in religion and politics Southey sustained many bitter attacks from the leaders of rising liberalism. In unflagging literary industry he was one of the most notable figures of his time. His prose, far more than his poetry, is a contribution of permanent value to English letters.

Consult: The *Life and Correspondence*, by his son, Rev. C. C. Southey (London, 1849-50), containing the fragment of an autobiography; *Selections from Southey's Letters*, ed. by Warter (ib., 1856); *Correspondence with Caroline Bowles*, ed. by Dowden (Dublin, 1881); Dennis, *Southey: Story of His Life*, an excellent selection from letters (Boston, 1887); *Southey*, a memoir and estimate by Dowden, "English Men of Letters" series, new ed. (New York, 1895); and poems with memoir by S. R. Thompson, in the "Canterbury Poets" series (London, 1888).

SOUTH FORE′LAND. See FORELAND, NORTH AND SOUTH.

SOUTH GEORGIA, jôr′jȧ. An island in the South Atlantic Ocean belonging to Great Britain, and situated in latitude 54° 30′ S., longitude 37° W., 800 miles east by south of the Falkland Islands (Map: World, Western Hemisphere, P 17). Area, about 1600 square miles. The island consists of mountains of Archæan formation from 6000 to 8000 feet high. Several permanent glaciers exist in the deep gorges on the mountain slopes, and the climate is damp and chilly. The lower slopes are covered with grass, but the flora is poor. The island is uninhabited. It was discovered in 1675 by Laroche.

SOUTH HAD′LEY. A town in Hampshire County, Mass., three miles northeast of Holyoke, on the Connecticut River (Map: Massachusetts, B 3). It is the seat of Mount Holyoke College (q.v.) and has a public library. There are manufactures of writing paper, brick, fertilizers, and lumber product. The government is administered by town meetings, held annually. Population, in 1890, 4261; in 1900, 4526.

SOUTH HOL′LAND. A province of the Netherlands, bounded on the north by North Holland, and on the west by the North Sea (Map: Netherlands, C 3). Area, 1166 square miles. Population, in 1899, 1,144,448, more than half of whom lived in the larger cities. The capital and largest city is Rotterdam. The Hague also is in this province.

SOUTHINGTON, sŭTH′ĭng-ton. A borough in a town of the same name, in Hartford County, Conn., 20 miles south of Hartford; on the New York, New Haven and Hartford Railroad (Map: Connecticut, D 3). It is engaged principally in manufacturing pocket cutlery, general and carriage hardware, carriage bolts, tools, and wood screws. Population, in 1900, 3411. Originally a part of Farmington and called Panthorn, Southington was settled about 1697 and became a separate parish in 1724. It was incorporated as a town in 1779. The borough of Southington was incorporated in 1889.

SOUTH KEN′SINGTON, National Art Schools of. The schools of South Kensington (London) were founded in 1852 for the application of art to industry. The nucleus of an art industrial museum was also formed. (See South Kensington Museum.) The central school for the systematic training of art teachers and students in all departments of design was afterwards established at South Kensington. Aid is furnished in the teaching of art in elementary schools, in night classes for artisans, and in regular schools of art. The same body controls the provincial schools connected with South Kensington, which have grown extensively in number since their first establishment. Many national, local, and free scholarships are also open to British subjects.

SOUTH KENSINGTON MUSEUM. An important London museum, under the charge of the Department of Science and Art of the Committee of Council on Education. It was opened in 1857 and is contained in buildings at Brompton, South of Hyde Park. It includes the extensive Museum of Ornamental or Applied Art, one of the most valuable in the world, with 45,000 works of modern and mediæval art and numerous reproductions; the National Gallery of British Art; the Art Library, with 70,000 volumes and nearly 200,000 engravings, drawings, and photographs; the India Museum (q.v.); the National Art Training Schools; and the Royal College of Science. It maintains as a branch the Bethnal Green Museum for the benefit of the working classes in the East End. The museum is visited annually by about 2,000,000 persons.

SOUTH KINGSTOWN, kĭngs′ton. A town, including West Kingston, the county seat, and several other villages, in Washington County, R. I., 23 miles south of Providence; on the New York, New Haven and Hartford, and the Narragansett Pier railroads (Map: Rhode Island, B 4). The Rhode Island College of Agriculture and Mechanic Arts is in the village of Kingston; also a public library with 7000 volumes. Other noteworthy features include the Narragansett Library, at Peacedale, and the Robert Beverly Hale Memorial Library at Matunuck. Matunuck is a popular watering place. South Kingstown is a rich farming district and also has fishing interests. The leading manufactured products are woolens and worsteds. The first power loom in the United States was established at Peacedale in 1814. Population, in 1890, 3415; in 1900, 4972.

SOUTH McAL′ESTER. A town of the Choctaw Nation, Indian Territory, about 85 miles southwest of Fort Smith, Arkansas; at the junction of the Missouri, Kansas and Texas and the Choctaw, Oklahoma and Gulf railroads (Map: Indian Territory, H 4). There are extensive coal mines. The town is engaged in cokemaking and is a centre for wholesale trade. There are cotton gins, a large cotton compress, iron foundries, brick plants, a flour mill, etc. Population, in 1900, 3479.

SOUTH MOUNTAIN, Battle of. A battle fought September 14, 1862, during the Civil War, at Crampton's Gap and Turner's Gap in the South Mountain range, near Sharpsburg, Md., between a Confederate force of about 18,000 under the immediate command of McLaws and D. H. Hill, and a Federal force of about 28,000 under the immediate command of Generals Franklin and Reno. The two forces formed parts respectively of the Army of Northern Virginia, under Lee, and the Army of the Potomac, under McClellan. The Confederate troops, who had the advantage of position, resisted with great stubbornness the advance of the Federals, but were finally driven back, and on the 16th the Army of Northern Virginia and the Army of the Potomac met at Antietam (q.v.). The loss of the Federals in killed, wounded, and missing was about 1800; that of the Confederates about 2600.

SOUTH NOR′WALK. A city in the town of Norwalk, Fairfield County, Conn., 14 miles west by south of Bridgeport; at the mouth of the Norwalk River, on Long Island Sound, and on the New York, New Haven and Hartford Railroad (Map: Connecticut, B 5). Its beautiful situation, on rising ground overlooking the Sound, makes it a very attractive residential city. There are two libraries; the Public and the Roth and Goldschmidt. South Norwalk has a good harbor, and a large coastwise trade is carried on. Its manufactures include hats, locks, and various iron products. The government is vested in a mayor, elected annually, and a unicameral council. The water works and electric light plant are owned and operated by the municipality. (For history, see Norwalk.) Population, in 1900, 6591.

SOUTH OMAHA, ō′mȧ-hạ. A city in Douglas County, Neb., adjoining Omaha; on the Missouri River, and on the Union Pacific, the Chicago, Rock Island and Pacific, the Burlington and Missouri River, and other railroads (Map: Nebraska, J 2). It has a public library. South Omaha ranks third among the cities of the United States in its slaughtering and meat-packing interests, being surpassed only by Chicago and Kansas City. In the census year 1900 the five establishments connected with that industry had an invested capital of $15,635,418 and an output valued at $67,716,724. The city government, under the revised charter of 1901, is vested in a mayor, elected biennially, and a unicameral council, and in administrative officials, the majority of whom are appointed by the mayor, with the consent of the council. The board of education, however, is chosen by popular vote and the fire and police board by the State Governor. South Omaha was settled in 1882 and was incorporated in 1886. Its rapid growth dates from the establishment in 1884 of the Union Stock Yards. Population, in 1890, 8062; in 1900, 26,001.

SOUTH OR′ANGE. A village in Essex County, N. J., 4 miles west of Newark; on the Delaware, Lackawanna and Western Railroad (Map: New Jersey, D 2). The main portion is picturesquely situated on a gentle eminence facing Orange Mountain. It is a residential suburb of Newark and New York. Seton Hall College (q.v.), a Roman Catholic institution, was opened here in 1856. The village has a public library and a handsome town hall. Population, in 1890, 3106; in 1900, 4608. South Orange was settled about 1670, and until erected into a township, in 1861, was a part, first of Newark, and then, after 1806, of Orange. Consult Whittemore, *Founders and Builders of the Oranges* (Newark, 1896).

SOUTH′PORT. A municipal borough and watering place in Lancashire, England, at the mouth of the Ribble Estuary, 15 miles southwest of Preston (Map: England, C 3). It is a handsome town, with fine public buildings and institutions. There are artificial lakes and marine parks on the shore for bathing and model-yacht sailing. Southport owns the gas and electric lighting works, markets, and cemeteries, and maintains a free library, art gallery, and technical schools. Its rise dates from 1830. Population, in 1891, 41,400; in 1901, 48,000. Consult Stephenson, *Southport* (Southport, 1898).

SOUTH PORT′LAND. A city in Cumberland County, Me, on Casco Bay, opposite Portland, with which it is connected by ferry and four bridges, and on the Boston and Maine Railroad (Map: Maine, C 8). It is the seat of the State School for Boys, formerly known as the State Reform School. Noteworthy are the Government fortifications, the town hall, Masonic Building, and the Soldiers' Monument and grounds. The city has iron works, acid works, ship railway and machine shops, etc. The government is vested in a mayor, chosen annually, and a unicameral council. South Portland was a part of Cape Elizabeth until 1895, when it was set off as the town of South Portland. In 1889 it was chartered as a city. Population, in 1900, 6287.

SOUTH SEA. A name formerly applied to the Pacific Ocean.

SOUTH SEA CHESTNUT. See Inocarpus.

SOUTH SEA COMPANY, The. An English commercial company incorporated in 1711. It was a financial scheme organized by the Lord Treasurer Harley for the purpose of extinguishing the national debt, which then amounted to £10,000,000. The company assumed the debt on condition of receiving from the Government an annual payment of £600,000 for a certain number of years and a monopoly of trade to the South Seas. It also secured from the Spanish Government the contract of supplying the Spanish-American colonies with slaves, and proposed to engage in whale fisheries. On the strength of its purely prospective profits, the value of the company's stock increased enormously. In the spring of 1720 it proposed to assume the entire national debt, which was at that time over thirty millions, on being guaranteed five per cent. per annum for seven and a half years. At the end of this time the debt might be redeemed, if the Government chose, and the interest reduced to four per cent. The directors used every means to increase the value of the stocks, until in the beginning of August, 1720, the shares were quoted at 1000, when the chairman and some of the principal directors sold out. This flagrant conduct and the failure of Law's Mississippi Scheme in France opened the eyes of the public, and at the end of 1720 the crash came. Thousands of innocent stockholders were ruined. Parliamentary investigation revealed a scandalous complicity on the part of a number of the Cabinet. By the able manner in which he afforded relief to the unfortunate stockholders, Sir Robert Walpole (q.v.), the new Chancellor of the Exchequer, acquired great popularity. The directors were deprived of their ill-gotten gains and almost one-third of the original capital was saved for the stockholders. Consult: Mackay, *Memoirs of Extraordinary Popular Delusions* (London, 1852); Coxe, *Memoirs of Sir Robert Walpole* (London, 1802).

SOUTH SHET′LAND ISLANDS. An Antarctic archipelago lying about 600 miles south of Cape Horn, between 61° and 63° 20′ south latitude, and 54° and 63° west longitude, and separated from Graham's Land and Louis Philippe Land by the Bransfield Strait (Map: Antarctic Regions, A 4). The islands are twelve in number, the chief of which are George, Livingston, Smith, Deception, Elephant, and Clarence. The total area is about 880 square miles. They were discovered in 1599 by Dirk Gherritz. The region was explored by Sir John Ross in 1842, and in 1893 by Laskar in the *Jason*, who determined the coast-line of Graham's Land to the 69th degree south latitude.

SOUTH SHIELDS. A seaport of England. See Shields, South and North.

SOUTH VICTORIA LAND, or Victoria Land. A portion of the Antarctic land regions, whose coast extends in a north and south direction between latitudes 71° and 79° south, and along the 170th meridian east of Greenwich, the meridian of New Zealand. It is a mountainous country, falling in steep snow-crowned cliffs to the sea, and rising in Mount Melbourne to a height of over 14,000 feet. It also contains the volcanoes of Erebus and Terror, the latter 11,000 feet high. Several hundred miles inland is the Magnetic South Pole. Victoria Land was discovered by Ross in 1841, and explored and mapped by Borchgrevink in 1899.

SOUTHWARK, sŭth′ẽrk. A Parliamentary borough in London (q.v.), on the southern side of the Thames.

SOUTH′WELL. A town of the Newark Parliamentary division of Nottinghamshire, England, 27 miles by rail southwest of Lincoln. The magnificent mediæval Minster of Saint Mary, founded on the site of a church said to have been erected by the first Archbishop of York in 630 still retains its three towers. The building is cruciform, the towers, nave, and transept are twelfth-century Norman, and the choir is a beautiful example of the English Gothic. It was renovated in 1882. Population, in 1901, 3160.

SOUTHWELL, Robert (c.1561-95). An English poet and martyr, son of Richard Southwell, of Horsham Saint Faith's, in Norfolk. Having studied at Douai and at Paris, he went to Rome, where he was received into the Order of Jesuits (1578), and ordained priest (1584). He was immediately sent to England as a missionary, where he became chaplain to the Countess of Arundel (1589). As a native-born subject ordained to the Roman Catholic priesthood, he was guilty of treason. He was not molested, however, till 1592, when he was arrested. After three years' imprisonment, with frequent tortures, he was tried, condemned, and executed (February 21, 1595). During his residence in England, Southwell wrote and circulated, usually in manuscript, several Catholic tracts, and a considerable body of choice verse (published after his death). His most ambitious poem is the long popular

Saint Peter's Complaint in 132 six-line stanzas; his best is perhaps the brief *Burning Babe.* Consult his *Poetical Works,* ed. by Turnbull (London, 1856); *Complete Poems,* ed. by Grosart ("Fuller's Worthies Library," ib., 1872); and *A Four-fould Meditation* (not in Grosart), ed. with bibliography by Edmonds (ib., 1895).

SOUTH'WICK. A town in Durham, England, 1 mile northwest of Sunderland (Map: England, E 2). It has shipbuilding industries, glass works, and potteries. Population, in 1901, 12,640.

SOUTH'WORTH, Emma Dorothy Eliza [Nevitte] (1819-99). An American novelist, born at Washington, D. C. She wrote tales for the *National Era* of Washington, in which she published her first novel, *Retribution* (1849), and she wrote nearly sixty popular novels. They dealt principally with Southern life and were highly wrought in color and emotion, but had little literary value. A uniform edition of her works was brought out in 1872 at Philadelphia.

SOUVESTRE, sōō'vĕs'tr', Emile (1806-54). A French novelist and dramatist. His best works, *Les derniers Bretons* (1835-37), *Le foyer Breton* (1844), deal with his native Brittany. More noted is the sentimentally cheerful *philosophe sous les toits* (1851).

SOVEREIGN. An English gold coin of the value of a pound sterling, the standard weight of which is 123.374 grains troy. The sovereign is worth approximately $4.85.

SOVEREIGNTY (OF. *sovrainte,* Fr. *souveraintè,* from OF. *sovrain, soverain, suverain, souverain,* from ML. *superanus,* principal, supreme, from Lat. *super,* above, over). Several uses of the term sovereignty must be distinguished. Of these the principal are internal sovereignty and external sovereignty. Internal sovereignty touches the relation between a State and its citizens or subjects; external sovereignty relates to the position of a State among other States. The essence of internal sovereignty is supremacy over subjects; that of external sovereignty is independence of other States.

Internal Sovereignty. Under the head of internal sovereignty another distinction is made between what is termed 'legal' sovereignty and 'political' sovereignty. Political sovereignty is the ultimate controlling power resident in any political society. Legal sovereignty is the organized power which at any given time must be regarded as legally supreme. Political sovereignty arises out of the very nature of the State as an organization for the purposes of social control. A supreme power enabling the State to preserve a form of public order, protect the community, and otherwise promote the general welfare is necessary to the life of organized society, and its absence is anarchy. Political sovereignty, then, is that power in the State the will of which is ultimately obeyed. At any given time this supreme will may or may not be accurately expressed by the existing legal or governmental authority.

Legal sovereignty refers to the supreme power of the State as embodied in some legal or governmental organ or agency. Thus the King in Parliament is termed a sovereign body in England; a Constituent Convention is so called in France; or a king in some cases is called the sovereign. This legal sovereign may not, although it generally does, represent the actual sovereignty in the State, but it is none the less supreme from the legal or governmental point of view. For example, the political sovereignty may actually belong to the mass of the people while the legal sovereignty may be vested in an aristocracy or a monarch; and, on the other hand, the actual power may be vested in a few while the government is democratic in form. Again, the legal sovereign, as for example the Parliament in Great Britain, may pass a law opposed by the majority of the people, but the enactment is none the less law and legally enforceable until repealed, or until the Government is overthrown by a revolution.

The *origin* of sovereignty has been explained in various ways by different schools of political philosophy. It has been asserted that the ruling authority holds by divine appointment or sanction; that the right to rule is a property right descending as other property in regular line of succession; that the sovereignty is created by a voluntary contract either between ruler and ruled or between independent individuals, as in the social contract (q.v.); that sovereignty is the prerogative of superior force and belongs to the strongest claimant. In modern times it is generally believed that sovereignty is a product of political necessity arising out of the essential nature of political association, and the tenure of the particular holders of the political sovereignty is a result of historical evolution. This process has thrown the supreme power in most civilized States into the hands of the mass of the people.

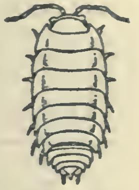
Characteristics of Sovereignty. In the narrower sense, sovereignty is generally regarded as absolute. There is no limitation of a legal or governmental character upon the exercise of its power. Legally speaking, all governments, whether monarchical, aristocratic, or democratic in form, are absolute. There are physical and moral limitations upon it, but so far as the legal organization is concerned, there is no other organization or association within the limits of the State which can resist in any legal way the commands of the sovereign. In the broader sense of the term, political sovereignty is not absolute, since the ruling element in the State, however powerful, is never strong enough to be absolute in all things. It is also pointed out by some authorities that there may be and actually are legal limitations on the sovereign power. Thus in the United States there is no legal way of depriving the States of their equal suffrage in the Senate without their consent (Const., Art. v.), and in Germany the special rights of the States are likewise protected (Art. lxxvii.). It has also been strongly urged that the self-limitation of a State through its own Constitution gives rise to inviolable rights against the supreme power, and that therefore, although limited only by its own act, the sovereignty of a State should be regarded as legally limited, and hence not absolute in character.

Furthermore, sovereignty in the narrower sense of the term is indivisible. There cannot be two sovereign powers acting on the same territory in an organized State. Two supreme powers having jurisdiction over the same persons and things would be logically impossible in a unified State. One must be sovereign and the other subordinate. Both cannot be the highest, the supreme authority. The King cannot be half-sovereign and the people half-sovereign, nor in a federal system can the various members of the union be partly sovereign and the central authority also partly sovereign. What seems like the division of sovereignty in a 'federal State' is, on closer analysis, modern constitutionalism. The sovereignty of the political society as a whole, as in the United States, or the complete sovereignty of a number of independent States, associated for certain common purposes, as in the Confederate States. The practical difficulty arises from uncertainty as to the degree of centralization in the given system.

The *location* of sovereignty has been a vexed question, especially in connection with the rise of modern constitutionalism. The sovereignty of the King on the one hand and that of the people on the other have been stoutly and ingeniously defended by the partisans of court and commonalty. In general the theory of popular sovereignty has triumphed, although in Germany the doctrine of State sovereignty has been accepted as a compromise. There the State, including both King and people, is declared to be the repository of supreme power by most publicists. The location of sovereignty has also been a subject of theoretical discussion as well as actual warfare in the great federal States, Germany and the United States, and in both instances has been decided to the prejudice of the individual States. See STATES' RIGHTS.

EXTERNAL SOVEREIGNTY. States which possess certain powers, such as that of negotiating treaties, declaring war, concluding peace, and regulating their internal administration, are called sovereign powers and are the parties to international law, entitled to its rights and privileges and liable to its duties and responsibilities. In international law the characteristics of sovereignty are not the same as in the cases already considered, but are nevertheless treated as sovereign powers for the purposes of international law. Examples of this would be Turkey, Servia, and Egypt. Moreover, in international law, sovereignty is generally looked upon as divisible in nature. Certain States are termed half-sovereign or semi-sovereign. A State may yield up its right to negotiate with other powers, or the right to make war, or may surrender the control of a large part of its internal administration, and yet remain in the eyes of international law at least a semi-sovereign State. We may thus have a State which is sovereign internally—that is, over its own subjects—and at the same time subordinate to the commands of some other State externally, as was Madagascar. In fact, the territorial expansion of the Great Powers has given rise to a variety of complicated relations between strong and weak States, such as the protectorate, suzerainty, and the 'sphere of influence,' which make exceedingly difficult the logical application of the conventional idea of sovereignty, and, indeed, can be explained only by reference to the category of international law.

In recent years it has been maintained that sovereignty has no place among the concepts of political science, and should properly be eliminated from its terminology. Sovereignty and absolutism are regarded as identical in nature, and it is declared that constitutionalism, federalism, and imperialism alike require that this concept, born in the days of the struggle with feudalism, should now be abandoned. Other publicists maintain that a State may exist as a State although devoid of the attribute of sovereignty. There may be, in other words, a non-sovereign State, of which such communities as Bavaria and Saxony would be types. Such 'States' possess true political power, governing in their right, and not by delegated authority, but are to be classed as non-sovereign States, inasmuch as they are subordinate to the Empire as a whole. The same position has been claimed for the members of the American Union by Woodrow Wilson.


SOW-BUG.

SOW-BUG. A small carnivorous crustacean of the family Oniscidæ, the species of which live under logs in the woods and in similar places. It is an isopod. See CRUSTACEA; ISOPODA; and compare GRIBBLE.

SOWER, sour (or **SAUR**), CHRISTOPHER (1693-1758). An early American printer and publisher, born at Laasphe, near Marburg, Germany. After receiving a university education, and studying medicine at Halle, he emigrated to Pennsylvania in 1724, and in 1731 settled at Germantown. There in 1738 he set up a printing press and began the publication of an almanac in German, which was continued by his descendants for sixty years. In 1739 he issued the first number of *Der Hoch-Deutsch Pensylvanische Geschichte-Schreiber*, a quarterly magazine, the first of the sort published in Pennsylvania. In 1743 he published a quarto edition of Luther's translation of the Bible in German, which was, with the exception of Eliot's Indian Bible, the first to be published in America. He continued his activity in publishing both English and German works, and in connection with that business established a type foundry, the first in America, a paper mill, and an ink factory. He is also generally credited with being the inventor of cast-iron stoves.

SOWERBY (sou'ẽr-bĭ) **BRIDGE.** A manufacturing town in the West Riding of Yorkshire, England, 3 miles southwest of Halifax. Its chief buildings are Christ Church, dating from 1526 and rebuilt in 1819, the town hall, and municipal offices. The town owns the gas works, slaughter houses, and public baths. Woolens are manufactured. Population, in 1901, 11,500.

SOW THISTLE (AS. *sugu istel*, from *sugu*, sow + *istel*, thistle), *Sonchus*. A genus of about 30 species of Old World plants of the natural order Compositæ. Several species have been introduced in the United States. The common sow thistle (*Sonchus oleraceus*) is a somewhat branching annual weed 2 to 3 feet tall, with small yellow flowers, common in richly cultivated soils. The tender tops and leaves are much used in Northern Europe as greens. The field sow thistle (*Sonchus arvensis*) is a perennial with large yellow flowers and found in similar soils. The Alpine blue sow thistle (*Lactuca alpina*) is a native of the mountainous parts of Europe.

SOXHLET. zōks'lĕt, FRANZ (1848—). A German agricultural chemist, born at Brünn, Austria, and educated at Leipzig. In 1879 he was appointed professor of agricultural chemistry at the Polytechnic Institute in Munich and superintendent of the principal Bavarian agricultural experiment station. There he became distinguished for his experiments in the chemistry of milk and its action. He put forth a new theory of the formation of butter and devised a method of extracting fats by means of ether. His investigations, embracing such subjects as the difference between human and bovine milk, the sterilization of milk, and the determination of the percentage of fat contained therein, the organic changes of tissue in the sucking calf, the varieties of sugars, and the formation of fats from carbohydrates, are all valuable.

SOY BEAN (Jap. *si-yan*, Chin. *shi-yu*, soy), *Glycine hispida*. An upright bushy annual leguminous plant 2½ to 4 feet tall, a native of Asia, where it has long been cultivated, especially in China and Japan, and whence it has been introduced into Europe and America. The name soy is derived from the Japanese *shoyu*, a food prepared from the seeds. The numerous varieties in cultivation vary principally in the color, shape, and size of the seed and the length of the growing period. Besides its use as a forage plant (see below) this crop is also frequently grown as a soil-improver on soils deficient in nitrogen. It thrives best under conditions favorable to corn culture and on soils of medium texture well supplied with potash, phosphoric acid, and lime, although it also gives good returns on light poor soils. If planted for hay or fodder the seed is sown broadcast or closely in drills in the spring when the soil has become thoroughly warm; if for the beans, in drills about three feet apart and cultivated like corn. When used for hay, ensilage, or green fodder the crop is cut when the plants are in bloom, when harvested for the seed, before the pods become ripe enough to burst and scatter the seeds. From eight to ten tons of green forage are obtained from an acre. About 40 bushels of seed per acre is considered a satisfactory yield, but sometimes from 75 to 100 bushels are obtained. Insect enemies and plant diseases do not seem to be troublesome.

Soy-bean hay cut at the proper season and well cured has a high feeding value, but since the stems become woody and the leaves fall off badly, the crop is put into the silo either alone or mixed with corn ensilage. The seed, being a very concentrated feed, is usually ground and mixed with other feeding stuffs. Fed alone or with other materials the meal is quite thoroughly digested; experiments with sheep showed that 91 per cent. of the protein and 84 per cent. of the total organic matter was assimilated. Similar values of the seed were 87 and 85 per cent.

Though the soy bean is eaten more extensively in China and Japan than in any other countries, so far as can be learned it is never eaten there as a vegetable, but as more or less complex food products of which natto, tofu, miso, yuba, and shoyu are commonly made in Japan and similar products in China. The composition of these foods is given in the following table:

Composition of Food Products Made from Soy Beans

SOY-BEAN FOOD PRODUCTS	Water	Protein	Fat	Nitrogen free extract	Fibre	Ash
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Fresh tofu	89.00	5.00	3.40	2.10	....	0.50
Frozen tofu	18.70	48.50	28.50	2.60	....	1.70
Natto	15.32	41.42	23.65	15.05	1.48	3.08
Yuba	21.85	42.60	24.62	7.65	....	2.82
White miso	50.70	5.70	24.40		12.60	6.60
Red miso	50.40	10.08	18.77		8.25	12.50
Shoyu (soy sauce)	63.29	8.31	5.10		....	19.45

Most of these soy-bean products, which have been popular from ancient times, are fermented. The cell walls and other carbohydrate materials are broken down, the cell contents rendered more accessible to the digestive juices, and at the same time peculiar and pleasant flavors are developed.

The statement is frequently made that the Orientals live almost exclusively upon rice, eating little or no meat. It is not, however, generally known that the deficiency of protein in the rice is made up by the consumption of large quantities of these soy-bean products, which are said to take the place in the Japanese dietary of meat and other animal nitrogenous foods too costly to be eaten by the populace. They are eaten in some form by rich and poor at almost every meal. A large number of dietary and digestion experiments have been made in Japan in which soy-bean preparations formed a considerable part of the food consumed. Generally speaking, the nitrogen was well assimilated. The beans are sometimes used for bread-making, and when roasted as a substitute for coffee.

SOYER, swä'yȧ', Alexis Benoît (1809-58). A French cook and writer on cookery, born at Meaux-en-Brie. After the Revolution of 1830 he went to England, where he became chief cook to the Duke of Cambridge. In 1837 he became chef at the Reform Club. In 1847 on a Government appointment he proceeded to Ireland, where a serious famine prevailed, and there erected and conducted a large number of kitchens from which food was served at half the regular price. In 1855 he went to the Crimea, where, in conjunction with Florence Nightingale, he directed reforms in the dietaries of the military hospitals. This work he continued after his return to England at the close of the war, with the result that a radical dietary reform both in the hospitals and in the ordinary barrack rations was effected. He wrote extensively on cookery, among his published works being: *The Gastronomic Regenerator* (1846), *The Modern Housewife* (1849), *A History of Food in All Ages* (1853), *A Shilling Cookery Book for the People* (1855), *Soyer's Culinary Campaign with the Plain Art of Cookery for Military and Civil Institutions* (1857), *Instructions for Military Hospitals* (1860). Consult also Volant and Warren, *Memoirs of Alexis Soyer* (London, 1858).

SOYESHIMA, sô-yĕsh'ĭ-mȧ, Tanéomi. A Japanese statesman and scholar, born at Saga, in the Province of Hizen, in Kiushiu, and educated in the local school for samurai. In 1866 at Nagasaki he came under the influence of Guido F. Verbeck (q.v.), an American missionary, by whom he was taught, particularly in the New Testament and the Constitution of the United States. Giving his special attention to the study of law, he was in 1868 made a commissioner by the new Government for framing laws and later an Imperial councilor. In 1871 the Mikado sent him to Russian Siberia to settle boundary question concerning the island of Saghalin, and in the following year he was an ambassador to the Emperor of China regarding Loo-choo. As Minister of Foreign Affairs he was instrumental in releasing the Chinese coolies from a Peruvian vessel at Yokohama and thus ending the coolie traffic. (See MACAO.) On his return to Japan he resigned from the Cabinet because of differences on the Korean war question, but in private life continued to be influential in agitation for constitutional government, and later was invited to reënter the Cabinet. He revisited China in 1876, was welcomed and lauded by the mandarins for his profound scholarship, and became a trusted private adviser of the Emperor, especially in his library.

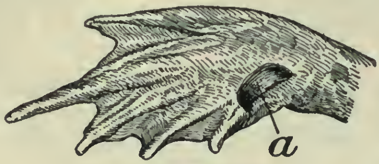
SO′YOTS. A people of the Sayan-Altai region, Mongolian by race, usually classed with the Samoyeds. They are of rather low stature, with brachycephalic head form. They are undoubtedly at present a mixed people, with the anthropological type of the Samoyed most prominent. They are hunters and nomads, and number some 35,000 or 40,000 in the Chinese Yenesei basin.

SOZ′OMEN (Gk. Σωζομενός, *Sōzomenos*), HERMIAS SALAMINIUS. A Church historian of the fifth century. He came from a wealthy family of Palestine and spent at least a part of his life as a lawyer at Constantinople. He wrote a history of the Church in nine books, covering the period from 323 to 439. The latter portion, dealing with the years from 423 to 425, is lost. He follows Socrates (q.v.) very closely, but has some independent material, especially upon monastic matters. The work was edited by Hussey (Oxford, 1860), and there is an English translation by Hartranft (New York, 1891).

SPA, spä. A famous watering place in the Province of Liège, Belgium, 20 miles southeast of the city of Liège (Map: Belgium, D 4). It is attractively situated in a hilly region. The waters of the Pouhon spring are largely exported. It is in an inclosure erected to commemorate the visit of Peter the Great in 1717. The *Etablissement des Bains*, a handsome modern structure, is in the Place Royale adjacent to the Casino. There are noted manufactures of woodenware, which is stained brown by being steeped in the mineral waters. Population, in 1900, 8192. Spa gained prominence in the sixteenth century and reached its greatest popularity in the eighteenth century, when it was the favorite resort of the European nobility. It declined in importance after the French Revolution, but is rapidly regaining its former prestige. About 15,000 people visit the place annually. 'Spa' as applied to mineral springs originated in the name of this town. Consult Poskin and Guilleaume, *Spa, les eaux et les bains* (Spa, 1895).

SPACE (OF., Fr. *espace*, from Lat. *spatium*, space; connected with *spes*, hope, OChurch Slav. *spěti*, to result, Lith. *spèti*, to have leisure, AS. *spōwan*, OHG, *spouan*, to succeed, Skt. *sphay*, to fatten). A term denoting the physical basis for dimension and magnitude. From ancient times it has occupied a large place in philosophical discussions. Parmenides and Plato make it equivalent to non-being. Leucippus (q.v.), on the contrary, recognizes its reality. Space of course is presupposed as a fundamental reality in all materialistic atomism. Aristotle defines place as limit, thereby committing himself to the denial of empty space. In modern philosophy the nature of space is one of the central questions. Descartes considered it one of the two attributes of reality, and Spinoza followed him in making it one of the two known attributes. Leibnitz (q.v.) cannot recognize space as an original attribute of his monads, else they become material and not spiritual. Space is therefore only the order of possible coexistent phenomena of sense. When thought clarifies away the obscurities of sense space is no longer left as a relation in which realities stand to each other. Natural science, however, and materialism have vigorously maintained the ultimate reality of space. Berkeley practically reduces space to time and Hume makes it the disposition of colored points. Kant taught that space is a form of perception; phenomena appear in space simply because the mind gives them a local habitation, and, he argues, we may not say that things in themselves are spatial. He tries to prove the *a priori* character of space from its inevitableness in our experience; and according to his view whatever is *a priori* must be of subjective origin. Hegel regards it as 'the first or immediate characteristic of nature,' and yet it is an abstract characteristic, not an independent entity. At the present time there are advocates of almost all theories that have in the past been broached. There are transcendentalists (Kantians); there are realists, who attribute an independent reality to space as if it were a vessel to be filled with objects; there are those who believe that our idea of space is so full of contradictions that it has no ultimate value; and there are those who believe it is a real quality of experienced objects and a real relation between such objects, but who refuse to attribute to it an existence entirely apart from the objects it qualifies or correlates. The last mentioned view seems to be in closer agreement with the facts than any of the others. According to this view pure space is an abstraction having no actual existence. Space is always in experience the figure of some object or the distance between some objects, or in some way an attribute or a relation, not a self-existent thing. The question of the origin of our spatial ideas is psychological. A question that has always been much mooted is that as to the finitude or the infinity of space. Kant tried to cut the Gordian knot by denying the reality of space as a thing in itself, whereby he thought to be able to say that the whole trouble was removed. Space is, therefore, for Kant neither infinite nor finite, but there is no limit to our power to produce space. It is indefinitely producible. Taking, however, the view that space is a real but not an independent element in the objective world, the question as to the infinity of space becomes one to be answered only on the basis of induction (q.v.), and if we may judge from past experience, we should say that there is no definite indication that experienceable spatial objects are limited. But the data are not sufficient for a dogmatic judgment. But even if an end of perceptible objects were found imagination would add further objects, and thus remove the limits. See Baumann, *Die Lehre vom Raum, Zeit und Mathematik in der neuen Philosophie* (Berlin, 1868-69); Deichmann, *Das Problem des Raumes in der griechischen Philosophie bis Aristoteles* (Leipzig, 1893); Hodgson, *Time and Space* (London, 1865); Lechalas, *Etude sur l'espace et le temps* (Paris, 1896); Saleta, *Exposé sommaire de l'idée d'espace* (ib., 1872); also the metaphysical works of Kant, Hegel, Lotze, Bradley, Bowne, Hobhouse.

SPADEFOOT. A 'toad' of the family Pelobatidæ, prominently characterized by the inner bone of the ankle (tarsus) being covered with a hard, sharp-edged horny sheath, which forms an effective tool for digging. Three species belong to Western Europe and the Mediterranean region, of which the best known is *Pelobates fuscus*, which makes deep holes in the sand, where it hides during the day, coming out to hunt at night. The very numerous eggs are laid in strings in water, and the tadpoles grow to a disproportionately large size, shrinking greatly when they change into young toads. American representatives of the family are several species of the genus Scaphiophus, one of which (*Scaphiophus solitarius*), common from New Jersey southward in all suitable places, is renowned for the remarkably loud noise it makes when calling in the spring. Other species are found in Mexico. Consult: Gadow, *Amphibia and Reptiles* (London, 1902); Abbott, *A Naturalist's Rambles About Home* (New York, 1884).



FOOT OF A SPADEFOOT.
Under surface of a left foot, showing the 'spade' (*a*).

SPAETH, spāt, Adolph (1839—). A German-American theologian, born at Esslingen, in Württemberg, and educated at Tübingen. He became a vicar in Württemberg and afterwards a tutor in the family of the Duke of Argyll. In 1864 he came to the United States and for ten years was pastor of a church in Philadelphia. He then became professor of New Testament exegesis in the theological seminary of the Lutheran Church at Philadelphia. He published the American edition of Bücher's *Hand-Konkordanz* and his own *Saatkörner* (1893).

SPAGNA, spä'nyȧ, Lo (c.1480-c.1530). A Spanish painter domiciled in Italy, known as Giovanni lo Spagnuolo or Giovanni di Pietro. Although one of the most distinguished pupils of Pietro Perugino, with whom—and with his own fellow pupil Raphael—he has often been confused, little is known of this Raphaelesque painter, save that he was born in Spain, was established in Umbria after 1500, studied under Pintoriccino, and was made head of the Painters' Guild of Spoleto in 1517. His chief works are in Assisi, Perugia, Spoleto, and Todi. In the National Gallery in London there is also a fine example, "The Agony in the Garden," and at Caen is the "Marriage," long attributed to Raphael, and a "Saint Jerome."

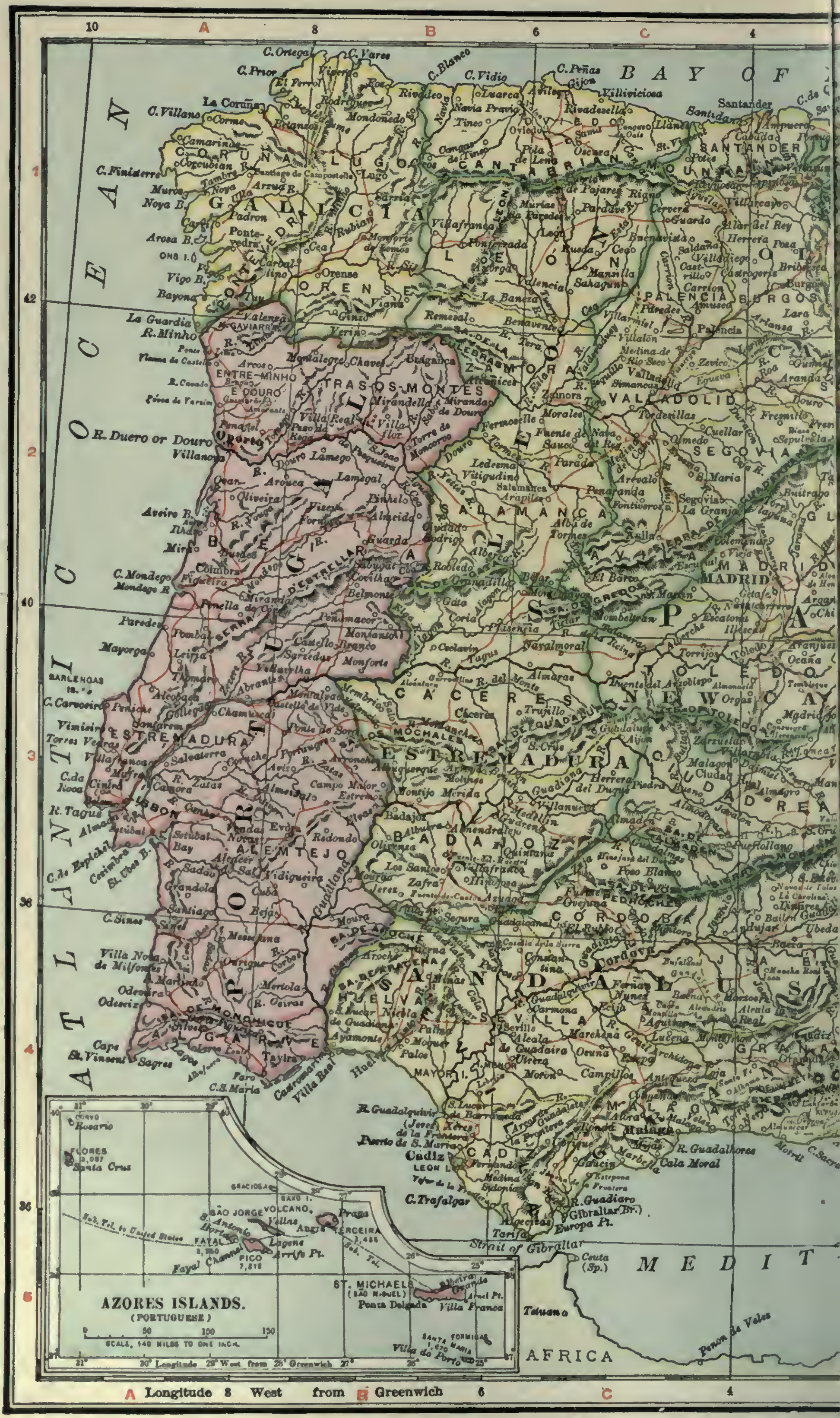
SPAGNOLETTO, spä'nyȯ-lĕt'tȯ, Lo. The familiar name of the painter Juste de Ribera (q.v.).

SPAHIS (Fr. *spahi*, from Hind., Pers. *sipāhī*, soldier, horseman, from Pers. *sipāh*, *supāh*, army). Native Algerian cavalry, originally formed from the Turkish spahis serving in the country at the time of its conquest by the French. The uniform is like that of the Arabs. The natives are not allowed to hold any rank higher than captain.

SPAHR, spär, Charles Barzillai (1860—). An American author and journalist, born at Columbus, Ohio. He was educated at Amherst College, at Leipzig, and at Columbia University. In 1886 he became an associate editor of *The Outlook*. His publications include "Essay on the Present Distribution of Wealth in the United States" (1896), in the *Library of Economics and Politics*, and *America's Working People* (1900).

SPAIN (Sp. *España*, from Lat. *Hispania*). A kingdom occupying about six-sevenths of the area of the Iberian peninsula, about one-seventh falling to the share of Portugal. Lying between latitudes 36° and 44° N. and longitudes 9° 15′ W. and 3° 20′ E., it is bounded by France, the Atlantic (in the north the Bay of Biscay), Portugal, and the Mediterranean. At the extreme south the narrow Strait of Gibraltar separates it from Morocco. Its continental area is 192,004 square miles. As the Canary and Balearic Islands and the small possessions on the north and west coasts of Africa are officially included in the kingdom, its total area is 194,783 square miles. The gorges of the Miño (Minho in Portuguese), the Guadiana River, and the cañons of the Duero (Douro) and Tagus (Sp. Tajo) constitute to a great extent a natural demarcation between Spain and Portugal.

Topography. The predominating natural feature of Spain is the great Iberian tableland which occupies the middle and much of the northern portion of the peninsula—a very compact, lofty, and mainly treeless plateau sloping as a whole to the west. The surface of the tableland rises from 1000 to 3000 feet above the sea, and in its highest part, on the edge of the Iberian Mountains, which wall in Castile on the east, it is 3500 to 5000 feet high. This lofty plateau is crossed by many mountain ridges called sierras, the most important of which are the Castilian Mountains in the centre of the kingdom (Sierra de Guadarrama and Sierra de Gredos), which divide the extensive high plains of Old Castile from those of New Castile. The northern limits of the tableland are the Cantabrian Mountains, the western continuation of the Pyrenees, and the southern limits are the Sierra Morena, which is nothing more than the steep edge of the plateau separating Castile from Andalusia. The highest mountains of the tableland are those of the central region, such as the Plaza Almanzor (8730 feet) in the Sierra de Gredos, and the Pico de Peñalara (7890 feet) in the Sierra de Guadarrama; but these summits rise scarcely 5000 feet above the general level of the plateau. Some of the depressions between the mountain ranges are narrow valleys drained by many



ATLANTIC OCEAN
BAY OF
MEDIT
PORTUGAL
SPAIN
GALICIA
CORUNA
LUGO
OREN
PONTEVEDRA
OVIEDO
SANTANDER
CANTABRIAN MOUNTAINS
LEON
PALENCIA
BURGOS
ZAMORA
VALLADOLID
SALAMANCA
SEGOVIA
AVILA
MADRID
TOLEDO
NEW CASTILE
CACERES
ESTREMADURA
BADAJOZ
CIUDAD REAL
CORDOBA
ANDALUSIA
HUELVA
SEVILLA
CADIZ
MALAGA
GRANADA
ENTRE-MINHO E DOURO
TRAS-OS-MONTES
BEIRA
ESTREMADURA
ALEMTEJO
ALGARVE
LISBON
Oporto
Coimbra
Braganca
C. Finisterre
C. Ortegal
C. Villano
C. Mondego
C. da Roca
C. de Espichel
C. Sines
Cape St. Vincent
C. S. Maria
C. Trafalgar
Strait of Gibraltar
Gibraltar (Br.)
Europa Pt.
Tarifa
Ceuta (Sp.)
Tetuan
AFRICA
R. Duero or Douro
R. Minho
R. Tagus
R. Guadalquivir
Guadiana
SIERRA DE GUADARRAMA
SIERRA DE GREDOS
SIERRA MORENA
SERRA D'ESTRELLA
BARLENGAS IS.
AZORES ISLANDS.
(PORTUGUESE)
FLORES
Santa Cruz
CORVO
GRACIOSA
SÃO JORGE
FAYAL
PICO
TERCEIRA
Angra
ST. MICHAELS (SÃO MIGUEL)
Ponta Delgada
Villa Franca
SANTA MARIA
FORMIGAS
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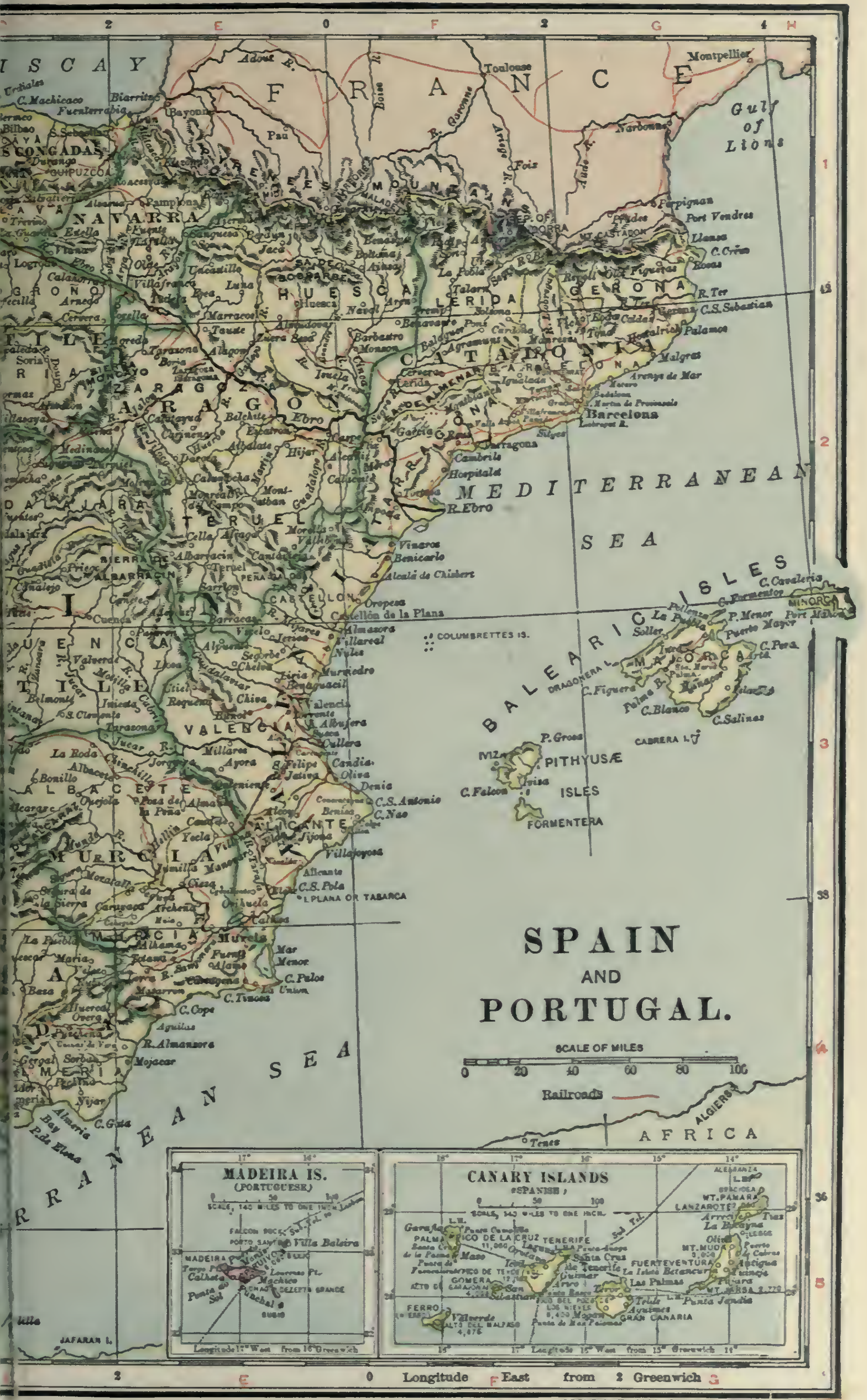

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rapid rivers, and communication across the sierras from valley to valley is difficult.

The long unbroken chain of the Pyrenees forms a mighty barrier on the side of France. They form a wall of exclusion over which no highways have been built, the mountains being circumvented only by roads at their extreme ends. The highest peak of the Pyrenees (which is situated on the Spanish side of the boundary) is the Pico de Aneto (Pic d'Anethou), whose summit is about 11,160 feet above the sea. The Sierra Nevada, in the extreme south, close to the coast, attains an elevation of 11,420 feet, in Mulahacén. the highest mountain in Europe (regarding the Caucasus as not belonging to Europe) outside of the Alps.

The alternation of mountain and river valley in Spain is very conspicuous—first the Cantabrian Mountains and the Duero River in the north; then in succession the Guadarrama Mountains and the Tagus, the Toledo Mountains and the Guadiana, the Sierra Morena and the Guadalquivir, with the Nevada Mountains, in the south. The coast throughout nearly its whole extent is bordered by mountains, giving it a very rugged character, and there are few openings that may be converted into good harbors. The coasts are further impaired for shipping by dangerous currents which tend to throw vessels on the shore. Barcelona has the only really first-class harbor. Spain contains two great low plains. One is the plain of Aragon in the northeast, through which flows the Ebro, which drains the greater part of Northeastern Spain. This plain extends between the Pyrenees and the Iberian Mountains, and is walled in from the Mediterranean by the Catalonian Mountains. The other is the Andalusian plain in the southwest, traversed by the Guadalquivir River and extending between the Sierra Morena and the Sierra Nevada. These plains, like the narrow and comparatively short coastal plains, are among the most fertile regions of Europe, but are of small extent compared with the wide-spreading tableland.

Hydrography. All the long rivers, excepting the Ebro, empty into the Atlantic, as the main water parting is nearer to the Mediterranean than to the ocean. Most of the rivers are for the greater part of the year very deficient in water and not navigable, and, therefore, of small value for shipping. They lie too far below the general level to be of much use even for irrigation. The Miño, Duero, Guadiana, and Tagus are not navigable in Spain, though they are useful for commerce to some extent in Portugal. Of the 800 miles of waterways in Spain only 300 miles are available the year around. The Guadalquivir, which flows through a part of the Andalusian plain, is the deepest river in Spain; vessels ascend it as far as Seville, and small boats reach Cordova. It draws most of its water supply from the high mountains of Andalusia. The Miño and Duero flow across the plateau of Old Castile; the Tagus, the longest of the rivers, courses through New Castile. These rivers with the Guadiana flow in deep rocky valleys. The Ebro reaches the Mediterranean through a tortuous gorge. With its largest tributaries, which bring much water from the slopes of the Cantabrian Mountains and the Pyrenees, it is of great value for irrigating the fertile low lands of Aragon. There are no important lakes, the small lake of Albufera, near Valencia, being the largest.

Climate and Soil. Spain has almost a continental climate notwithstanding the great length of its coast line. The range of temperature between summer and winter and the diurnal variations are great and rapid. Spain has often been misconceived as a land of eternal spring, in which groves of olives and oranges thrive. The climatic conditions adapted for these fruits are found, however, only in the coast districts, and in Andalusia, in the extreme south, and Galicia in the northwest. The summers of the tableland are so hot that nearly all the rivers are dried up and the earth becomes so parched and unproductive that whole villages are sometimes compelled to migrate. The nearness to the Sahara, across the narrow Mediterranean, exposes the southern part of the country to intense heat. On the other hand, the height of the tableland causes the winter temperature to be low. At Madrid, in the centre of the peninsula, there is often skating in winter, although in summer the temperature may rise to 107° F. in the shade, making the climate of Madrid the most extreme in Western Europe. On the southern coast, by contrast, the mean temperature in January is 55°, and frost and snow are extremely rare. The mean temperature at Malaga, on the south coast, is in summer 77° and in winter 57°; at Barcelona, in the northeast, on the Mediterranean, the summer and winter means are respectively 77° and 50°, and at Madrid, in the centre, 75° and 44.6°. The climate is also one of the driest in Europe, and has been made still drier by the destruction of the forests. The rainfall is very small, only 8 to 12 inches per annum in the interior. The evil of deficient precipitation is increased by the fact that. as in all Mediterranean lands, the largest rainfall is in the winter months after the growing season. Irrigation is, therefore, the basis of agriculture. The soils need only moisture to make them very fertile. The hot south wind of Andalusia, known as the Solano, and the cold north wind, called the Gallego, are peculiar to Spain.

Flora. The vegetation is that of Central Europe. It is, however, very monotonous on the whole, for the number of plants capable of supporting great extremes of temperature is naturally limited. Herbs and shrubs predominate on the plateau, but a greater variety of plants is found in ascending from the plains to the mountain summits. Woods are met with only on the slopes of the mountains, where chestnut trees and oaks of various species occupy the lower zone and conifers extend to the tree limit. The elm is found in many river valleys, and is planted with success in some cities. The poplar is one of the cultivated trees, and the beech forms large forests on some of the mountain slopes. The vine flourishes on stony soil, and the olive tree is an important element in the national wealth. The cork tree, from which the bark may be stripped every ten years, is found in Granada and southwest of the Pyrenees, and also in various other districts. Esparto, or alfa, and rushes, largely used for baskets and mats, are grown on the coast and in the interior; sugar cane is cultivated in Andalusia and Valencia; European and Mediterranean fruits and nuts, such as apples, pears, oranges, lemons, almonds, chestnuts, and figs, grow in abundance; the southern provinces also raise maize and rice; and Spain is the chief saffron-producing country in the world.

FAUNA. The remnants of the forests still harbor wolves, lynxes, wildcats, foxes, and even wild goats. The bear is now rare. Deer, hares, and other game abound, and wild boars of great size and strength are hunted in the oak forests.

GEOLOGY AND MINERAL RESOURCES. The tableland is a very ancient and much altered block of the earth's crust, chiefly composed of Archæan and Paleozoic rocks, for the most part of Cambrian, Silurian, and Devonian formation. On the north and south margins of the tableland two younger land masses were upheaved into lofty bordering ranges, the Pyrenean-Cantabrian on the north, and the Andalusian on the south. The Pyrenees are an example of a young folded mountain system built up of parallel belts usually in a northwest and southeast direction. The crust folds of the Andalusian system have a low outer zone of folded Mesozoic and Tertiary strata and a lofty inner girdle, in which the Archæan and Paleozoic rocks rise high above the Mediterranean. Spain had the reputation till the discovery of America of being the richest metal-producing country in the world. It is the most metalliferous land of Europe, not excepting the Ural mining district. The rapid development of mining has been impeded by insufficient fuel and defective means of communication; but the chief reason for the inferior condition of the mining industries is found in the lack of enterprise and skill among the Spaniards. Foreign capital and energy have brought about most of the development in recent years, and the greater part of the ore is exported to foreign countries in its raw state. The rich iron ore and the copper ore go to England and Germany, and Spanish gold and silver ores are melted at Freiberg in Saxony. The great iron fields of North Spain have been chiefly tributary to Great Britain, whose iron-makers have imported from first to last about 100,000,000 tons of this ore, chiefly through the port of Bilbao. It is especially desired in Great Britain and Germany because it is hematite of the best steel grade. These mines along the Bay of Biscay are now nearly exhausted, but iron of excellent quality is also found in considerable quantities in Andalusia, the Sierra Morena, and Leon. In 1903 a fresh source of oxide of iron ore, discovered 85 miles from Malaga, began to enter into commerce.

Nearly every province contains coal measures, the resources of the country being estimated at 13,000,000,000 tons. Coal is worked chiefly in Asturias, Leon, and Lérida, but the amount mined is comparatively small and the railroads, even in the coal-producing provinces, burn English coal. The quicksilver mines of Almaden are the richest in the world. Spain produces more lead than any other country of Europe, and lead-mining in recent years has given new life to Granada. most of it being obtained from the mines of the Alpujarras (q.v.) and those of Linares in Jaén. Copper is found in inexhaustible quantities on the Rio Tinto, in Southern Spain, where mines have been worked by British and German capital since 1873. The ore is also mined in Murcia, Oviedo, Jaén, and Zamora. Salt is chiefly obtained by evaporation of sea water at Cadiz, Valencia, and the Balearic Islands, though Catalonia and New Castile abound in rock salt. Among the other important minerals are sulphur, soda, saltpetre, alum, graphite, and potter's clay. Mineral springs are numerous, the best known being the thermal sulphur springs of Mombuy, in Catalonia. In 1901 there were in Spain 2291 productive mines employing 87,409 workmen. The output of raw minerals in the same year was valued at $26,960,328. The quantities and values of the more important minerals produced in 1901 (the peseta being valued at 14.28 cents) were as follows:

CRUDE MINERALS	Tons	1,000 pesetas
Iron	7,906.517	40,833
Coal	2,556,591	28,932
Copper	2,672,365	45,756
Lead	174,326	13,666
Silver-lead	207,188	33,578
Quicksilver	28,367	5,200
Zinc	119,708	4,029
Manganese	60,235	1,008
Salt	345,090	3,000

AGRICULTURE, LIVE STOCK, AND FISHERIES. Spain's largest interests are agricultural, over half the people living by farming, which supplies about two-thirds of the exports. In general the husbandry of Spain is of an antiquated character. Farm methods and implements are primitive, and the special disadvantages are that much of the land is owned by the nobility in large holdings, the taxes are high, and communications poor. Four-fifths of the area is classed as productive; 33.8 per cent. is devoted to general agriculture and gardening, 3.7 to vineyards, 1.6 to olive-growing, 19.7 to natural grasses, and 20.8 to fruit. Pasturage is abundant, even the great plains of the dry tableland being covered in summer with aromatic herbage on which sheep thrive, while in winter the flocks are driven down to the lower districts, especially to Estremadura. Although about 250,000 of the holdings are in large estates, the subdivision of the soil has been rapidly advancing in recent years. As in all countries in which winter rains prevail, irrigation, as stated above, is necessary during the rainless months. Artificial watering in a wide belt along the Mediterranean coast transformed a great area into a region of remarkable fertility. These lands are called huertas or gardens. All available fertilizers, including street sweepings, are used, with the result that no land in the world is more productive than the huertas. Here are produced southern fruits, vegetables, sugar cane, maize, and other crops requiring abundant moisture. Only about nine per cent. of the country, however, is artificially irrigated. The Government in 1900 took steps to enlarge the agricultural area by the construction of reservoirs and irrigation canals. The plans adopted for the irrigation system cannot fully be carried out for many years. Lands now irrigated in the valleys of the Ebro and Tagus are yielding twelve times as much fruit as the dry lands.

The most profusely watered and the best cultivated region is Valencia, where three or four crops are harvested every year. The level parts of Catalonia, Murcia, and Andalusia are also very fertile, while Asturias and Galicia, though less productive, are carefully cultivated. A large part of the dry lands of the interior is untilled, though where subterranean waters are near the surface wheat and other cereals are grown. In good years the northern provinces export cereals, though the wheat crop does not always meet the home demand. A region extending widely around Valladolid is called the granary of Castile. The swampy lands bordering the Gulf of Valencia yield fine crops of rice. Oats are little grown; rye is the chief breadstuff in the part of Spain fronting on the Atlantic; and barley is grown for cattle food.

The areas in acres devoted to the cereal crops in the year of 1901 were as follows: Wheat, 9,172,196; barley, 3,301,115; rye, 1,968,989; oats, 944,198; maize, 1,156,126; rice, 84,463.

The most important branch of husbandry is the cultivation of the vine, and wine at times forms as much as a third of the total exports. As much as 700,000,000 gallons is sometimes produced, but most of the wines are poorly made. In the African climate of the south are produced the famous wines of Malaga, Alicante, and Jerez (Sherry). These wines are highly valued both for medicinal and table purposes. Besides wine Valencia, Malaga, and Alicante also export great quantities of raisins and grapes. The most profitable crop of the huertas is fruits. Oranges and lemons thrive best along the Gulf of Valencia and in the Balearic Islands. Large quantities of the peel of the bigarade or bitter orange are sent to Holland to be used in the manufacture of the liqueur Curaçao. Olives and olive oil are large products, though somewhat less important than oranges in the export trade. No other country produces so much olive oil as Spain, and most of the product is consumed at home. The industry is chiefly developed in the southern provinces, Seville supplying the greater part of the olives for table use, while the oil comes from Cordova. As a large amount of the home product is poorly made, much of the oil is refined in France; but efforts have been made in recent years to improve the quality of the oil, so that it may compete in foreign markets with French and Italian oils. Leguminous vegetables, a staple article of food in Spain, are raised in sufficient quantity to provide a surplus for export. Esparto, which thrives in droughty lands, grows in the southeast and is sent in large quantities to England. Tobacco is cultivated, but much is also imported; the tobacco industry, which is a Government monopoly, is an important source of revenue. Hemp and flax are grown chiefly in the northern provinces.

Though the area in forests is said to comprise 7,500,000 acres, the timber supply is deficient and large quantities must be imported from Scandinavia and North America.

The breeding of domestic animals was once of great importance in Spain, but the industry has retrograded. The most famous domestic animal is the fine-fleeced merino sheep, now not so numerous as formerly. Though Spain raises more sheep in proportion to population than any other country of Europe, the number has been reduced from 23,000,000 to 16,500,000 since 1890; and the famous fine-wool merinos have been largely replaced by coarse-wool breeds. In the mountain districts about 2,600,000 goats are reared for their milk, flesh, and skins. A single peasant in Sierra Nevada sometimes owns as many as 3000 or 4000 goats. The best horses, originally of Arab stock, are raised in Andalusia and Asturias; but horse-breeding is much neglected in favor of the highly prized mule, the kingdom containing only about 400,000 horses. On the other hand, there are 1,521,000 mules and asses, which are bred with great care in most parts of Spain. The number of cattle amounts to barely 2,217,000 head. They are most numerous on the pastures of the northwest, where the rain from the Atlantic is abundant. To this region dairy farming is confined. The wild cattle specially raised for bull-fighting are obtained from the Sierra Guadarrama and the Sierra Morena. Hogs, about 2,000,000 in number, are reared chiefly in the mountainous parts of the kingdom, especially in the north and in Estremadura. Silkworm culture is only one-tenth as large as half a century ago, and is chiefly confined to the regions around the Gulf of Valencia. The yield of cocoons in 1901 amounted to 2,190,000 kilograms. Most of the raw silk is sold to France and large quantities of silk goods are imported. The sea fisheries are important. The home industry does not begin to supply the demand and much fish is imported from Norway. The total number of boats engaged in the industry in 1892 was 14,726; fishermen, 67,197. The chief catches are sardines, tunny, and cod.

Manufactures. The manufacturing industries do not supply the home demand. Catalonia has always been the home of the greater part of Spanish manufactures. Next in order come those districts of Galicia, Asturias, and Vizcaya in which water power abounds and also a few towns in the interior, such as Madrid, Seville, and Toledo. Barcelona, in Catalonia, is the leading manufacturing town and the chief seat of the textile, metal, paper, and leather industries and lace-making. The cotton industry, which is improving on the whole eastern coast, depends for its patterns upon France and England and does not satisfy the home demand. The silk industry of Valencia, Murcia, and Andalusia and the woolen industry of Barcelona, Alicante, and Burgos also fail to supply the local consumption. Cordova, once famous for its horse-hide leather (Cordovan leather), no longer leads in the leather industry. The manufacture of tobacco is carried on extensively in the royal factories of Madrid, Valencia, Seville, and other towns, about 50,000 families being supported on the wages disbursed. Alcoy manufactures much cigarette paper, and paper-making is steadily growing in importance. The metal industry is most flourishing in Catalonia and the northern provinces near the largest sources of iron, but meets the domestic demand in no department. In the iron and steel industry, however, Spain is making every effort to supply the entire home demand. Large wire mills have been erected, and in 1903 the largest plant for the production of all classes of steel was completed at Badalona. Gold and silver wares are produced in large quantities in Madrid, Toledo, Seville, and Barcelona; and Gijón, Seville, and Madrid are noted for their glass and porcelain. In the manufacture of cotton goods 2,614,500 spindles and 68,300 looms were employed in 1901; the woolen manufactures used 662,000 spindles and 8800 looms; about 150 paper mills make printing, packing, writing, and cigarette paper; 47 mills produce beet, and 22 cane sugar, the total output in 1901 having been

86,243 tons. Under Government encouragement the production of the sugar beet is growing. More than 30 factories make glass; about 33,000 tons of corks are manufactured every year; and there are over 60 mills for expressing olive oil. The pickling of green olives is an important branch of industry; in addition to the large home consumption, some 6000 to 7500 tons are annually exported. There are about 400 factories engaged in sardine-canning, with about 16,500 workmen.

COMMERCE. The trade consists chiefly in the export of raw produce and the import of the larger part of the manufactures consumed. Wine, minerals, and fruits form the larger part of the exports. The imports are chiefly confined to cotton, coal, foodstuffs, textiles, lumber, and machinery. The domestic trade is seriously hampered by natural and artificial obstacles. The rivers are navigable only to a very small extent, the canal system is very deficient, the different provinces are separated from one another by lofty mountains, the common roads are very poor, and excessive rates are charged for freightage by rail. Spain's commerce with foreign lands is chiefly maritime, and England and France are the most important factors in it. The imports and exports, exclusive of gold and silver bars, in three years were as follows:

IMPORTS

DESCRIPTION	1900	1901	1902
Raw materials	$59,589,346	$61,146,277	$63,068,206
Manufactures	44,654,776	37,566,175	34,892,771
Food supplies	19,883,248	19,790,997	16,062,014
Total	$124,127,370	$118,503,449	$114,022,991

EXPORTS

DESCRIPTION	1900	1901	1902
Raw materials	$42,413,783	$43,563,968	$45,666,832
Manufactures	24,431,365	21,344,998	20,516,587
Food supplies	37,788,873	32,839,108	39,114,447
Total	$104,634,021	$97,748,074	$105,297,866

The following table shows in greater detail the various classes of goods which entered into the import and export trade, including precious metals, in two years, in pesetas (average value, 14.28 cents):

DESCRIPTION	Imports		Exports	
	1900	1901	1900	1901
	Pesetas	Pesetas	Pesetas	Pesetas
Stone, minerals, glassware, and pottery	106,480,129	112,686,699	159,124,433	150,298,509
Metals and their manufactures	45,849,988	34,952,014	101,422,310	98,912,374
Drugs and chemical products	76,340,119	79,996,894	20,154,902	20,651,895
Cotton and its manufactures	94,211,048	108,225,041	34,056,899	29,001,152
Other vegetable fibres and manufactures	25,224,672	23,396,478	1,308,698	922,467
Wool and hair and their manufactures	27,061,270	26,466,035	9,780,502	11,636,039
Silk and its manufactures	25,280,134	24,333,578	4,979,960	5,071,664
Paper and its applications	11,345.657	11,582,591	8,463,849	8,305,112
Timber and its manufactures	60,846,964	61,716,512	60,658,103	47,715,308
Animals and their products	82,320,185	70,867,651	65,498,346	61,478,108
Machinery, vehicles, and vessels	135,198,181	97,553,930	792,952	797,322
Alimentary substances, including grain, sugar, wine, etc	139,238,556	136,222,950	264,627,966	233,475,688
Various	8,398,878	8,214,438	1,865,811	2,192,731
Gold and silver (bar and coin)	5,566,400	7,987,283	20,854,768	21,612,215
Other articles (special)	31,443,631	42,574,855	....	....
Total	874,805,792	846,776,949	753,589,499	692,070,584

The following table shows the distribution of the more important foreign trade in two years:

COUNTRY	Imports from (1899)	Imports from (1900)	Exports to (1899)	Exports to (1900)
	Pesetas	Pesetas	Pesetas	Pesetas
France	144,564,896	137,386,661	213,666,360	187,750,220
Great Britain	240,687,682	246,107,975	279,340,901	274,801,514
United States	119,558 539	105,834,020	13,195,777	17,415,050
Germany	64,543,730	77,792,154	25,436,218	31,804,682
Belgium	35,349,215	43,017,270	28,213,103	25,046,872
Russia	46,043,435	42,663,843	1,867,944	2,679,615
Italy	23,200,446	24,015,794	15,524,072	23,199,680
Sweden and Norway	21 091,476	24,783,175	2,702,859	2,482,547
Portugal	26,594,170	37,271,048	29,627,197	32,385,749
Argentina	24,843,715	30,553,983	13,042,623	12,607,616
Cuba	21,375,477	5,335,477	73,778,216	56,796,054
Philippine Islands	21,181,983	15,849,846	11,653,148	22,374,782
Porto Rico	9,751,437	3,227,480	13,042,623	12,607,616

Cotton, petroleum, staves, and lumber are the chief imports from the United States. The United States sales of raw cotton to the mills in the Barcelona manufacturing district averaged 267,093 bales in the three years 1900-1902. Wine, fruits, and cork wood are the chief exports from Spain to the United States. The following table shows the value of the total trade with the United States in three years:

	1900	1901	1902
Imports into Spain	$13,399,680	$15,480,288	$15,511,987
Exports from Spain	5,950,047	5,409,301	8,270,546

TRANSPORTATION AND COMMUNICATIONS. Much of the domestic trade is carried by coasting vessels, as Spain possesses more than 100 harbors large and small on its two seas. The home merchant marine is inferior, and most of the shipping is under the British and French flags. The merchant marine in 1900 comprised 449 steamers of 430,966 tons net and 693 sailing vessels of

110,968 tons net; total, 1142 vessels of 541,964 tons. In 1901 18,241 vessels of 14,503,348 tons entered and 17,118 vessels of 14,302,589 tons cleared from the Spanish ports. There is excellent communication with the chief Atlantic and Mediterranean ports of Europe and with the Philippine Islands and Cuba, and regular steamer service between New York and Barcelona and the north and south coast ports of Spain. New Orleans has regular steam communication with Barcelona and Bilbao. The most important Spanish ports are Barcelona, Cadiz, Malaga, Bilbao, Santander, Alicante, and Valencia. The railroad system connects all the chief towns with one another and unites Spain with France by two routes around the ends of the Pyrenees. Madrid is the centre of the Spanish broad-gauge railroad system. In 1900 the length of the railroads open for traffic was 8315 miles.

BANKING. The chief financial institution is the Bank of Spain. Its note issue up to 1,200,000,000 pesetas is guaranteed by a metallic reserve of one-third the amount of the issue, half of which must be in gold. If the note issue exceeds this amount it must, up to 1,500,000,000 pesetas, be guaranteed by metallic reserves of at least 40 per cent. in gold and 60 per cent. of the remainder in silver. For issues exceeding 1,500,000,000 and up to 2,000,000,000 pesetas, 50 per cent. must be guaranteed in gold, and 70 per cent. of the remainder in silver. On January 21, 1903, the notes in circulation amounted to 1,634,504,000 pesetas; capital and reserve, 170,000,000; deposits and accounts current, 617,431,000; property, 11,305,000; portfolio, 1,542,825,000; cash in hand, 901,924,000.

FINANCE. The revenue of Spain in 1901 amounted to $170,998,000 and the expenditure to $174,752,000. Revenue is raised by direct taxes on land, trade, mines, Government salaries, etc.; indirect taxes are derived from imports, articles of consumption, tolls, and bridge and ferry dues; other sources of revenue are the tobacco monopoly, the lottery, mint, and receipts from the sales and rentals of national property. The detailed estimates of revenue and expenditure for 1903 were as follows:

REVENUE

	Pesetas
Direct taxes on land, trade, mines, Government salaries, registration, etc	421,967,930
Indirect taxes, customs, excise, etc	328,710,000
Tobacco monopoly, lottery, mint, and minor sundries	164,870,000
National property: Revenue	19,997,797
" " Sales	2,770,000
From the public treasury	12,862,500
Total	951,178,227

EXPENDITURE

	Pesetas
Civil list	9,200,000
Cortes	1,838,085
Public debt	409,092,054
Various	1,365,900
Pensions	71,780,500
Council of Ministers	735,883
Ministry of State	5,002,212
" Justice and Worship	54,171,544
" War	144,012,982
" Marine	35,936.201
" Interior	51,543,426
" Instruction, etc	43,122,259
" Public works, etc	73,283,908
" Finance	16,500,845
Tax-collecting	29,076,099
Colonial	2,000,000
Total	948,661,898

In 1901 the outstanding debt amounted to $1,727,994,620 bearing interest at 4 and 5 per cent. Details of the outstanding debt on March 31, 1902, are as follows:

	Pesetas
Recognized debt to the United States	3,000,000
External 4 per cent	1,226,878,704
Perpetual internal 4 per cent	5,903,208,270
Redeemable internal 5 per cent	1,190,085,000
Convertible internal, Cuba and Philippine	87,009,000
Guarantee stock	2,000,000,000
Total	10,410,180,974

GOVERNMENT. The present Constitution of Spain was proclaimed June 30, 1876. It declares the government to be a constitutional monarchy with the executive power vested in the King. The King is forbidden to alienate or exchange Spanish territory, or to admit foreign troops into the realm, or to make treaties of alliance, of commerce, or of subsidy or such as impose burdens on Spaniards, or to abdicate the crown in favor of a successor without special authorization by the Legislature. The sovereign is declared to be inviolable and irresponsible. He is aided by ministers who countersign all his official acts and who thereby assume the responsibility for them. Since the abolition of the Colonial Department in 1899 the Ministry has been organized as follows: President of the Council; Minister of Foreign Affairs; Minister of Justice; Minister of Finance; Minister of the Interior; Minister of War; Minister of Marine; Minister of Agriculture, Commerce, and Public Works; Minister of Education. The Ministers have seats in the national legislature and are permitted to take part in the debates.

The legislative power is vested in the King and a Cortes composed of a Senate and a Chamber of Deputies, the two Houses having substantial equality of powers in legislation. The Senate is composed of three classes of Senators: First, those entitled to seats in their own right (*Senadores de derecho propio*); secondly, 100 life Senators nominated by the Crown from certain designated classes; and thirdly, 180 Senators elected by communal and municipal delegates and by the provincial estates, the Church, the universities, learned societies, etc., and by the largest taxpayers. The first two groups must not exceed 180 members. Senators by right embrace the adult sons of the King and those of the immediate heir to the throne; Spanish grandees who have an annual income of at least $12,000; captain-generals of the army, admirals of the navy, the patriarch of the Indias and the archbishops, and the presidents of the councils of State, of war, of the navy, of the Supreme Court, and of the tribunal of accounts. One-half the elective Senators retire every five years; and all retire whenever the King dissolves the Senate. The Chamber of Deputies is composed of 431 members chosen for a term of five years by popular election. Eighty-eight Deputies are elected by general ticket in 26 districts, provision being made for minority representation. The members are apportioned on the basis of one to every 50,000 of the inhabitants. They must be twenty-five years of age. By a law of 1890 all male Spaniards twenty-five years of age who are in the full enjoyment of their civil rights and who have been citizens of a municipality for at least two years are qualified voters. The Deputies receive no compensation for their services and are disqualified from holding office while serving in the Parliament. Annual sessions of the Parliament are held; it is summoned by the King, and may be prorogued or dissolved by him, subject to the limitation that the new Cortes must be summoned within three months after the dissolution of the old. The sessions are public; each Chamber regulates its own procedure, and is the judge of the election and qualification of its own members. Both Senators and Deputies are responsible only to their respective Chambers for any words spoken in debate or votes cast. They are also privileged from arrest except in case of flagrant crime. The seat of government is Madrid.

For purposes of local government Spain is divided into provinces and communes, each with its own elected assembly. The Ayuntamiento or elected assembly of the commune consists of from 5 to 39 Regidores and is presided over by an Alcalde chosen from the body of the Ayuntamiento, except in some of the large towns, where he is appointed by the King. The term of the members of the Ayuntamiento is four years, one-half the membership being renewed biennially. The provincial deputations meet once a year and are represented during the interval by a permanent committee. These two local assemblies have entire control of the local government in their respective jurisdictions and are free from interference of the central Government except when they exceed their powers to the detriment of the general interest.

The judiciary consists of a Supreme Court of Cassation, which sits at Madrid; a number of district courts or *audiencias* immediately under the jurisdiction of the Supreme Court; tribunals *de partidos* below the audiencias; justices of the peace; and municipal courts. The audiencias serve as courts of appeal in civil matters and as courts of first and last resort for crimes and certain misdemeanors. The tribunals *de partidos* have jurisdiction in first instance of civil causes and in first and last resort of misdemeanors. They also have appellate jurisdiction in cases decided by the inferior courts. The *partido* is divided into circumscriptions, usually two, in each of which is a *juez de instrucción*, with civil and criminal jurisdiction in cases assigned to them by the higher courts of a Minister. The circumscriptions are subdivided into communes, in each of which is a municipal judge with jurisdiction of petty offenses.

COLONIES. The colonial possessions of Spain are confined to Africa and are represented in the following table:

POSSESSIONS	Area, sq. miles	Population
Rio de Oro and Adrar	243,000	100,000
Bata (Rio Muni) and Cape San Juan	9,000	302
Fernando Póo, Annobón, Corisco, Elobey Chico, Elobey Grande	850	23,709
Total	252,850	124,011

The Rio de Oro Colony and Adrar are administered by the Governor of the Canary Islands. The national expenditure on account of the above possessions far exceeds the revenues derived from them. About $300,000 had to be provided by the Spanish Government to supply the deficiency for 1902, the revenues being only about $19,000. For an account of the colonies, see the respective headings.

WEIGHTS, MEASURES, AND MONEY. Spain maintains the double gold and silver standard. The unit of coinage is the peseta, nominally worth 19.3 cents or 1 franc, but actually valued at an average of about 14.28 cents. The value of the money coined in Spain from 1868 to 1901 was: Gold, 920,537,615 pesetas; silver, 1,285,010,511 pesetas. Metric weights and measures were introduced in 1859, but in addition to these the old Spanish weights and measures are still largely used.

DEFENSE. See ARMIES and NAVIES.

POPULATION. The population of Spain by the census of 1900 was 18,618,086, with a density of 96.7 inhabitants to the square mile. In 1850 it was about 14,000,000. The population in 1900 consisted of 9,087,821 males and 9,530,265 females. Emigration from Spain is chiefly to Brazil, Uruguay, and Argentina, the emigrants in 1900 numbering 63,020. The cities with a population of over 90,000 each are: Madrid, the capital, 539,835; Barcelona, 533,000; Valencia, 213,530; Seville, 148,315; Malaga, 130,109; Murcia, 111,539; Cartagena, 99,871; and Saragossa, 99,118. The following table gives the area and population of each of the 49 provinces according to the census of 1900:

PROVINCE	Area, sq. miles	Population, 1900
Alava	1,175	96,385
Albacete	5,737	237,877
Alicante	2,185	470,149
Almería	3,360	359,013
Avila	3,042	200,457
Badajoz	8,451	520,246
Baleáres (Balearic Islands)	1,935	311,649
Barcelona	2,968	1,054,541
Burgos	5,480	338,828
Cáceres	7,667	362,164
Cadiz and Ceuta	2,834	452,659
Canarias (Canary Islands)	2,807	358,564
Castellón	2,495	310,828
Ciudad-Real	7,620	321,580
Córdoba (Cordova)	5,299	455,859
Coruña	3,051	653,556
Cuenca	6,636	249,696
Gerona	2,264	299,287
Granada	4,928	492,460
Guadalajara	4,676	200,186
Guipúzcoa	728	195,850
Huelva	3,913	260,880
Huesca	5,848	244,867
Jaén	5,203	474,490
León	5,936	386,083
Lérida	4,690	274,590
Logroño	1,946	189,376
Lugo	3,814	465,386
Madrid	3,084	775,034
Malaga	2,812	511,989
Murcia	4,453	577,987
Navarra (Navarre)	4,055	307,669
Orense	2,694	404,311
Oviedo	4,205	627,069
Palencia	3,256	192,473
Pontevedra	1,695	457,262
Salamanca	4.829	320,765
Santander	2,108	276,003
Segovia	2,635	159,243
Sevilla (Seville)	5,428	555,256
Sória	3,983	150,462
Tarragona	2,505	337,964
Teruel	5,720	246,001
Toledo	5,919	376,814
Valencia	4,150	806,556
Valladolid	2,922	278,561
Vizcaya (Biscay)	836	311,361
Zamora	4,097	275.545
Zaragoza (Saragossa)	6,726	421,843
Total	194,770	18,607,674

Religion. The national Church is the Roman Catholic, and in few countries has it so powerful an influence. The whole population adheres to that faith excepting about 30,000 Protestants, Jews, and others. The Constitution requires the nation to support the clergy and religious buildings and institutions, the State expending for these purposes annually about 41,000,000 pesetas. Only restricted and private liberty of worship is permitted to Protestants. In 1884 there were 32,435 priests, 18,564 churches, 11,202 other buildings of a religious character, 1684 monks, and 14,592 nuns. The religious Orders are numerous and influential, and many of them have schools and teach industries of all kinds.

Education. Instruction was almost entirely neglected until quite recent times. The older generations of the poorer classes are, for the most part, unable either to read or to write. The middle schools and the once famous universities are far inferior in their standards to corresponding institutions in most European countries. Spaniards seldom learn any language but their own, excepting the nobility, who usually can converse in French. In 1889 68.1 per cent. of the population could neither read nor write, though by the law of 1857 education was made compulsory. Improvements in the educational system have been in progress for some years. It is now under charge of a Minister of Education with a council. The public primary schools are supported chiefly by the municipalities, with a small contribution from the Government; and the average sum now spent on primary education (most of the children being educated free) is about $5,000,000 a year. By a law passed in 1902, the schools are now regularly inspected, and rules regarding sanitation, discipline, and the appointment of qualified teachers are enforced under Government authority. In 1901 there were 25,340 public schools, with 1,617,314 pupils, and 6181 private schools, with 344,380 pupils. The secondary schools, of which there must be one in every province, prepare for the universities and are largely attended, but they are still regarded as inefficient. There are nine universities, with about 16,000 students, the largest being at Madrid, which has upward of 5000 students. The Government also supports special schools for instruction in engineering, agriculture, fine arts, music, and other branches. The sum set apart in the budget of 1903 for education was 43,122,259 pesetas.

Ethnology. The perspective of Spanish ethnology extends back to the Chellean Epoch, implements of that type having been dug up in the ancient alluvium at San Isidro and other stations near Madrid. Solutrean implements were found in the grotto of Altamira, Province of Santander. In the same grotto Magdalenian implements and characteristic objects in bone were discovered, and relics belonging to this epoch come from the Basque Provinces, from the basin of the Ebro, and from Catalonia. In historic times all the great divisions of the Caucasian race have mingled their blood in Spain in greater or less proportion—Hamite, Semite, Teuton, Celt, and Mediterranean. The fundamental type bears the name of Celtiberian, and is a result of a mixture of the earliest long-headed Mediterraneans and the later-coming brachycephalic Celts producing a cranial index of 76-79. Keane and Ripley call attention to the uniformity of this index in Spain and in Britain, associated with tall stature and blondness in the latter, with dark color and low stature in the former. Spain has been invaded in historic times by Phœnicians, Carthaginians, Romans, Visigoths, Vandals, Arabs, and Moors. It is generally believed that these conquerors modified the original type but little, simply because many of them were already short of stature, dark in skin, hair, and eyes, as well as dolichocephalic.

History. Spain, the *Iberia* of the Greeks, and the *Hispania* (q.v.) of the Romans, is supposed to have been originally inhabited by a distinct race called Iberians, upon whom, however, a host of Celts appear to have descended from the Pyrenees. In the earliest times of which we have any record, these two races had already coalesced and formed the mixed nation of the Celtiberians, who were massed chiefly in the centre of the peninsula, in the western districts, and on the north coasts. In the Pyrenees and along the east coast were to be found pure Iberian tribes, while unmixed Celtic tribes occupied the northwest. On the south and east coasts were Phœnician, Carthaginian, Rhodian, and other colonies. In the second half of the third century B.C. a large territory was brought under subjection to Carthage by Hamilcar Barca (q.v.), who, according to Roman tradition, founded the city of Barcelona. After the death of Hamilcar, in B.C. 228, the Carthaginian interest was advanced, and the power of Carthage further strengthened by Hasdrubal (died B.C. 220), son-in-law of Hamilcar, who founded Carthago Nova (the modern Cartagena) and concluded a treaty with the Romans whereby it was stipulated that he should not advance his standards north of the Iberus (Ebro). Hannibal (q.v.), son of Hamilcar, after the death of Hasdrubal attacked and destroyed Saguntum (q.v.), in B.C. 219, and thus initiated the Second Punic War. (See Carthage; Rome; Hannibal.) After the Romans had driven the Carthaginians from the peninsula, in B.C. 206, the country was made into two Roman provinces (B.C. 197), *Hispania Citerior*, including the eastern and northern districts, and *Hispania Ulterior*, including the southern and western districts. The conquest of the native tribes proved an arduous task for the Romans. (See Lusitania; Numantia.) It was not till B.C. 19 that the Cantabri and Astures in the extreme north of the country laid down their arms to Augustus. Under Augustus the peninsula was divided into the three provinces of Hispania Tarraconensis, Bætica, and Lusitania. (See Hispania.) From the time of the establishment of the complete supremacy of the Romans till the death of Constantine the condition of Spain was eminently prosperous. Its fertile fields formed for a considerable time the granary of Rome, and from its metal-veined sierras an immense amount of treasure in gold and silver flowed into the Roman coffers.

In A.D. 409 hordes of barbarians, Alans, Vandals, and Suevi crossed the Pyrenees and swept over and desolated the peninsula. About 414 the Visigoths invaded the country, and their King, Athaulf, who acknowledged a nominal dependence on the Roman Emperor, established the Gothic monarchy in Catalonia. (See Goths.) The best known of the kings were Wallia (415-

419), who greatly extended the Gothic monarchy, making himself master of a great part of Aquitania (where a century later the Visigoths were overcome by Clovis); Euric (465-485), who, besides increasing his territory, introduced and enforced a body of laws, and did much for the advancement of civilization in Spain; Leovigild (569-586), who effected the subjugation of the Suevi; Wamba (672-680), who built a fleet for the protection of the coasts; and Roderic (q.v.), who was killed at Jerez de la Frontera in 711, in battle with the Arabs (Saracens). The battle of Jerez gave the Arabs almost undisputed mastery of nearly the whole of Spain, as well as of Septimania (Languedoc) in France. The remnant of the Goths betook themselves to the highlands of Asturias, Burgos, and Biscay, where they maintained their independence.

The Arabs held Spain for the first few years of their rule as a dependency of the Province of North Africa; but after the downfall of Musa (q.v.) the country was governed (717) by *emirs* appointed by the Caliph of Damascus. These emirs were intent upon the extension of their conquests into Gaul, to the neglect of the rising power of the Goths in Asturias. Their northward progress was arrested in the battle of Poitiers by Charles Martel (q.v.) in 732. The *walis*, or local governors of districts and provinces, frequently rebelled against the emir, and drew swords against each other. Within a period of forty years no fewer than twenty emirs had been called to the direction of affairs; but a revolution at Damascus, which unseated the Ommiads, and placed the Abbassides in possession of the caliphate, put an end to this state of misrule in Spain. The last of the emirs, Yusuf, was in favor of the Abbassides, but the walis and alcaydes, being chiefly of the Ommiad faction, invited one of this family, Abd-ur-Rahman, who was in concealment among the Zeneta Arabs in Barbary, to become an independent caliph in Spain. (See OMMIADS.) Thus was founded (756) the *Emirate of Cordova.* By 778 the Franks had wrested from the Arabs all their possessions north of the Pyrenees and northeastern Spain to the Ebro. The latter acquisition, subsequently denominated the *Spanish March,* was for a time alternately in the hands of the Moslems and dependent upon France.

During the early period of Arab-Moorish domination the small independent Kingdom of Asturias, founded by Pelayo (q.v.), grew in power and extent. Alfonso the Catholic, son-in-law of Pelayo, conquered nearly all of Galicia and recaptured Leon, together with Salamanca and other cities. Alfonso the Great (866-910) by his victories greatly extended the Asturian dominions, which soon after his reign figure as the Kingdom of Leon. In the course of the ninth century Navarre struggled into existence as a separate State. The Kingdom of Leon was for a long time distracted by bitter and bloody strife among the members of the royal line, and with its neighbor, Navarre, would have fallen an easy prey to the powerful Ommiads had not the latter directed their chief attention to the subjugation of Morocco. During this relaxation of the constant warfare between Moors and Christians another independent State, Castile, an offshoot from Leon, came into existence, at first under the rule of the famous Count Fernán González. In 1033 it was erected into a kingdom. Castile, from its central position, and consequently greater facilities for expansion, soon became the most powerful of the Spanish States. A considerable part of Aragon was wrested from the Moors by Sancho the Great of Navarre (1000-35), and at his death this part of his dominions passed as a separate kingdom to his son Ramiro, who added to it the districts of Sobrarbe and Ribagorza, and a considerable extent of country which he conquered from the Moors. In 1151 the territory of the counts of Barcelona (Catalonia) was united with Aragons. The last Christian kingdom to be founded in the Iberian Peninsula was Portugal (q.v.).

The Ommiads ruled Mohammedan Spain for about 275 years. The greatest of this dynasty was Abd-ur-Rahman III., who ruled from 912 to 961, and who in 929 assumed the title of Caliph. His capital, Cordova (q.v.), was the greatest city in Europe except Constantinople, and was unrivaled in the splendor of its edifices. The civilization of Spain during the Moorish supremacy was far in advance of that of the rest of Europe. At the great Mohammedan universities medicine and mathematics were cultivated, and Aristotle was studied there long before he was well known to Christian Europe. An extensive literature was developed, the caliphs themselves often being poets and authors of note. Commerce and agriculture were fostered, and the stranger marveled at the splendid system of irrigation, which made the country like a garden. The Moorish fleets controlled the Mediterranean and carried on an extensive trade. For the art which was developed in Spain by the Moors, see MOHAMMEDAN ART.

The Ommiad dynasty came to an end in 1031, and a number of independent Moorish kingdoms were formed—Cordova, Seville, Toledo, Lisbon, Saragossa, Tortosa, Valencia, Murcia, Badajoz, and others of less note. The kings of Castile and Aragon did not fail to benefit by this disruption of the Mohammedan realm, for by well-directed and unremitting attacks they subdued some States and rendered others tributary. A few years more might perhaps have destroyed the Moorish domination in Spain had not the rulers, hard pressed by Alfonso VI. of Leon and Castile, who in 1085 conquered the Kingdom of Toledo (New Castile), applied for aid to the ruler of the sect of the Almoravides (q.v.) in Morocco. The Almoravides crossed over to Spain, but after defeating the Christians they turned their arms against the Spanish Moors, and by the beginning of the twelfth century the Almoravide sovereign was acknowledged the ruler of Mohammedan Spain. The power of the Almoravides was extinguished by the Almohades (q.v.), a fanatical sect who passed over from Morocco just before the middle of the twelfth century, and conquered the territories of the Mohammedans. In a great battle fought on the plains of Tolosa (*las navas de Tolosa*), in 1212, the kings of Castile, Navarre, and Aragon broke the Almohade power in Spain. Soon nothing was left out of the wreck of the Almohade realm but the Kingdom of Granada, which was forced to acknowledge the overlordship of Castile. This last Moorish kingdom rose to great splendor.

Prominent among the late Castilian monarchs were Ferdinand III., who extended the dominions of Castile far into Andalusia, conquering Cordova in 1236 and Seville in 1248; Alfonso X., the Wise, famous as a legislator, writer, and patron of learning; Alfonso XI.; Peter the Cruel; and Isabella, whose marriage with Ferdinand the Catholic (1469) brought about the union of Castile and Aragon in 1479. Among the sovereigns who raised Aragon to the position of an important power and extended its dominion beyond the bounds of the Iberian Peninsula were James I. (1213-76), who conquered Valencia and the Balearic Islands; Pedro III. (1276-85), who obtained Sicily (1282); James II. (1291-1327), who annexed Sardinia; Alfonso V. (1416-58), who conquered Naples; and Ferdinand V., the Catholic (1479-1516), who became the ruler of the whole of Spain. The mediæval history of Castile and Aragon is marked by a vigorous development of constitutionalism as embodied in the assertion of their power by the estates of the realm. (See CORTES.) In both kingdoms the cities enjoyed great political freedom, of which they were gradually deprived after the consolidation of Spain into a single monarchy.

The union of Castile and Aragon enabled the Christians of Spain to undertake the subversion of what remained of Moorish dominion in the peninsula. In 1482 Ferdinand and Isabella entered upon a war for the subjugation of the Kingdom of Granada, and at the beginning of 1492 the sovereigns made their entry into the Moorish capital. All Spain,with the exception of Navarre, was now practically one power. The shrewd policy of Ferdinand the Catholic, who followed the tendency of the age and strengthened the royal power at the expense of the privileges both of the feudal nobility and the people. enabled Spain to grow in external power and influence, and to assume a military preëminence among the countries of Europe. In Italy the arms of Spain, under Gonsalvo de Córdova, triumphed over those of France. In 1512 Ferdinand made himself master of Navarre, with the exception of the district north of the Pyrenees, and thus completed the unification of Spain. The discovery of the New World by Columbus and his successors under Spanish auspices in the closing years of the fifteenth century made Spain the pioneer colonial power, and for a considerable period the greatest. The expulsion of the Jews from the Spanish dominions in 1492 deprived them of a large body of industrious citizens. In 1516 Charles I. (from 1519 Holy Roman Emperor as Charles V.), the grandson of Ferdinand and Isabella, and of Maximilian of Austria and Mary of Burgundy, inaugurated the Hapsburg dynasty on the throne of Spain. He was the ruler of the Netherlands, which became part of the Spanish realm, and he acquired the Duchy of Milan (embracing most of Lombardy), which was made a Spanish possession. Mexico and Peru, whose mines poured the precious metals into Spain in an inexhaustible supply, were acquired during his reign. Charles was the most powerful Christian monarch of his time. His reign was taken up with endless contests with the French, and, as German Emperor, with efforts to suppress Protestantism, as well as with war against the Turks. (See CHARLES V., HOLY ROMAN EMPEROR.) His son Philip II. (q.v.) (1556-98), who succeeded to the Spanish possessions of the House of Hapsburg, prepared the way by his narrow and bigoted policy for the decline of Spain. He developed the Inquisition, which had been introduced by Ferdinand and Isabella, into a powerful engine for the repression of religious and political dissent, and his attempt forcibly to root out the Reformation in the Netherlands brought about a rising which resulted in the severance of the Dutch provinces from Spain. With England he waged long wars, which were disastrous to the Spanish naval power. (See ARMADA; DRAKE.) In 1580 Philip II. conquered and annexed Portugal. The Spaniards took possession of the Philippines in his reign. Under Philip III. (1598-1621), in whose reign the Moriscos were expelled, and under Philip IV. (1621-65), in whose reign the Dutch Netherlands were definitively given up and Portugal reasserted its independence, the decadence of the nation proceeded at a rapid rate. The male line of the Hapsburgs became extinct in Charles II. (1665-1700) and the conflicting claims to the throne produced the war of the Spanish Succession (see SUCCESSION WARS), in which England and Holland were allied with Austria, Prussia, the German Empire, and Savoy against Louis XIV. to prevent the aggrandizement of France by the acquisition of Spain as an appanage of the House of Bourbon. When the rival Austrian claimant became Emperor and head of the Austrian dominions as Charles VI., in 1711, a similar objection existed to his obtaining the throne of Spain, and the allies conceded the succession to Philip of Anjou, who had been proclaimed King of Spain as Philip V. in 1700, and was confirmed by the Peace of Utrecht in 1713. This was the beginning of the Bourbon dynasty in Spain. Spain emerged from the War of Succession stripped of the Belgian Netherlands, Naples, Sicily, Sardinia, and her Lombard territories. She had to cede Gibraltar to the English, who had captured it in 1704.

A few years later Spain, whose policy was at this time directed by Alberoni, made an effort to recover some of her lost possessions, but her aggressions were promptly met by the Quadruple Alliance of 1718 between Great Britain, France, Austria, and Holland, and the schemes of the able Prime Minister came to naught. In the War of the Polish Succession, however, Don Carlos, son of Philip V., wrested the Two Sicilies from Austria and established the Bourbon dynasty there.

Philip was succeeded by his son, Ferdinand VI. (1746-59), in whose reign numerous reforms were introduced in the administration. Ferdinand was succeeded by his half-brother Charles III. (1759-88), who, on ascending the Spanish throne, relinquished the Two Sicilies to his son, Ferdinand IV. Charles brought into Spain from his Italian domains a new spirit, and initiated reforms in the internal administration, foreign policy, and economics of the State. As a result of the Seven Years' War, in which Spain joined France, Florida was ceded to Great Britain and Louisiana acquired from France (1763). In 1767 the Jesuits were expelled from the Spanish dominions. In 1779 Spain became the ally of France in the war against England, and in 1783 she recovered Florida, which in 1819 was ceded to the United States. Charles IV. (1799-1808) was incapable of continuing his father's vigorous policy. He was under the control of the notorious Godoy (q.v.), the Queen's favorite, who played into the hands of Napoleon for his own profit. In March, 1808, the King abdicated in favor of his son, Ferdinand, and the latter was compelled to renounce his claims to the crown in favor of his father, who then handed his right over to Napoleon. The latter then conferred the Spanish crown upon his brother Joseph Bonaparte. Deserted by their rulers, the Spanish people organized resistance, declared for Ferdinand VII., and refused to recognize the Bonapartes. A supreme junta of leading Spaniards was established at Seville and subordinate juntas were formed in each of the provinces.

It was the obstinate resistance of Spain and the efficient work of the supporting English armies in the Peninsular War that first checked Napoleon and showed Europe that he was not invincible. (See PENINSULAR WAR.) Meanwhile the Spanish colonies in America revolted, and after a fierce warfare of sixteen years the Spanish dominion on the American mainland was completely extinguished (1826). After the expulsion of the French King Ferdinand VII. returned to Spain and entered Madrid May 14, 1814. The liberal Constitution of 1812 enacted by the Cortes was at once abrogated, the religious Orders were restored to their earlier predominance, the Cortes were abolished, and the Inquisition was reëstablished. A popular reaction aided the King and his Ministers in this course. A liberal revolution in 1820 restored the Constitution of 1812 and instituted a Cortes which was notable for its extreme liberalism. The Inquisition was abolished and the privileges and exemptions of the Church were invaded. The clergy and the peasants opposed the revolution, but it was received with favor by the army and the educated classes. In 1822 the Holy Alliance (q.v.) took note of the Spanish situation, and France was commissioned to suppress the liberal movement. A French army of nearly 100,000 men invaded the peninsula and the Spanish forces were entirely unable to meet the attack. On May 24, 1823, the French entered Madrid, established a regency, drove the Cortes from Seville to Cadiz and out of the country, and restored Ferdinand, who had been declared of unsound mind by the Cortes. The King at once revoked all of the liberal measures, except the abolition of the Inquisition. Repression and wholesale punishment followed. The French army remained in occupation until 1827. Bermudez, the Prime Minister, adopted finally a moderate policy, but this satisfied neither absolutists nor liberals. The clerical party guided by the Apostolic Junta rallied around Ferdinand's brother, Don Carlos, as the representative of extreme absolutism and clericalism, and a number of insurrections were started by the Junta in his interest. In 1831 Ferdinand, having no male heir, decreed the revival, on behalf of his daughter Isabella, of the old law admitting female succession. Ferdinand died in 1833 and Queen Maria Christina became Regent for her daughter Isabella II. The Carlists proclaimed their candidate as Charles V., and there was an immediate division of parties in the kingdom into Carlists and Cristinos. The Queen Regent was compelled to turn to the liberals for support. A royal charter, in lieu of a constitution, was promulgated in 1834, but it did not give real popular government, and the Ministry and the Chambers were both under the control of the Crown. Civil war broke out and the Carlists were at first successful. An alliance was concluded by the Regent with England, France, and Portugal, for the purpose of maintaining the crowns of Spain and Portugal against the pretenders, Carlos and Miguel (q.v.). The death of Zumalacarreguy (q.v.), the only Carlist leader of ability, and the accession to the command of the Government forces of General Espartero (q.v.) turned the tide. Maroto, the Carlist commander, concluded the convention of Vergara with the Government in 1839 and returned to his allegiance with his army. By this treaty Navarre and the Basque Provinces, which had been the strongholds of Carlism, were confirmed in their ancient privileges. Espartero defeated the remnants of the Carlists in Catalonia, and Don Carlos went into exile, handing over his pretensions to his son.

In the meanwhile the struggle for a liberal constitution was being waged in the kingdom, and a revolutionary movement at the palace of La Granja in 1836 forced Maria Christina to swear to the Constitution of 1812. In 1840 Espartero, the liberal leader, was made the head of the Ministry on his own terms. Maria Christina resigned the regency October 12, 1840, and the Cortes made Espartero Regent and guardian of Isabella and her sister. The Regent's firm government made enemies, and in 1843 a revolutionary movement, headed by Narvaez and Prim (qq.v.), drove him from power. In November, 1843, Isabella was declared of age and assumed the crown with Narvaez, the leader of the Moderates (Moderados), as Prime Minister. Maria Christina was recalled and the Constitution modified on reactionary lines. Narvaez exercised practically dictatorial powers until 1851. Parties gradually readjusted themselves, the old Absolutists, with whom the Moderates tended to assimilate, grouping themselves about Queen Isabella and her mother, and the liberal elements joining the Progressists. In March, 1851, a concordat was arranged with the Pope by which all ecclesiastical affairs were to be canonically regulated and all religions but Catholicism were forbidden in the kingdom, the Church in return yielding its secular jurisdiction and recognizing the sale of church lands. A Cabinet of personal supporters was made up by the Queen mother. They attempted in 1852 a modification of the Constitution in the direction of absolutism. This led in 1854 to a new outbreak. A coalition of the more liberal Moderates under Narvaez and Progressists under O'Donnell was formed and was joined by Espartero, now again recognized as one of the Progressist leaders. Maria Christina left the country and a Government was formed with Espartero as President of the Council and O'Donnell as Minister of War. The latter was now at the head of a new party, the Liberal Union, which favored a liberal constitutional monarchy. In the coalition Government the Progressists were at first the dominant factor, but before the new Constitution of 1855 was promulgated they lost control. There were republican risings in the northeast and Carlist risings in the northwest, and the suspension of popular liberties by the Government, while engaged in the suppression of these revolts, gave an opportunity to O'Donnell and his party. Their control was short-lived, and in 1856 Queen Isabella appointed a Moderate Ministry under Narvaez, which adopted a reactionary policy. In 1858 the Queen recalled O'Donnell and he held office for five years. A war with Morocco (1859-60) had no result except to test the efficiency of the Spanish army. Spain joined France in the ill-advised Mexican expedition, but Prim, in command of the Spanish forces, signed a convention with Juarez and refused to support the French. Napoleon III. was indignant with his ally, and in Spain there was bitter discussion of Prim's course. The Progressists made it a handle for a partisan attack on the Government and the Moderates also took a hostile attitude. The O'Donnell Government, which had added vastly to the national debt, went down in 1863.

With the passing of the Liberal Union there was a gradual return to absolutism. The Miraflores Government, which succeeded that of O'Donnell, attempted to govern constitutionally, but the absolutist pressure in Court circles was too strong, and this Ministry gave way to successors more pliable. The Government really fell into the hands of the *camarilla*, a group of personal favorites who had influence with the Queen. The Liberal groups were forced more and more into a hostile and revolutionary attitude. Castelar (q.v.), then a professor in the University of Madrid, raised his eloquent voice against the extravagance of the Crown and was supported by the university. The Government attempted to suppress such agitation. The Cortes was dissolved in 1866 and Marshal Serrano (q.v.), president of the Senate, was sent into exile. Narvaez, who had represented all shades of political opinion at different times, was now called to the head of affairs and maintained a strong Government, which was really a military dictatorship, until his death in 1868. An open revolt, headed by Prim, failed, but a little later Prim, Serrano, and Admiral Topete (q.v.) began a better organized and better supported revolutionary movement. The fleet at Cadiz under Topete declared for national sovereignty. Serrano marched toward the capital, defeated the Government forces at Alcolea on September 28, 1868, and on October 3d entered Madrid, already in a state of insurrection. Isabella in the meanwhile escaped into France and the revolution was accomplished.

A provisional government was established by the revolutionists under the presidency of Serrano. A liberal monarchical constitution was put through by a combination of Republicans under Castelar and Progressists under Prim, and was promulgated June 6, 1869. Serrano was made Regent, with Prim as Prime Minister. Carlists, Republicans, and Constitutional Monarchists all aspired to profit by the upheaval in the government. Several foreign princes were invited to take the crown—among them Prince Leopold of Hohenzollern, whose candidacy (July, 1870) gave rise to irritation between France and Germany, and in a measure provoked the Franco-German War. At last, in December, 1870, Amadeus, Duke of Aosta, son of King Victor Emmanuel, accepted the crown (see AMADEUS I.), but before his arrival in Madrid Prim, the king-maker, was assassinated. King Amadeus thus lost a strong support, and he abdicated February 11, 1873, after a brief and uncomfortable reign, distracted at the end by a great rising in favor of the young Don Carlos (Charles VII.) and disturbed by an insurrection in Cuba, which had broken out in 1868. A republic was then declared. Figueras was the first president of the Ministry, with Castelar as Minister of Foreign Affairs. A constituent Cortes was summoned in June, and prepared a constitution making Spain a federal republic. Several Ministries attempted vainly to cope with the situation, which, in addition to the Carlist insurrection in the north, was complicated by the risings of the Intransigentes (see INTRANSIGEANTS) and Internationals in the cities of Andalusia, Murcia, and Valencia. On September 7th Castelar was made President of the Executive with dictatorial powers, and the Cortes adjourned until January, 1874. The wise and positive course of Castelar in enforcing order and recognizing conservative interests displeased the extremists, and when the Cortes reassembled a vote of lack of confidence was passed. Castelar resigned, and Serrano became nominally President of the Executive, but in reality a military dictator. He carried on with vigor the war against the Carlists, but he had hardly secured recognition for his Government from the European powers when Gen. Martinez Campos (q.v.) proclaimed Alfonso XII., son of Isabella, King (December, 1874). The army declared for Alfonso. The Serrano Government, of which Sagasta (q.v.) was then Prime Minister, gave way, and Cánovas del Castillo (q.v.) headed a provisional government. Alfonso, then seventeen years of age, assumed the government on January 14, 1875, guided by Cánovas del Castillo. The Carlist revolt was completely suppressed in 1876. Don Carlos went into permanent exile, and Navarre and the Basque Provinces were deprived of their ancient privileges and *fueros* (q.v.). A constitution of a decidedly illiberal character was adopted in 1876, and its provisions were enforced with severe literalness by the Ministry of Cánovas del Castillo. By 1878 order had been reëstablished throughout most of Cuba. Martinez Campos, who was sent to the island to put down the insurrection, came back in 1879 an advocate of a reform policy toward Cuba, and attempted to form a Ministry on that issue, but failed and went into the opposition. Much of his programme including abolition of slavery in the Antilles, was carried out by Cánovas del Castillo. In 1881 a more liberal régime was inaugurated under Sagasta.

The government under the restored monarchy was nominally in the hands of a Ministry responsible to the majority in the Cortes, but personal factions and rivalries disintegrated parties to such an extent that this was not so in practice. There were two leading parties—Conservatives, and Liberals or Constitutionalists, both upholding the constitutional monarchy. The remnant of the Carlists could do little but agitate. The Republicans lacked a leader, since Castelar had given up the republican programme as impracticable. Cánovas del Castillo returned to power in 1884, after having been out of office for three years. On November 25, 1885, Alfonso XII. died, and his widow, Christina, who was pregnant, became Regent of the kingdom, the Premiership being intrusted to Sagasta. On May 17, 1886, Christina gave birth to a son, who became King as Alfonso XIII. Sagasta governed with vigor, energetically repressing military uprisings, and brought about the enactment of a measure providing for universal suffrage. A Conservative Ministry under Cánovas del Castillo was in office from July, 1890, to December, 1892. The succeeding Liberal Ministry under Sagasta was unpopular because of its attempt to apply needed economies and its severe measures to repress anarchism, which had become rampant in Catalonia. In 1895, when a new revolt broke out in Cuba, the Conservatives returned to power under Cánovas del Castillo. The army officers were dissatisfied with the growth of the civil power and restive under the criticism of an increasingly independent press. Premier Cánovas del Castillo was assassinated in 1897, and Sagasta took his place at the helm, in time to face the problems of a war which was already imminent. The Cuban revolt, which consumed the flower of the Spanish army, and in the effort to suppress which the most cruel military measures were instituted, produced complications which led in 1898 to a conflict with the United States. (See Cuba; Spanish-American War; United States.) This unequal struggle was brought to a close by a treaty of peace negotiated at Paris, December 10, 1898, by which Spain relinquished her sovereignty in Cuba, Porto Rico, and the Philippine Islands. Later the Caroline, Pelew, and Ladrone Islands were sold to Germany.

The military party under Weyler (q.v.) made the peace treaty an issue, and forced Sagasta out of office. A Conservative Ministry headed by Silvela came in but resigned in October, 1900, and a reconstruction was effected under General Azcarraga on distinctly military lines. A congress of the Spanish-American States was held in Madrid in November, 1900, at the instance of the Sociedad Unión Ibero-Americana, for the purpose of establishing more cordial relations with these offshoots of the older Spain. Anti-clerical disturbances in 1901 pointed to a growing spirit of liberalism and independence. A new government was organized under Sagasta, March 6, 1901, and adopted a stern attitude toward the religious Orders. King Alfonso XIII. came of age May 17, 1902, and the regency was terminated. For several months Sagasta retained office with great reluctance, and on December 6, 1902, the Ministry retired and an entirely new Cabinet was constituted by Silvela.

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SPALATIN, spä′lå-tēn′, Georg Burckhardt (1484-1545). A German reformer and friend of Luther. He was born at Spalt, near Nuremberg, and studied law and theology at Erfurt and Wittenberg. In 1508 he was ordained priest. He became one of the trusted advisers of the Elector Frederick the Wise of Saxony. He continued to enjoy Court favor after the death of Frederick, and was made Canon of Altenburg in 1525. He wrote biographies of the electors Frederick the Wise (ed. by Neudecker and Preller, Weimar, 1851) and John the Constant, *Christliche Religionshändel* or *Religionssachen* (extracts from which were published as *Annales Reformationis* by Cyprian, Leipzig, 1818), and a history of popes and emperors of the Reformation period. Many of his manuscripts are still unpublished. Consult Seelheim, *Georg Spalatin als sächsischer Historiograph* (Halle, 1876).

SPALATO, spä′lå-tō. A seaport of Dalmatia, charmingly situated on a peninsula in the Adriatic Sea, 74 miles southeast of Zara (Map: Austria, E 5). High mountains lie to the north and east. Fort Grippi is on the east. The harbor, protected by a long mole, is ample and safe. In the vast and remarkable palace of Diocletian, to which the town owes its name, the Emperor lived after abdicating. The remains are interesting—the loggia, with its red columns, and a ruined rotunda, both being especially noteworthy. The old town, with its narrow streets, is mostly inclosed in the confines of the palatial ruins. The new town, with wide thoroughfares, lies to the west. The cathedral is an attractive octagonal structure of Roman origin. Spalato has a naval school, an episcopal seminary, a Serbo-Croatian national Realschule and Gymnasium, and a public garden. Spalato exports olive oil, fruit, and especially wine. A railroad connects the town with Sebenico and Knin. There are manufactures of wool and silk. Population, in 1900, 27,198, mostly Serbo-Croatians.

SPALDING, spạl′dĭng, John Franklin (1828-1902). An American bishop of the Protestant Episcopal Church. He was born at Belgrade, Me., educated at Bowdoin College, and at the General Theological Seminary, New York. Ordained priest he was first stationed at Saint James's, Old Town, Me. In 1873 he was consecrated Missionary Bishop of Colorado, with jurisdiction in Wyoming. Later the missionary territory became a diocese and was divided. His principal publications are: *The Church and Its Apostolic Ministry* (1887); *The Threefold Ministry of the Church of Christ* (1864; 2d ed. 1887); *The Best Mode of Working a Parish* (1888); *Jesus Christ the Proof of Christianity* (1891).

SPALDING, John Lancaster (1840—). An American Roman Catholic bishop. He was born at Lebanon, Ky., and educated at Mount Saint Mary's College, and at the University of Louvain, Belgium; was ordained priest in 1863; was appointed secretary and chancellor of the diocese of Louisville (1869), and of Peoria (1877). He took a prominent part in various social and educational movements, and his position as an authority in the former class of questions was recognized by his appointment in 1902 as a member of the President's commission to investigate the coal strike. Among his works are: *Education and the Higher Life* (1890); *Things of the Mind* (1894); *Means and Ends of Education* (1895); *Thoughts and Theories of Life and Education* (1897); *Opportunity and Other Essays and Addresses* (1900); *Socialism and Labor* (1902); *Religion, Agnosticism, and Education* (1902).

SPALDING, Martin John (1810-72). An American Roman Catholic bishop. He was born near Lebanon, educated at Saint Joseph's, Bardstown, Ky., and in Rome, where he was ordained priest in 1834; became Coadjutor Bishop of Louisville in 1848; Bishop 1850, succeeded Dr. Kenrick as Archbishop of Baltimore in 1864. He published *Early Catholic Missions in Kentucky* (1846), *Lectures on the General Evidences of Christianity* (1847; 4th ed. 1866), *Life of Right Rev. B. J. Flaget*, his predecessor at Louisville (1852), *History of the Protestant Reformation* (1860). Consult his *Life* by his nephew, Bishop J. L. Spalding (Baltimore, 1872).

SPALLANZANI, späl′lȧn-zä′nė, Lazzaro (1729-99). An Italian naturalist. He was born at Scandiano, and educated at Modena and Bologna. In 1754 he became professor at Reggio, in 1761 at Modena, and in 1768 professor of natural history at Pavia. He was distinguished in experimental physiology, where he showed the falsity of the doctrine of the spontaneous generation of life, demonstrated the physiology of digestion, and the true nature of the spermatic fluid and of the spermatozoa. His works are: *Opuscoli di fisica animale e vegetabile* (1780); *Expériences pour servir à l'histoire de la génération des animaux et des plantes* (1786); *Viaggi alle Due Sicilie ed in alcune parti degli Apennini* (1792).

SPANDAU, spän′dou. A town in the Province of Brandenburg, Prussia, situated at the confluence of the Havel and the Spree, nine miles west-northwest of Berlin (Map: Prussia, E 2). Through extensive improvements in its fortifications and the construction of numerous detached forts Spandau has been made a stronghold of the first rank for the protection of Berlin. In the citadel, which is also used as a Government prison, is kept the Imperial military reserve fund. Spandau has an infantry rifle-practice school, an artillery construction bureau, and a Gymnasium. The State ammunition, rifle, and artillery works are located here. The city owns the gas works. Its manufactures include porcelain, woolens, and military tents. The town is the shipping centre for a large trade between Berlin and Hamburg. There are fisheries and important horse and lumber markets. Spandau received municipal privileges in 1232 and was strongly fortified in the fourteenth century. Population, in 1900, 65,014.

SPANDREL. The flat wall space comprised between the extradoses of two adjoining half-arches and a horizontal line or molding touching, or nearly touching, their crowns; or, at the end of an arcade, and in structures having arches set between vertical piers or pilasters or columns, the space included between such vertical feature, the adjacent half-arch, and the molding or line immediately above the arches. This space is approximately triangular, and in decorative architecture offers an admirable field for decoration. It may be adorned with figures in relief, as in Roman triumphal arches, or with medallions, as in the Ospedale degli Innocenti at Florence and many other Renaissance buildings; with surface enrichments in color or with incised surface carving. In certain types of steel arched bridges the spandrels are formed by series of columns or other supports for the upper chord of the truss or the roadway. The term is also applied in the engineering of steel-skeleton buildings to the rectangular space between two columns from the head of a window to the sill of the window next above it.

SPANGENBERG, späng′*en*-bĕrk, Augustus Gottlieb (1704-92). A bishop of the Moravian Church. He was born at Klettenberg, Prussia, and educated at Jena. In 1732-33 he was a member of the theological faculty of the University of Halle. He then allied himself with the United Brethren and was sent to the West Indies and North America as a missionary, receiving in 1735 a grant of land near Savannah, Ga., and establishing a colony there. The Moravians made him bishop in 1744 and for nearly twenty years he exercised his jurisdiction principally in America. In 1760 he was called to the supreme council of the sect; four years later was appointed supreme inspector in Upper Alsatia, and in 1789 was made president of the general directory. He died at Berthelsdorf, Saxony. His principal work is *Idea Fidei Fratrum, oder kurzer Begriff der christlichen Lehre in den evangelischen Brüdergemeinden* (1782), translated into English by Benjamin La Trobe. Consult Ledderhose, *Leben Spangenbergs* (Heidelberg, 1846; Eng. trans., London, 1855).

SPANIEL (abbreviation of OF. *chien espagnol*, Fr. *chien épagneul*, Spanish dog, from Sp. *Español*, Spanish, from *España*, Spain). A short-legged, long-haired variety of the domestic dog. Two groups may be made: (1) Hunting spaniels, (2) fancy or toy spaniels. The first contains the field spaniel, clumber, cocker, Norfolk, Sussex, and the English and Irish water dogs; the second has the King Charles, Prince Charles, Ruby, Blenheim, and the Japanese spaniels. All the spaniels are exceedingly close hunters on a ground scent, and although for rapidity of action and range they have been largely supplanted by the pointer and setter, they are unsurpassable in a rough, tangled country. They neither 'point' nor 'set,' but (except the clumber) give tongue when their nose has discovered the game. The difficulty with them is to keep their eagerness in control. They will not only find game, but will retrieve it, especially from water. The chief characteristics of all varieties are length of body and shortness of legs, which in modern dogs has been greatly exaggerated, a great abundance of beautiful silky coat, and a placid disposition.

FIELD SPANIEL AND COCKER. Although of different origin, these may well be considered together. Both in form are long and low, with shapely, gracefully carried heads, and straight strong front legs. The coat is straight, dense, and silky, heavily fringing the ears, the back of the legs, and the toes. The color most preferred is solid black. The cocker usually weighs from 18 to 24 pounds, while the field spaniel is twice as heavy.

THE CLUMBER. This is a large dog weighing up to 65 pounds, with a predominance of white in its color. It takes its name from the seat of the Duke of Newcastle, who introduced the breed into England from the kennels of the Duc de Noailles of France, early in the eighteenth century. Unlike other spaniels, these hunt in silence. They are handsome, grave-looking dogs. Their heads are massive, and marked with a furrow between the eyes. The nostrils are large, open, and flesh-colored; the eyes large and deeply set, and show a 'haw.' The coat is not very long, except the profuse 'featherings,' properly lemon and white with few markings. The tail is usually docked. The Sussex spaniel is a variety of clumber which must be a rich golden liver color. It is faster in the field, and, although not mute, is less noisy than any other kind. The Norfolk is another variety of this type which arose in the English county of that name as a pheasant dog. In the days of hawking this spaniel was the falconer's special assistant. See Plate of DOGS.

IRISH WATER SPANIEL. This dog is of very ancient lineage and great value as a retriever. Its general appearance is that of a large spaniel, with a top-knot of hair falling down over the eyes. The tail tapers like that of a pointer; the face is long and the hair on it is quite free from curling, although that on the body is closely curled, and the small, dark amber eyes are set flush and have no eyebrows. The color is a rich dark liver, and the weight from 50 to 60 pounds.

TOY SPANIELS. The best known of the small pet or 'fancy' spaniels is the King Charles—a black and tan breed, which was maintained pure-blooded for many generations with jealous care by the dukes of Norfolk. In early times they were broken to hunt. Now they are only pets. They are in the main simply miniature spaniels, weighing from 7 to 10 pounds, with eyes large, wide apart, and level, and ears long, drooping, and silky. The Blenheim resembles the King Charles, but its ears are shorter and it differs in color, being a pure pearly white, with bright chestnut or ruby red markings, evenly distributed in large patches. Both the ears and cheeks are red, with a blaze of white between them, in the centre of which is one small red spot. The breed derives its name from the estate of the first Duke of Marlborough, by whose family it was bred. They were in those days trained for the hunt as well as highly prized in the house. The Prince Charles, Charles I. spaniel, or tricolor, resembles the Blenheim, except that where the Blenheim is red he is black, and he has no 'blaze.' The 'ruby' is a King Charles spaniel, with a black nose, and is wholly red. The Japanese spaniel is pure white, parti-colored with black or red or lemon, and of very small size. It may weigh 8 to 12 pounds, or only one pound, as do some of the 'sleeve-dogs,' so called in Japan because they may be carried in the coat sleeve. The Japanese spaniels have a very compact body, large, highly arched head, and their dark eyes are set high and wide apart. The nose is short and pug-like; the legs are slender; and the tail is well feathered and carried in a tight curl over the back. They are very alert and affectionate. A similar dog is highly esteemed in China, especially when solid fawn or silver in color.

Consult authorities cited under Dog; also Spicer, *Toy Dogs* (London and New York, 1903).

SPANISH-AMERICAN LITERATURE. THE COLONIAL PERIOD. Spanish-American literature owes almost nothing to the few fragments of Nahua and Inca literature that survived the destruction of hieroglyphs by the Spanish conquerors. The early literature centres largely around the City of Mexico. (See MEXICAN LITERATURE.) As subsidiary literary centres, Bogotá, Quito, Lima, and Guatemala became noted during the later colonial era.

The subject matter of intellectual colonial effort consists largely of the preparation of grammars and dictionaries of native languages (Menéndez y Pelayo in *La ciencia española* gives a list of fifty-nine of the principal ones), and of catechisms and sermons in both Spanish and the native vernacular. This work was largely utilitarian in object, and, save for the occasional translation of some fragment of native hieroglyphs, is merely of philological interest. Another branch of literary activity was the writing of the history of the conquest and early settlement of America, or the compiling of materials for that purpose. During the later colonial period works on natural and political science began also to appear. The remaining literary effort, directed toward what is generally called pure literature, produced a few works of merit (so recognized by the mother country), which were of importance in the further literary development of America. These writers (largely ecclesiastics, though occasionally some *conquistador* handled the pen equally well with the sword), described the conflicts of the Spaniards with the natives, as did the Chilean epic poet Pedro de Oña (born c.1571) in his *Araucano domado* and Pedro de Peralta y Barnuevo (d. 1760; of Spanish birth) in his *Lima fundada;* or they depicted the beauties of natural scenery and the happenings of agricultural life, as did the Guatemalan Rafael Landívar (1731-93), in his bucolic Latin poem, *Rusticatio Mexicana;* or they collected the materials for history and wrote excellent accounts of the pacification and settlement of America, as did Juan de Velasco, of Ecuador, in his *Historia del reino de Quito*, and the Jesuits Ovalle and Rosas in Chile. Fr. Juan de Barrenechea y Albis, of the latter country, in his *Restauración de la Imperial* (1693), made a solitary attempt at novel-writing. There appeared also some worthy attempts at devotional writing, both in prose and verse, such as the *Sentimientos espirituales* of Sor Francisca Josefa de la Concepción (d. at Tunja, 1742), and *La Cristiada* of Diego de Hojeda (who lived in Lima early in the seventeenth century). Juan de Castellanos (sixteenth century), of New Granada, in his *Elegias de varones ilustres*, not only celebrated in hendecasyllabic verse the deeds of the early explorers of America and of his native viceroyalty, but also achieved the doubtful distinction of writing the longest poem in the language. The crowning glory of New Granada, however, lies in the intellectual movement which, under the leadership of José Celestino Mutis (1732-1808), the "illustrious patriarch of botanists of the New World," and the many-sided José de Caldas (1741-1816), became memorable in the Spanish-American scientific literature of the latter half of the eighteenth century. During this same period the Ecuadorean Antonio de Alcedo (died 1812) produced his *Diccionario geografico-histórico de las Indias occidentales* (1786-89), a translation of which, by G. A. Thompson, with numerous additions, was published in London (1812-15).

The Period of Independence. The revolutionary days of the early nineteenth century, which, in Spanish America, substituted the radical philosophy and sentiment of the progressive French branch of the Latin stock for the unswerving loyalty and religious mysticism of the conservative Spaniard, did not wholly release American writers from dependence upon Peninsular schools of thought. It is true that through translation and imitation it is possible to trace the influence of Byron, of Hugo, of Heine, and of the other great leaders of the romantic school of literature; but in the majority of cases these and other writers are introduced to Spanish America indirectly, and above all through the writings of the Spanish romanticist Zorilla, who has exerted a most profound influence upon American authors. The one great bond that unites the separate republics and, though perhaps unwillingly, keeps them in touch with the thought of the mother country, is the 'sonorous Castilian language,' which its best writers have preserved in all its grammatical and rhetorical purity of diction; but to which they have given a buoyancy and flexibility lacking in the original, and a greater freedom of thought and a more revolutionary and virile spirit that together have rendered this 'offshoot of French art and of Latin culture' a vigorous literary product.

During the early decades of the nineteenth century themes suggested by the revolutionary conflict, in which so many of the writers took an active part, naturally formed the greater portion of the literary output. The period which followed is marked by literature of a more contemplative and personal tone. Within recent years there has arisen the new school of 'Creolism,' whose devotees show in the faithful portrayal of native customs, generally of a rustic character, many elements of rugged strength that promise well for the originality of future literature. During the century there has also occurred a shifting of literary centres in South America. Lima, Quito, and Bogotá have been relegated to a secondary rank, while Buenos Ayres, early brought under the direct influence of the French romantic school, and Caracas, influenced as profoundly by Zorilla and his followers, and Santiago, at present the centre of the most inspiring literary productions of the South American continent, far outstrip their rivals of colonial fame.

The chief literary figure of Latin America is that of Andrés Bello (q.v.), whose mastery of Castilian is illustrated in his many-sided career and whose reputation as a poet rests chiefly upon his georgic *La agricultura en la zona tórrida.* José Antonio Maitín (1792-c.1859), another native of Venezuela, was one of the first of the ardent followers of Zorilla. Rafael María Baralt (1810-1860), in his *Historia antigua y moderna de Venezuela*, in style and method compares favorably with the best of modern Spanish historians, and also ranks high as a linguist and poet. Among others who have shed lustre on the literary reputation of Venezuela are the members of the gifted Calcaño family; the lyricist Jacinto Gutierrez Coll (1836—), made famous by his *A mi angel guardián* and *Sueño de amor;* Francisco de Sales Perez (1836—), whose *La vida del campo* is a faithful portrayal of the customs of his native *llanos;* and the present day Diaz Rodriguez, whose artistic romance, *Sangre patricián*, recalls the Italian D'Annunzio. Colombia was the home of the lyric poet José Eusebio Caro, whose *Lara* (published in 1834) marked an important literary period in the history of his native land. His associate, Julio Arboleda (died 1862), essayed in *Gonzalo de Oyón* a notable attempt at epic-writing, but achieved a greater success in his brilliant romance *Casimiro el Montañés.* The realistic poet José Joaquin Ortiz is favorably known because of his masterpiece, *Los colonos.* The most noted Spanish-American novel, *María*, is the work of the Colombian Jorge Isaacs; while the *Historia de la revolución de Nueva Granada* (1827) of José Manuel Restrepo is but one of the many historical works that have brought honor to the northern republic. Her southern neighbor, Ecuador, boasts of the statesman poet José Joaquín de Olmedo (1782-1847), whose *Canto de Junín* is the most stirring of revolutionary poems, but whose work has been rivaled by the more recent verse of Juan Leon Mena, famous also as a critic and for his novel *Cumanda,* and Julio Zaldumbide, a poet of the contemplative school. Lima, in Peru, was the home of the political satirist Felipe Pardo de Aliaga, famous also for his dramas, *Frutos de la educación* and *Una huérfana en Chorillos.* From the middle of the century Peruvian writers have largely followed the Spanish school of romantic literature, and one of the most inspiring of this class of writers is Fernando Velarde, whose collected poems, *Flores del desierto,* appeared in 1848. José Arnaldo Marquez (1825-81) is regarded as the leading lyric poet of modern Peru. The *Noche de dolor en las montanas* of Numa Pompilio Llona (born 1832) is one of the best poems of recent American literature. In fiction *El Padre Orani* of Narciso Aréstegui occupies a prominent place, and the dramatists Corpancho and Segura take a high rank. As under the political régime of viceroyalty days, Bolivia has continued to be in a literary sense the appendage alternately of Peru and of Argentina, but the lyric poetry of Ricardo J. Bustamante (born 1821) and the *Ensayo sobre la historia de Bolivia* of Manuel José Cortés (1811-65) have received favorable notice, as has also the *Ultimos dias coloniales en el Alto-Peru* (1896), written by Gabriel René-Moreno.

Chile, long the most backward of the South American republics, was greatly aroused by the long residence of Bello and by the coming of many exiled Argentines. Of the succeeding generation the publicist and poet Arteaga Alemparte (1835-1880) achieved a poetic triumph in his hymn *Al Amor.* Isaias Gamboa, in his *Poemas* (1902); the rare and strange Antonio Bórquez Solar, in his *Campo lírico* (1900); and Carlos Walker Martinez in *Poesías* (1894) and *Romances Americanos* (1899) exhibit an elevation of thought and a beauty of versification unequaled elsewhere in Spanish-America and hardly surpassed in Europe. Chilean writers of history and political science, among whom are reckoned Arana and the Amunáteguis, likewise enjoy an international reputation, while *Alberto el jugador,* a novel by Rosario Orrego de Uribe, and *Contra la marea,* by Alberto del Solar, attest the worth of her writers of fiction.

With the dawn of independence the classic translations and imitations of Valera, Quintana, and Cienfuegos inaugurated the literary history of Argentina, a history which includes that of her neighbor, Uruguay. In Argentina Estéban Echeverría, one of the first American lyricists, known for his *La cautiva,* introduced romanticism directly from the French, and liberated the thought of his own countrymen. His fellow citizen José Rivera Indarte produced the stirring poem *El festín de Baltasar,* and his pupil Juan Maria Gutierrez the lyrics *Recuerdo* and *A mi caballo.* Following these came a host of littérateurs, with centre at Buenos Ayres, or, in time of political proscription, at Montevideo, whose work in poetry and prose has greatly influenced the political thought and literature of their own and neighboring republics, and has rendered famous the names of the historian Vicente Fidel Lopes, the dramatist José Marmol (author also of the novel *Amalia*), and the poet José Hernandez, whose *Martín Fierro* has been the most widely sold poem of the southern continent. The *Flores silvestres* of the dramatist Francisco Javier de Acha, of Uruguay, have also met with a favorable reception, and the *Libro extraño* of Francisco Sicardi is one of the best of recent novels. The *Historia Argentina* (1894) of Mariano A. Pelliza is a monumental work of great merit. In the department of criticism the *revistas* of Buenos Ayres have occupied a leading place, and one of their most famous contributors was Juan Bautista Alberdi, whose *Escritos póstumos* appeared during the last decade. Bartolomé Mitré's *Historia del general Belgrano* is one of the most successful attempts at biographical history that the century has produced. During recent years the prevailing commercialism of the Plata valley has undoubtedly exerted a pernicious effect upon its literature. Central America, in addition to a number of political writers, has contributed to the field of letters the satirist José Batrés y Montúfar, and the writers of fables García Goyena and Matías Córdoba of Guatemala.

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SPANISH-AMERICAN WAR. The war between Spain and the United States in 1898. After more than a century of unrest in the island of Cuba, and intermittent struggles between the Cubans and their home Government, when the increase of bloodshed, starvation, and general devastation had attracted world-wide attention, and when the rights of American citizens had been systematically disregarded by the Spanish authorities, the United States decided to interpose its friendly offices. After the 'Ten Years' War' (1868-78) in Cuba, there had been a period of comparative peace (see CUBA), but in February, 1895, the Cubans again rebelled, and the Spanish Government resorted to repressive measures of unusual severity and cruelty. The island was devastated, famine and death were everywhere, American interests suffered greatly, and the condition of affairs fast became intolerable. On April 6, 1896, Secretary of State Olney represented to Spain that American commerce was being greatly damaged, and that the Cubans were threatened with 'absolute impoverishment,' and vaguely offered the friendly offices of the United States, his 'offer,' however, falling short in definiteness to that of a resolution passed, on April 4th, by the American Congress. Olney's offer was immediately declined by Spain, and in December, 1896, President Cleveland, in his annual message, spoke of 'higher obligations' than those due to Spain, which would devolve upon the United States if conditions should grow worse in the island and if Spain's inability to deal successfully with the insurrection should become manifest. In Congress feeling was much more radical, and the President's 'timidity' was vigorously criticised. President McKinley, at the outset of his administration, devoted special attention to the situation in Cuba. In May, 1897, Congress appropriated $50,000 for the relief of the Cubans, and on May 20, 1897, the Senate passed a resolution recognizing the belligerency of Cuba, which, however, was never acted upon by the House. Meanwhile, the activity of Cuban agents in the United States caused almost constant diplomatic friction between the two governments. A new Ministry under Sagasta in Spain made an effort to ameliorate conditions, and on October 6, 1897, recalled Captain-General Weyler, who had been held responsible for much of the Spanish cruelty to the Cubans, General Blanco being sent out in his stead. Stewart L. Woodford, of New York, had been sent as United States Minister to Spain, with special instructions to urge that country to establish civil order in Cuba, and to announce that the United States could not view with indifference the indefinite prolongation of the existing conditions. The representations of the American Minister were met with promises from Spain to give Cuba local autonomy and to ameliorate the conditions which the war methods had created. In view of these assurances, the President, in his annual message of December, 1897, recommended to Congress the postponement of action until Spain had been given ample opportunity to redeem her promises. On December 24th an appeal was issued by Secretary Sherman in the President's name, calling for contributions for the relief of the Cuban *reconcentrados*. This appeal met with a hearty response. At the opening of 1898 the Government began to concentrate its naval forces, and to accumulate war supplies. The tone of the press and the expressions of public opinion generally showed that the nation was ready for war. The relations with Spain were further strained on February 8th, when a Cuban sympathizer purloined from the mail a letter from the Spanish Minister at Washington, Señor Dupuy de Lome, addressed to a Spanish editor, and containing severe strictures on President McKinley and his policy. The Minister at once admitted that he had written the letter and resigned. The prompt disavowal on the part of Spain of any sympathy with the Minister's conduct closed the incident so far as official circles were concerned. On the evening of February 15th the battleship *Maine* (Captain Charles D. Sigsbee), which had been sent to Cuba on the representation of Fitzhugh Lee, the American Consul at Havana, but not for unfriendly purposes, according to official announcement, was blown up in Havana harbor and 266 of the crew killed. The United States and Spain at once appointed separate boards of investigation. Congress immediately appropriated $50,000,000 for national defense. On March 28th the American commission reported. It attributed the catastrophe to the explosion of a submarine mine in the harbor, but in view of the lack of evidence declined to fix responsibility. Public opinion, however, at once decided that the Spanish officials in Cuba were responsible for the disaster. On the day before the report of the *Maine* commission, the President made overtures to Spain for a cessation of hostilities and a peaceable settlement of difficulties. He tendered his good offices in the negotiation of peace and proposed a dissolution of the concentration camps and the relief of the suffering Cubans by the United States through the mediation of Spanish officers. In reply, Spain offered to leave the peace negotiations to the Cuban Parliament appointed to meet on May 4th, and to cease hostilities when the Cuban insurgents asked for it. Spain added that the concentration orders had been revoked, agreed to a joint relief of distress, voted $600,000 for that purpose, and offered to arbitrate the *Maine* case. The President regarded this reply as unsatisfactory and announced his intention of submitting the whole matter to Congress in the forthcoming message. Meanwhile, in anticipation of the war, American inhabitants left Cuba, the Cuban Government declared against interference on the part of the United States, the Cuban 'junta' demanded recognition of independence before intervention, and Spain on April 10th declared a general armistice. On the following day the President's message, describing the situation in Cuba and giving an account of the state of diplomatic relations with Spain, was laid before Congress. The President did not favor the recognition of Cuban belligerency or independence, but advocated intervention as a neutral. At all events, he declared, the war in Cuba must be ended, and he accordingly asked Congress for authority to use the army and navy to secure the formation of a Cuban government capable of discharging its international obligations and maintaining internal order. Congress promptly replied by a joint resolution declaring the people of Cuba free and independent, demanding the surrender of all Spanish authority over the island, and directing as well as empowering the President to enforce the resolution by the army and navy. Congress further declared that the United States was not "to exercise sovereignty, jurisdiction, or control over said island except for the pacification thereof." The President signed the measure, and on April 20th sent the ultimatum to Spain, fixing the hour of noon, April 23d, as the last date for a satisfactory reply. This was a practical declaration of war, for the Spanish Government had already announced its intention to oppose the policy outlined in the President's message. Both Powers at once defined their attitude on questions of international law, and preparations that had been going on in both countries were quickened, the United States devoting special attention to the equipment of the navy.

Almost immediately the Spanish Minister demanded his passports and the American Minister at Madrid was notified by the Spanish Government that diplomatic relations between the two nations had ceased. On April 23d President McKinley called for 125,000 volunteers and ordered the North Atlantic squadron to blockade Havana and other Cuban ports. Formal declaration of war by Spain on the 24th and by the United States on the 25th inst. were followed by the proclamations of neutrality by Great Britain and other foreign Powers.

The first gun of the Spanish-American War was fired (April 23d) by the U. S. S. *Nashville* across the bows of the *Buena Ventura*, a Spanish merchantman, and the first action occurred on the 27th, when three vessels of the United States

Navy under Captain Sampson bombarded the defenses of Matanzas.

Spain had an army of 60,000 men distributed throughout Cuba, and had fleets near that island and in the Philippines. Commodore Dewey, U. S. N., commanding the Asiatic squadron, then in Chinese waters, had completed the equipment and coaling of his ships, when the cable brought him orders to "proceed to the Philippine Islands; commence operations at once against Spanish fleet; capture vessels or destroy." Entering the harbor of Manila (April 30th) under cover of darkness, with his fleet (131 guns, 1678 men), made up of the *Olympia* (flagship, Captain C. V. Gridley), the *Baltimore* (Captain N. M. Dyer), the *Raleigh* (Captain J. B. Coghlan), the *Boston* (Captain F. Wilder), the small cruiser *Concord* (Commander A. Walker), the gunboat *Petrel* (Commander E. P. Wood), the revenue cutter *Hugh McCulloch*, and two colliers, he attacked the ships of Admiral Montojo, ten in number (120 guns, 1796 men), supported by land batteries. The action, which lasted from 5.41 A.M. (with an interruption of three hours) till 12.30 P.M., ended in the destruction of the Spanish vessels and the silencing of the fortifications. The American casualties were 6 wounded; Spain admitted a loss of 634 killed and wounded.

The mobilization of the United States land forces proceeded rapidly, and on May 25th a second call was made—for 75,000 volunteers. While camps of instruction were established near Tampa and Chickamauga, the Navy was watching the seacoast and preparing the way for a combined attack by the land and naval forces upon Cuba.

In the meanwhile the movements of a Spanish fleet of four cruisers and three torpedo-boat destroyers under Admiral Cervera, which sailed from Saint Vincent on April 29th, for some time puzzled the Americans. But finally (May 29th) the Spanish ships were discovered by Commodore Schley (q.v.) at anchor in the Bay of Santiago, and a carefully organized blockade of the bay was planned and rigorously conducted by Admiral (then Captain) Sampson, the commander of the American fleet in Cuban waters, who had arrived at Santiago and had superseded Schley in actual command on June 1st. In Sampson's fleet was the *Oregon* (Captain Charles E. Clark), which to join the fleet had made a wonderful trip from Puget Sound to Key West between March 6th and June 4th. A daring attempt by Lieutenant R. P. Hobson (q.v.) on June 3d to lock the door upon Cervera's fleet, by sinking the collier *Merrimac* in the entrance to the harbor, was only partially successful. The harbor of Guantanamo was occupied as a coaling station by the Americans after several collisions with the Spanish troops.

Finally, an expedition consisting of 32 transports bearing 819 officers and 15,058 enlisted men under Major-General Shafter, U. S. V., left Tampa, June 15th. The force was composed almost entirely of regulars—18 regiments of infantry, 6 regiments of cavalry (dismounted), 1 battery of engineers, 4 batteries of light artillery, 2 batteries of siege guns, and 1 balloon detachment—together with 1 regiment of cavalry and 2 regiments of volunteer infantry (subsequently increased to 4 regiments).

General Shafter's instructions from his Government were to "go with your force to capture garrison at Santiago and assist in capturing the harbor and fleet." Arriving off Guantanamo (June 20th), he communicated with the Cuban forces (5000 strong) under General Garcia, whose coöperation was secured. It was estimated that there were about 12,000 Spanish soldiers in Santiago and vicinity. A plan having been agreed upon between the United States land and naval forces, a landing was effected (June 22d) at Daiquiri of 6000 men, and on the three following days the remainder of Shafter's troops disembarked there and at Siboney, without opposition. The rainy season having set in increased the natural difficulties of an advance over a soft clay surface, covered with a tough undergrowth, interspersed with cow-paths in lieu of roads. The Spaniards had withdrawn to their intrenchments near Santiago, protected by an entanglement of barbed wire.

Although orders had been issued to the American advance to await the completion of the disembarkation and landing of supplies, the leading division under General Wheeler (June 24th) attacked the Spanish troops at Las Guasimas and after a sharp engagement dislodged them, with casualties of 68 Americans and 36 Spaniards. When the preparations had been completed for a general advance, the United States troops on July 1st, having taken up positions on the slopes of the hills in front of Santiago with a detachment of Cubans protecting their flanks, opened fire with a field battery, which, using black powder, became a target for the Spanish gunners. A battery of rapid-fire guns, however, did much execution. The character of the ground, the absence of roads, and the stout resistance of the garrison of El Caney (q.v.) retarded the advance of a part of the American force under General Lawton, but by sundown Shafter's troops were in full possession of the line of hills along the San Juan River, one and a half miles from the city. These engagements were fought chiefly by regulars, but efficient services were rendered by the First Volunteer Cavalry, popularly known as the "Rough Riders," under Colonel Leonard Wood and Lieutenant-Colonel Theodore Roosevelt. The following day was utilized by both sides in strengthening the lines and by the Americans in bringing up ammunition and rations. The exposed position of the American forces rendered an immediate advance or temporary withdrawal necessary.

On the morning of Sunday, July 3d, Cervera, taking advantage of the operations on land, had sought to escape from the harbor of Santiago. The appearance of the leading ship was the signal for every ship in the American squadron to close in upon the fugitives with a hot fire, which was returned with spirit, but without material effect. Within two hours the six Spanish ships were totally destroyed, with a loss of about 350 men killed and about 1700 men and officers captured, including Admiral Cervera. Early in the morning Sampson in his flagship *New York* had started for Siboney, where he had planned to hold a conference with General Shafter, and Schley was thus left as the ranking officer. At the beginning of the battle, however, Sampson, about ten miles away, started back, arriving before the battle was over. During the battle the Americans lost only one man killed and ten wounded. The seven American vessels engaged had a total of 225 guns, while the Spanish fleet had only 146; the weights of metal the two fleets could throw per minute were 6720 and 4827 pounds respectively. On the same day as that on which the naval battle occurred General Shafter notified the Spanish commander, Toral, that unless he surrendered by the morning of the 4th, the city would be shelled. After several communications had passed between these officers, and the request of foreign consuls for an extension of time had been complied with, a final demand brought the truce to an end on the 10th and the joint attack by ships and troops was resumed. On the 11th another demand upon the besieged was made, culminating on July 15th in articles of capitulation providing for the surrender of all forces, material, and territory of the district of Santiago, and the transportation of all Spanish soldiers to Spain. The Spanish forces in the captured territory numbered 23,500 and of these 10,000 defended the city. Their losses aggregated nearly 1000, while the Americans killed and wounded numbered 1614, of whom 114 were officers. On Sunday (July 17th) at noon the Stars and Stripes were hoisted in the plaza of Santiago. On July 27th General Miles, U. S. A., at the head of an expedition landed at Ponce, Porto Rico, and a few days later formally took possession of the island. On the 25th General Merritt arrived at Manila to assume command of 20,000 United States troops, of which the advance guard had already been sharply engaged with the Spanish forces stationed there. On August 7th Admiral Dewey and General Merritt united in a demand for the surrender of the city and the islands. This being refused, a combined attack was made, and 7000 regular and 4000 volunteer Spanish soldiers fell into the hands of the Americans, who lost 50 men killed and wounded. Meanwhile, the Filipinos had been organized by Aguinaldo, who subsequently conducted hostilities against the American troops for the purpose of gaining independence. See PHILIPPINE ISLANDS.

On July 26th Spain made overtures for peace through the French Ambassador at Washington, M. Cambon, who was authorized to act as Minister Plenipotentiary for Spain during the coming negotiations. On August 12th the peace protocol and preliminary arrangements were concluded. It was provided that the final treaty should be made by a commission to meet at Paris not later than October 1st. The representatives of the United States were William R. Day (chairman), Senator Cushman K. Davis, Senator William P. Frye, Whitelaw Reid, and Senator George Gray. After prolonged discussions and threatened failure, the treaty was signed on December 10th. It was ratified by the United States Senate on February 6. 1899, signed by the Queen Regent of Spain on March 17th, and final ratifications were exchanged on April 11th. Diplomatic relations were soon resumed. By the treaty, Porto Rico and the other Spanish West Indian Islands, Guam in the Ladrones, and all of the Philippines were ceded to the United States, which in return agreed to pay $20,000,000 and to yield some temporary commercial privileges in the Philippines. The political status of the inhabitants of the new possessions was to be determined by the new Government.

The finances for the war were provided by special taxes. On June 13, 1899, an act was approved for that purpose. Internal taxes were increased and a stamp tax imposed on certain papers and articles. A popular loan was also negotiated. This war tax continued in force until March 2, 1901, when a reduction was made, and on April 14, 1902, the remainder was repealed. The total expenses for the war from the opening to October 31, 1898, were estimated at $165,000,000. During that period the lives of 2910 American soldiers were lost, all but 306 from disease. The enormous death rate in the camps brought out serious charges of maladministration against the War Department that culminated in the appointment of a committee of investigation, which after a thorough examination of charges reported in general in favor of the department, laying most of the blame upon the want of preparation at the time war broke out. For further details concerning the results of the war, see UNITED STATES; CUBA; PORTO RICO; PHILIPPINE ISLANDS.

Consult: Lodge, *The War with Spain* (New York, 1899); Bigelow, *Reminiscences of the Santiago Campaign* (ib., 1899); Alger, *The Spanish-American War* (ib., 1901); Sigsbee, *The Maine* (ib., 1899); Hobson, *Sinking of the Merrimac* (ib., 1899); Kennan, *Campaigning in Cuba* (ib., 1899); Miley, *In Cuba with Shafter* (ib., 1899); Spears, *Our Navy in the War with Spain* (ib., 1898); Joseph Wheeler, *Santiago Campaign, 1898* (Philadelphia, 1899); Atkins, *The War in Cuba; the Experiences of an Englishman with the United States Army* (London, 1899); Bonsal, *The Fight for Santiago* (New York, 1899); Morris, *The War with Spain* (Philadelphia, 1899); Roosevelt, *The Rough Riders* (New York, 1899); and Titherington, *History of the Spanish-American War of 1898* (New York, 1900).

SPANISH-AMERICAN WAR, NAVAL AND MILITARY ORDER OF THE. A patriotic and hereditary society organized in New York City on February 2, 1899. It admits to membership any man of good repute who served on the active list, or performed active duty as a commissioned officer, regular or volunteer, in the United States Army, Navy, or Marine Corps, during the war with Spain, or in the subsequent insurrection in the Philippines, or who participated in the war or insurrection, prior to April 1, 1901, as a naval or military cadet, or as an officer in the Revenue Cutter Service on any vessel assigned to duty under the control of the Navy Department.

SPANISH BARBER, THE. A comedy by George Colman, the elder, produced in 1777, based on Beaumarchais's famous comedy *Le barbier de Séville*.

SPANISH BAYONET. See YUCCA.

SPANISH FLY. See BLISTER-BEETLE.

SPANISH FOWL. The black Spanish fowls constitute one of the oldest varieties of domestic poultry, and are renowned for their exceptionally fine laying qualities. The white face is a distinguishing feature, and should be long, smooth, free from wrinkles, rising well over the eyes in an arched form, extending toward the back of the head and to the base of the beak, covering the cheeks and joining the wattles and ear-lobes. The color of the plumage is rich, glossy black, and any gray is considered a serious defect. Shanks and toes are blue, or dark leaden blue. The comb is single, and bright red in color; wattles, bright red, except the inside of the upper part, which is white; ear-lobes, pure white.

SPANISH FRIAR, The. A drama by Dryden, produced in 1681, written against the Roman Catholic priesthood. Two plots, one serious, the other comic, are combined in the story, connected by Dominick, the friar, a fat amusing rascal.

SPANISH GYPSY, The. (1) A romantic comedy by Middleton, assisted by Rowley, printed in 1653. Two stories are combined, one from Cervantes's *Fuerza de la Saugre* and the gypsy tale from his *La Gitanilla*. (2) A long dramatic poem by George Eliot (1868). A duke of mediæval Spain is about to marry Fedahua, a beautiful girl, who discovers that she is the daughter of the gypsy chief Zarco. The call of race and duty conquers, followed by a tragic renunciation of her love.

SPANISH LANGUAGE. A Romance language, evolved out of Latin in the Iberian Peninsula and carried by Spanish colonists to the Canaries, the Antilles, the Philippines, Mexico, portions of the United States, Central America, the greater part of South America, and a few places on the coast of Africa, and by the Jews into Turkey and other regions in which they settled after their expulsion from Spain. In the Iberian Peninsula the boundaries of the Spanish-speaking domain do not coincide exactly with those of the political division called Spain, since within the latter are contained Galicia, whose inhabitants speak a Portuguese dialect, a Basque-speaking district in the north, and a Catalan-speaking region in the east. The inhabitants of the Balearic Islands speak a Catalan dialect. Probably not far from 50,000,000 persons at present use Spanish as their native tongue, the majority being in the New World. Five principal dialects are distinguishable in the language as spoken in the mother country: Asturian, Leonese, Aragonese, Andalusian, and Castilian. Castilian has become the standard literary speech.

Castilian has the five simple vowels, *a*, *e*, *i*, *o*, *u*, a variety of diphthongs, and a few triphthongs produced by the union of a strong vowel (*e*, *o*, *a*) with two weak vowels (*i*, *u*). Examples of the diphthongs and triphthongs are *iu* in *viuda*, 'widow;' *ui* in *ruido*, 'noise;' *ai* in *baile*, 'dance;' *eu* in *deuda*, 'debt;' *io* in *Dios*, 'God;' *iai* in *estudiáis*, 'you study.' The diphthongs *ie* and *ue* are especially common as representatives of a Latin short *e* or *o;* compare Latin *bĕne* and *fŏrum* with Spanish *bien* and *fuero*. Qualitative distinctions in vowels (open and close *e* and *o*) exist, but are not so marked as in certain other Romance languages (e.g. Italian and French). In assonance (rhyme of vowels without that of the consonants) these qualitative distinctions are not regarded; open and close *e* may therefore rhyme together, as may also open and close *o*, and, furthermore, final unaccented *i* and *u* may rhyme respectively with *e* and *o* similarly situated. Although *liaison*, strictly speaking, is not a feature of Spanish pronunciation, yet in rapid speech the vowel ending one word may be merged into the same vowel of the immediately following word, provided this latter be syntactically allied to it (e.g. *mi querida amiga* may become *mi queridamiga*, with a possible compensatory lengthening of the *a*). The consonant sounds are *p;* a bilabial spirant written both *b* and *v* (the more frequent sound of these letters); a labial stop written both *b* and *v* (the value of these characters where they follow an *m* of the same word or an *n* at the end of the preceding word, as in *también* and *en vida;* the sound is that of the usual English *b*, the sound of the English *v* not existing in Spanish); *f; w* (written *u* in hiatus); *m; t; d* (both *t* and *d* are articulated farther forward in the mouth than the corresponding English sounds, and *d* has a decided tendency to become everywhere the interdental spirant); a voiceless spirant that is interdental or nearly so (written *c* before *e* or *i*, and *z* before a consonant, at the end of a word, or before any vowel, though rarely now before *e* or *i;* e.g., *celo*, 'zeal;' *cielo*, 'heaven;' *zapato*, 'shoe;' *raiz*, 'root;' the value is about that of *th* in the English *breath;* a voiced spirant, interdental or nearly so (written *d*, which has this sound especially between vowels, as in *lado*, 'side;' or when preceded by a vowel and followed by *r*, as in *padre*, 'father,' or at the end of a word, as in *abad*, abbot; the value is about that of *th* in the English *breathe*); *l;* a palatalized *l* (written *ll* and pronounced nearly like the *li* of *filial*); *n;* a palatalized *n* (written *ñ*, and pronounced like the *ni* of *pinion*); a simple tongue-trilled *r* (never slurred); a reënforced form of the same sound (written *rr* between vowels and *r* at the beginning of a word, or after *s*, *l*, or *n* within a word, e.g. *perro*, 'dog;' *reo*, 'criminal;' *israelita*, 'Israelite;' *honra*, 'honor'); a voiceless *s* (with the value of the English *ss*); *y* (written both *i* in hiatus and *y*); *k* (written *c* before *a*, *o*, and *u*, or before a consonant and in the final position, and *qu* before *e* and *i*—*carro*, 'car;' *frac*, 'frock coat;' *acto*, 'act;' *querer*, 'to like;' *quién*, 'who'); *g* (the so-called hard sound of English *g* in *game, get;* written *g* before *a*, *o*, *u*, and *gu* befor *e*, *i*—*gato*, 'cat;' *guerra*, 'war'); a velar or guttural spirant (with approximately the value of *ch* in Scotch *loch* and German *nach;* written *j* in all positions and *g* frequently before *e*, *i*—*jamás*, 'never;' *gente*, 'people;' some observers find also a voiced form of this spirant, but it is usually voiceless); a velar *n* (with the value of English *ng* in *sing;* written *n* before a guttural or palatal, as in *banco*). It is the general rule that the Spanish written characters represent actual sounds; but *u* is frequently used before *e* or *i* as a sign that a preceding palatal consonant has the 'hard' or stop value, as in *que* or *guerra; j* is silent in the singular noun *reloj;* and in a few words like *usted* a final *d* may not be pronounced. The simple *h* is generally not pronounced, though before the diphthong *ue* it may have a slight aspiration. In the conjunction *y* (= 'and') the sound is that of the vowel *i*. An aversion to the doubling of consonants is a distinguishing feature of Spanish spelling; *c* and *n* alone may be doubled, as in *acción*, 'action,' and *innoble*, 'ignoble,' and these combinations must be pronounced as double sounds wherever they occur; *ll* and *rr* are properly not doubled consonants, and they figure as individual signs in the alphabet. Among the combinations of consonants may be mentioned *ch*, like *ch* in the English word *church;* e.g. *chico*, 'little.' According to the Academy the written *x* is a double consonant equivalent to *ks;* but before a consonant there is a rather widespread tendency to pronounce it like a simple *s.* In older Spanish *x* was a much more common character than now and had the value of our *sh.* By a decree of the Spanish Academy issued in 1815, *x* with the value of *sh* has been displaced in favor of *j,* pronounced as described above. The matter of accentuation is governed by strict rules of the Academy. Words ending in a consonant not *n* or *s* regularly stress the last syllable; e.g. *verdad,* 'truth;' *amar,* 'to love.' Words ending in *n* or *s* or in a vowel regularly stress the syllable before the last; e.g. *aman,* 'they love;' *hijos,* 'sons.' Words infringing these rules and all words stressed on a syllable not the last or second last must bear a written acute accent on the stressed syllable, as *nación,* 'nation;' *cortés,* 'courteous;' *médico,* 'physician.' If a diphthong or a triphthong occur in the stressed syllable the stress will fall upon its strong element (*a, e,* or *o*), and where the diphthong consists of two weak elements (*i, u*) the second of the two will have the stress.

In its chief grammatical usages Spanish accords with French, Portuguese, Italian, and the other Romance languages. A decided peculiarity is the use of the preposition *á,* 'to,' before the direct object of a verb, when that object represents a person, e.g. *veo á mi amigo,* 'I see my friend.' Like Portuguese, Spanish has two verbs 'to have' (*tener* and *haber,* the latter used as an auxiliary in conjugation) and two verbs 'to be' (*estar* and *ser*), and in each case the functions of the verbs are distinct. With *estar* and the gerund of a principal verb there may be formed a very useful periphrastic conjugation corresponding to the English progressive form, thus, *Juan está estudiando,* 'John is studying.' Instead of the four conjugations of Latin there are but three in Spanish; furthermore, regular verbs of the Spanish second conjugation and the Spanish third conjugation differ in only four forms, viz. the present infinitive, the first and second persons plural of the present indicative, and the second plural of the imperative. There are certain radical-changing verbs which, though perfectly regular as to their endings, change their root vowels *e* and *o* under the accent, and in some cases where they are not accented, to the diphthongs *ie* and *ue* respectively, or, going a stage farther, to the simple vowels *i* and *u.* The subjunctive mood persists with much more vigor than in most modern languages; besides the usual present and imperfect tenses, it has a second imperfect form (called also the conditional subjunctive), which is properly a descendant of the Latin pluperfect indicative, and upon occasion may still be used as an indicative pluperfect or aorist in Spanish, and also a future tense. Auxiliaries are used to form the compound tenses, as in the sister Romance tongues, but, contrary to the custom in French and Italian, it is 'to have' (*haber*) and not 'to be' that forms the perfect tenses of reflexive verbs, thus, *se ha lisonjeado,* 'he has flattered himself.' The neuter gender survives in the case of the singular of the definite article *lo,* of the demonstrative words, *esto, eso, aquello,* and of the objective pronoun of the third person *lo.* These neuter forms occur only in indefinite and general constructions, and then the neuter article, always accompanied by an adjective (or an adverb), forms abstract expressions, thus, *lo bueno,* 'the good' = 'goodness.'

Latin, of course, forms the basis of the Spanish vocabulary, but there is an admixture of words from other sources. There are doubtful traces of words from pre-Romance languages, such as Iberian and Celtic and the speech of the Punic invaders and colonists. Despite trading relations, no permanent acquisitions seem to have been made from Greek until after the Roman conquest. The Visigothic invasion brought a few Germanic words, and that of the Arabs brought in a host of Oriental words, many of which are easily detected by the prefixed Arabic article *al.* In the eleventh century many lexical elements came from beyond the Pyrenees with the entrance of French soldiers, ecclesiastics, and colonists, and an infusion of Italian elements was occasioned by Aragonese domination in Italy and by the great vogue of Italian poetry in the Spanish Peninsula during the fifteenth and sixteenth centuries. Colonial relations have led to the introduction of a few terms from Indian and other sources; and learned influences have constantly increased the stock of borrowings from Latin, Greek, and French.

Traces of written Spanish are found in Latin deeds and grants as early as the eighth century, but the first really important Spanish document is one of the eleventh century, containing a series of glosses, and literature in Spanish does not begin until the twelfth century, in so far as the extant documents are concerned.

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SPANISH LAW. The most widely extended branch of the civil law (q.v.). Even if Portuguese law, which is an offshoot of mediæval Spanish law, be left out of the reckoning, Spanish law prevails to-day over a wider area and governs a larger population than any other system except the English. Spanish law, in its Castilian form, was introduced into all the Spanish colonies. In Mexico, in Central America, and in all of the South American States, except Brazil (which is governed by Portuguese law), the law of Castile still forms the historical basis of the legal order. Modern Spanish law, as codified in the later decades of the nineteenth century, obtains in Cuba, in Porto Rico, and in the Philippines.

HISTORY. (1) *Pre-Roman and Roman Periods.*—in mediæval Spanish law, some legal historians find traces of Iberian, Celtic, and Phœnician customs; but for all practical purposes the history of Spanish law begins with the conquest and civilization of the peninsula by the Romans. Until the fifth century of the Christian Era the rule of the Roman law was as complete in Spain as in any other province of the Roman Empire. The laws of Malaga and Salpensa, preserved in inscriptions dating from A.D. 82 or 83, are among the most valuable sources of our knowledge of Roman municipal law.

(2) *Visigothic Period.*—A new and important element was introduced in the fifth century by the German conquest of the peninsula. In the Visigothic kingdom, which existed until 711, the conquered Roman population retained, for nearly two centuries, their own law in matters that concerned themselves only. A special compilation of Roman law, the so-called Breviary of Alaric (q.v.), was drawn up for their use, A.D. 506. From the name of the royal official who attested the copies of this compilation, it is generally described in Spanish legal literature as the Breviary of Anianus. The Visigothic conquerors, however, lived by their own customs and laws; and to these, in case of conflict, the Roman law gave way. Their law also was put in written form. The so-called Lex Antiqua Visigothorum (palimpsest in the Bibliothèque Nationale, Paris) is ascribed by some authorities to King Euric (A.D. 466-c. 485), by others to King Leovigild or to King Reccared, a century later. The written law of the Visigoths was developed from reign to reign, with an increasing infusion of Roman law, civil and ecclesiastical. The assemblies which approved these laws were practically Church councils; they consisted wholly or chiefly of prelates. About the middle of the seventh century the Breviary of Alaric was deprived of legal authority, and the Romanized Lex Visigothorum became the general law of the peninsula. The form in which this code has come down to us is practically that which it received in the reign of King Reccessuinth (649-672). In the eighth and following centuries the Visigothic code was frequently described as the Liber Judicum, or Forum Judicum, or (in the vernacular) Fuero Juzgo. To the Visigothic period belongs a Spanish collection of council decrees and Papal decretals, the so-called Hispana, which was much used in Western Europe and became one of the most important sources of the canon law (q.v.).

(3) *Mediæval Period.*—The Moorish conquest and occupation of the peninsula (A.D. 711-1492) left few permanent traces upon Spanish law. The Christians who lived under Mohammedan rule retained not only their religion, but, in matters concerning themselves alone, their laws also. This was the case even with the so-called 'Mozarabs' who accepted the speech of the conquerors, as is shown by the existence of an Arabic translation of the Hispana and by Arabic notes on the Visigothic code. As the peninsula was gradually reconquered and the Christian States of Northern Spain, the Moors who remained enjoyed similar privileges; but the general expulsion of the 'Moriscos' (A.D. 1609-14) left Catholic Christianity and Gothic-Roman law in complete dominion. In Christian Spain, however, as in other parts of Europe, the development of the law during the Middle Ages was particularistic. The Visigothic code remained, in theory, applicable, but its rules were superseded by local, provincial, and class customs and laws (fueros, q.v.). The Spanish cities obtained charters of self-government (cartas pueblas) and developed independent city laws earlier than in the cities in the rest of Europe. The earliest town law that has come down to us is that of Leon (1020). At the close of the fourteenth century there was scarcely a town of any consequence that had not its own fuero. In the open country, the tenants and serfs of the Crown, of the Church, and of the nobles lived by different manorial customs. The earliest fueros of provinces or kingdoms represented the legal customs of the nobles; one of the most interesting of these is the Fuero Viejo of Castile (1212). In the thirteenth century attempts were first made to combine the general rules of provincial and town law in 'general fueros' of the various kingdoms, issued by the kings with the approval of the estates. Such were the Fuero Real (1255) and the Ordeniamento de Alcalá (1348) in Castile; the Fuero de Huesca (1247) and the Observancias (1437) in Aragon; and the Fueros Generales of Navarre (1237) and of Valencia (1239). The revival of the study of the law-books of Justinian in the twelfth and following centuries resulted in Spain, as elsewhere, in more or less 'reception' of Roman Imperial law. (See CIVIL LAW.) In Catalonia, in Valencia, and in Navarre the law-books of Justinian, as interpreted by the Italian commentators and taught in the Italian and Spanish universities, were received as subsidiary 'common law.' In Aragon and in Castile they were not so received, in bulk; but in Aragon the new jurisprudence influenced legislation, and in Castile it produced an essentially Roman code, the celebrated Siete Partidas. In its first form (so-called Spéculo or Setenario) this code dates from c.1260, but it did not obtain legal force until 1348. It was to be applied only when the general laws of Castile and the special fueros still in force furnished no rule; but in practice, through the influence exercised upon the courts by the doctrines of the universities, the Partidas to some extent supplanted the purely Spanish sources.

(4) *Modern Period.*—The union of Castile and Aragon (1479), the conquest of Granada (1492), and the annexation of Navarre (1512) established the modern Kingdom of Spain. In the new Spain, however, the provinces that had been

separate kingdoms retained a considerable degree of autonomy. Each of them kept its separate parliament (Cortes) and in each of them the law was developed by provincial legislation. In each of them compilations of the laws were made from time to time. In Castile the most important legislative products were the Ordinanzas Reales (1485), the Leyes de Toro (1505), the Nueva Recopilación (1567), and the Novísima Recopilación (1805-7). After the parliaments had ceased to play an important part some of the new laws promulgated by the kings were made applicable to all Spain, but no serious efforts to establish a common national law of marriage, it does not derogate from the penal code was adopted in 1822; another in 1848; another, which is still in force, in 1870. The existing code of criminal procedure dates from 1882. A code of civil procedure was promulgated in 1855 and revised in 1881. In 1885 a commercial code was adopted. The attempts to unify the civil law encountered obstinate resistance, because of the attachment of the provinces to their ancient fueros. The law of real property was transformed, early in the century, by the abolition of feudal tenures and of entails, and an important law requiring the registration of conveyances, mortgages, etc., was adopted in 1861 (revised in 1871). Civil marriage was introduced in 1870. In 1888 a general civil code was adopted (revised in 1889), but this code has not given Spain a common law, for, except as regards the law of marriage, it does not derogate from the laws previously in force in Navarre, Aragon, Catalonia and the Balearic Isles; i.e. it has, in these provinces, only subsidiary force. In Catalonia the Roman law, civil and canon, is still subsidiary law. In the rest of the peninsula, however, the code of 1888-89 has replaced the older laws.

Spanish Colonies. From the early part of the sixteenth century many laws were issued concerning the colonies. The earliest compilation of these laws was made in Mexico, in 1563, by Vasco de Puga. In 1570 was published, in Spain, a collection of Orders in Council affecting the colonies, and a fuller collection was made early in the seventeenth century. In 1680 a code of colonial laws was published—Recopilación de las leyes de las Indias. (This was repeatedly revised, the last edition dating from 1841.) This code dealt chiefly with administrative matters, to some extent with crimes and penalties, hardly at all with private law. In matters not covered by special colonial legislation the laws of Castile had been applied from the beginning, and this practice was expressly sanctioned in the Laws of the Indes, II., i., 2 and II., xv., 66.. In the early part of the nineteenth century (1810-26) all the Spanish colonies of Central and South America achieved their independence. These republics have adopted codes of their own. The earliest Spanish American civil code was that of Bolivia (1831). The most important is that of Chile, which has served as a model for several other Central and South American codes. All these codes, like the Spanish code of 1888-89, show the influence of the Code Napoléon. (See Code.) In Cuba, Porto Rico, and the Philippines the Spanish codes of the nineteenth century are still in force.

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SPANISH LITERATURE (called also Castilian literature, since the dialect of Castile is the dominant and literary speech of Spain). Literature in the Spanish tongue began only when the process of reconquest restored to the Christian Spaniards a considerable portion of their ancestral domain. This first literature was epic song reflecting the warlike spirit of an heroic age. Very little of the Old Spanish epic poetry has been preserved to us in anything like its original form. The only considerable remains are some poems on the Cid, of which one, the *Poema del Cid*, is the oldest extant monument of Spanish literature, some fragments of a poem or of poems on the Infantes of Lara, and a learned poem on Fernán González. But allusions and records in the Chronicles and elsewhere lead us to believe that there once existed epics now lost. It was the *juglares* or minstrels who popularized and developed Spanish epic tradition, according to the theory of Gaston Paris, at first singing only the heroes celebrated by the French *jongleurs*. It was quite natural that the French tales dealing with Charlemagne's wars against the Spanish Arabs should most impress the Spaniards; and it was equally natural that the Spanish *juglares* should seek to make native heroism play some part in the conflicts with the Moors. This they did by inventing the figure of Bernardo del Carpio to supplant the French hero Roland. The traditions concerning Bernardo are preserved for us only in the prose accounts of the Chronicles, especially the *Crónica general* of Alfonso the Wise; but the Chronicles drew upon the poems of the *juglares* for the matter that they contain.

We come to a thoroughly domestic tradition in the story of Fernán González, Count of Castile (932-970), with whom began the actual though not the nominal independence of that region. An extended poetic account of his active life we owe to a monk of the monastery of San Pedro de Arlanza. This work was written in the second half of the thirteenth century, but we now possess it only in a late manuscript of the fifteenth century, which is incomplete. The *Crónica general*, however, affords us the substance of what must have been the second part of the poem. A purely Spanish tradition is found again in the tragic story of the seven Infantes of Lara (or

Salas), done to death through the perfidy of their uncle and aunt, and later avenged by their Moorish half brother, Mudarra. Here, also, the legend is preserved by the *Crónica general*, which has, in this case, absorbed many verses of the Old Spanish poems on the subject without wholly obliterating their rhyme and metre. By good fortune we still possess two of the Old Spanish poems dealing with the story of the doughtiest of all the native heroes, the Cid (q.v.), an historical personage of the eleventh century. The *Poema del Cid* has survived in but a single and incomplete manuscript of the fourteenth century, and, besides, its versification is in an exceedingly corrupt state. There are two main divisions (or *cantares*); the first begins with Rodrigo's exile from Castile, and ends with the conquest of Valencia and the marriage of his two daughters to the unhistorical Infantes of Carrión; in the second, the necessity of punishing the Infantes for their abuse and desertion of their spouses brings the Cid to the Court of Castile and affords an opportunity for completely reconciling him and his liege lord. The poem ends with a second marriage of the Cid's daughters, who, now wedding the princes of Barcelona and Navarre, make the Cid an ancestor of the later royal house of Spain. An imaginative account of the Cid's youth is found in the poem termed the *Crónica rimada*, a document of the thirteenth century relating particularly Rodrigo's slaying of Count Gormaz and the marriage of the youthful slayer to the Count's daughter, Ximena.

Much greater than the bulk of the heroic poetry preserved is that of Old Spanish religious, didactic, and narrative verse. The greater part of this verse is in the form of quatrains of alexandrines, with a single rhyme in the stanza (the so-called *cuaderna vía*). There is no knowledge of the existence of this learned poetry before the thirteenth century, but in the first half of that period it is found fully developed in a mystery play, in translations from the French or Provençal, and in poems. The mystery play, which is incomplete, is *El misterio de los reyes magos*. It is an outgrowth of the liturgical dramas or offices of the Church. No other important remains of the early Spanish drama have been discovered. Of the matter composed in *cuaderna vía* a large proportion is due to the cleric Gonzalo de Berceo, who is the first Spanish poet that we know by name. He flourished in the first half of the thirteenth century. Most of his productions deal with religious subjects. There is now attributed to him furthermore a long poem dealing with profane matter, the *Libro de Alexandre*, which relates in some 2500 stanzas the life of Alexander the Great.

With the end of the thirteenth and the beginning of the the fourteenth century the use of the *cuaderna vía* began to yield to prose in didactic composition. Contemporary with this change appeared the first true poet in Spanish literature, Juan Ruiz, who is known as the Archpriest of Hita. He belonged to the reign of Alfonso XI. (1312-50), and he was imprisoned by his superiors because of his evil life; but, like the French poet Villon, he sang with the true note of passion. In his *Cantares* (called by him *El libro de buen amor*) he recounts his erotic adventures, interspersing here and there many fables, descriptions of his disputes with Love (Don Amor), an account of a lesson which Venus, wife of Don Amor, gave him, etc.

Spanish prose, at first clumsy and labored, earliest appeared in law codes and official documents. The first use of Spanish prose for chronicle purposes is seen in the two *Anales Toledanos* put together before 1250. Between 1217 and 1223 were written certain genealogies and translations from Latin chroniclers were made in following years. Under the direction of Saint Ferdinand was begun the encyclopædic *Septenario*, which his son, Alfonso, completed, and there was planned a codification of Castilian laws. The prose thus formed, employed largely for didactic and historical works, was applied to fiction in the framework tales of Juan Manuel. Alfonso X., the Wise, wrote, or had written under his direction, many works dealing with the science of the time. Great value attaches to the so-called *Crónica general*, in which, availing himself of earlier Latin chronicles, he dealt with the history of his land from the earliest times down to the period of his own accession.

Moralizing works and collections of sententious sayings drawn from Arabic sources or written in imitation of them became rife both in Alfonso's time and in the ensuing period. One of the Arabic moral anthologies thus introduced into Spanish was the very popular *Bocados de oro*, which lived on in the poetical aphorisms of Sem Tob and Santillana.

Sancho IV. (1284-95), the successor of Alfonso X., inherited his father's love for letters, and by his direction there were prepared translations from Latin, French, and Provençal. The interesting translation, the *Gran conquista de Ultramar*, dealing with the Crusades, preserves the substance of French literary monuments now lost. This and other translations show a broadening interest in foreign literature, further exemplified in an early fourteenth-century version of the prose *Tristan*. To the first half of the same century may be ascribed the first independent example of Spanish prose fiction, the *Caballero Cifar*, and possibly also the *Amadis*, for the chivalrous romance seems already to be beginning its long period of popular favor.

Literature was not especially favored by Sancho's immediate successor, but a monarch of intellectual force appeared again in Alfonso XI. The most important of the works which were prepared under his direction was a series of chronicles that should close the gap between his own time and the period with which the *Crónica general* of Alfonso X. ended, a work which formed the basis of the *Poema de Alfonso XI*. Don Juan Manuel (1282-1345), a nephew of Alfonso X., played a more direct part in the development of letters at this time, being, like his uncle, one of the greatest prose writers in early Spanish literature. The most interesting and important of his many treatises is the famous framework of tales called the *Conde Lucanor* or *Libro de Patronio*, in which Count Lucanor, seeking advice from his tutor, Patronio, is answered by the latter with moralizing tales conveying the necessary counsel. The contents of the fifty-one tales comprise historical or pseudo-historical elements relating to Spain, matters of personal experience, Arabic traditions, besides elements drawn from Phædrus, the *Calila et Dimna*, the Barlaam story, and above all the general European stock of stories; and all are told in an original and unpretentious style.

With the middle of the fourteenth century, an artificial form of the lyric continuing the tradition of the Troubadour poetry of Galicia, and called Court poetry—because it was mainly cultivated by versifiers attached to the royal Court—began to take the place of importance formerly occupied by epic, religious, and didactic verse. There was a transition period of some duration, however, so that the greatest development of the Provençalized lyric did not come until the reign of John II. (1407-54), and then there flourished by its side a humanistic literature bearing the impress of the Renaissance movement and an allegorical poetry that derived from the works of Dante and other Italian poets. As time went on, the Provençal Galician Court poetry passed out of vogue and the lyric measures of Italy became predominant everywhere throughout Spain. Spanish prose, already given considerable flexibility by Alfonso the Wise and Juan Manuel, becomes in the second half of the fourteenth century the medium of translation from the classics of antiquity, and, even more than the verse of this time, teems with Latinisms. Much more attractive than the verse already mentioned is the epic ballad, which was much cultivated during the period preceding the Golden Age (1550-1700) of Spanish literature; here and there may be found examples of a charming popular lyric.

Pedro Lopez de Ayala (1332-1407), who held important offices at the courts of King Pedro the Cruel and of Henry of Trastamare, was one of the last writers of his time to make any large use of the *cuaderna vía*. This form prevails in his satirical and didactic *Rimado de palacio*, in which he assails the social, political, and other abuses of his time. In the second part of the poem, he inserts, here and there, plaints, laments, and songs to the Virgin, which are lyric in their nature and are composed in various measures. These mark Ayala as one of the earliest of the Court poets who imported into Castilian that form of the lyric which, following Provençal rules, had long been cultivated in Galician. During the reign of Pedro the Cruel the Rabbi Santo of Carrión (Sem Tob) prepared his *Proverbios morales*. This collection constitutes one of the most important Hebrew contributions to Spanish literature, and it introduces a *genre* which is later to be attempted by such writers as Santillana and Pérez de Guzmán. Seriousness of purpose, lacking in the Court poetry, is present in the Dantesque allegory and vision introduced into Spain, soon after 1400, by Imperial, a native of Seville, but of Genoese origin. The serious moralizing tendency is also visible in the *Doctrina* of Pedro de Veragua and especially in the noted *Danza de la muerte* (Dance of Death), which seems to be the work of the middle of the fifteenth century. The highest point reached by culture in the reign of John II. is seen in the literary works of Santillana, of Fernán Pérez de Guzmán, of Mena, and of Rodríguez del Padrón. To Fernán Pérez we owe the *Claros varones de España* (a panegyric in verse), versified *Proverbios*, and allegorical and lyrical poems, besides historical works in prose; Rodríguez has left us ballads and a little verse in the conventional Court manner, besides a prose tale. Iñigo López de Mendoza, Marquis of Santillana (1398-1458), is probably the most impressive literary figure of the fifteenth century. He was one of the first to imitate Horace in Spain, he imported the sonnet from Italy, and he furthered the influence of Dante by copying the latter's allegorical methods in his *Comedieta de Ponza*, his *Coronación de Mossén Jordi*, and his *Infierno de enamorados*. In certain other poems he displays a didactic and a satirical bent, as in his *Proverbios*, his *Diálogo de Bias contra Fortuna*, and his *Doctrinal de privados*. The most interesting and certainly the most entertaining element of his poetical work is that represented by his love songs, such as the *serranillas*. In prose he himself prepared a *Carta al Condestable de Portugal*, in which he appears as the first true historian of Spanish literature. The influence of Dante, as well as that of Lucan, is obvious in the allegorical *Laberinto* (also called the *Trecientas*, from the original number of its stanzas) of Juan de Mena (1411-56), and to him are due likewise a poetical eulogy of Santillana, entitled *La coronación*, and the moralizing *Coplas de los siete pecados mortales*. Of other noteworthy poets of this time there can be mentioned here only Gómez Manrique (died 1491) and Jorge Manrique (died 1479); the latter is remembered for his noble *Coplas* on the death of his father.

During the reign of Henry IV. (1454-74) there appeared no slight amount of political satire, the chief instance being among the *Coplas de Mingo Revulgo*. Of ballads (*romances*) Spain has been exceedingly productive; in broadsheets or in collections (*romanceros*), there were published during the final years of the fifteenth century, and during the sixteenth century, a very large number dealing with subjects drawn from the real or legendary history of Spain and of France, etc., as well as with subjects chivalrous and erotic.

In Spanish prose of the fifteenth century, the humanistic work already begun in Italy was zealously carried on. There was much translation of the classics of antiquity and of the modern Latin writings of Boccaccio and others. Ecclesiastical Latin authors also received some share of attention, and works were introduced from the French, Catalan, and Italian; those of Boccaccio being particularly popular for translation purposes. The influence of all these translations—and especially those from Plutarch, Livy, and Valerius Maximus—manifested itself in the development given to the writing of history. López de Ayala continued the official chronicle of the realm (*Crónicas de los reyes de Castilla*); García de Santa María, Fernán Pérez de Guzmán, and Diego de Valera (1412-86) worked upon the *Crónica del rey Juan II.*; the last named writer and Enríquez del Castillo dealt with the reign of Henry IV. in the *Memorial de diversas hazañas;* and Fernando del Pulgar and Andrés Bernáldez prepared the account of the reign of Isabel I. There also appeared a multitude of chronicles dealing with the lives of individual personages. No little interest attaches to the *Crónica Sarracena* of Pedro de Corral, which gives the whole legendary history of Roderick the Goth.

In French stories of a pseudo-historical nature the Spaniards had very early begun to take a serious interest; and these stories, particularly those treating the *matière de Bretagne*, were to play an important part in connection with the development of prose fiction in Spain. The Court poetry of the reign of John II. (first half of the fifteenth century) is full of references to Arthur and his knights of the Round Table, to Merlin, and to the Quest of the Holy Grail. Charlemagne and Roland are still named along with the heroes of the Round Table, but they obviously have no longer the same living interest.

With the *Caballero Cifar,* of the first half of the fourteenth century, we have the first independent work of fiction in Spain, and this was followed perhaps a generation later by one of the most famous of all modern romances, the *Amadis de Gaula.* (See AMADIS OF GAUL.) This important Spanish work may lay claim to no small amount of originality; it accepts the elements at the basis of the French courtly romance, but it develops them in its own way, for, though retaining the traditional service of woman and quest of adventure, it stresses the virtuous qualities of the hero no less than his courtliness, something that the French romances had not done. In the form in which we possess it, the *Amadis* is due to García Ordoñez de Montalvo, who completed his redaction of it between 1492 and 1504. By him we are told that he had simply rid its first three books of the errors and imperfections introduced into it by earlier redactors and by scribes, that he borrowed and improved the fourth book, and that he himself added the whole fifth book, the *Sergas de Esplandian* (or Exploits of Esplanadian), in which he deals with the history of the son of the hero, Amadis. The *Amadis* was the forerunner of many similar romances which enjoyed enormous vogue in the sixteenth century.

In imitation of Boccaccio's *Fiammetta,* which had been translated about the middle of the fifteenth century, the tale was now attempted in Spain; noteworthy instances are Rodriguez del Padrón's *Siervo libre de amor* and *El cárcel de amor* of Diego de San Pedro. Novelistic and didactic in its manner is the *Trabajos de Hércules* of Enrique de Villena (1384-1434). One of the most original and entertaining works of the whole period appeared in 1438; this is a satire on womankind by Alfonso Martínez de Toledo, chaplain to John II. and archpriest of Talavera, entitled *De los vicios de las malas mujeres,* but also called the *Corbacho.* Of decided interest for the study of folk-lore are the Hebrew-Spanish and the *aljama* documents, in which the Jews and the Moors, writing in Spanish, but using their Hebrew and Arabic characters, created a rather considerable literature of their own. Many of the documents in question belong to the fifteenth century, and especially the most important of them all, the *Poema de José,* which gives a Mohammedan version of the story of Joseph.

The sixteenth century ushers in the classic age of Spanish letters, that period which extends into the second half of the seventeenth century and is generally known as the Golden Age. The influence of Italy and the Renaissance, which had been so strong during the preceding century, persists, but, contrary to what happened in other European lands, it does not tend to bring about any dissolution of continuity as between the old and the new. The ancient Church remains unaffected and the humanistic paganism of the Renaissance gets no foothold in Spain. In lyric verse Italian forms prevail, but the subject matter is only partially affected by influences from without. A realistic movement, marked by a strict application of keen powers of observation, guides the development of the novel, which is perfected by Cervantes in the reign of Philip II. The ballad continues to be a favorite form and it contributes to the rise of the drama. The drama, giving fullest expression to the national and religious ideals of the Spaniard, constitutes the greatest glory of the Golden Age.

Already, in the fifteenth century, Santillana had imitated the structure of the Italian sonnet, but in this innovation he had had no followers; it remained for the Catalonian Boscán (c.1493-c.1542) to establish Italian verse methods in Castilian. A better poet than Boscán is his friend and companion in the work of innovation, Garcilaso de la Vega (1503-36). Petrarch is the chief model of the lyric poet, but so far as content is concerned, the love lyric of Petrarch did not differ very materially from that already cultivated by the Spaniard; the real innovation was a formal one. Moreover, the older Castilian measures were not cast aside; even those who favored most warmly the use of the imported forms continued to employ the domestic forms. A third leading representative of the movement was Diego Hurtado de Mendoza (1503-75); elements of refinement still lacking in the art of the three poets mentioned were added by writers such as Fernando de Acuña (c.1500-80), Gutierre de Cetina (c.1520-60), and the Portuguese Gregoria Silvestre (1520-70). In the second half of the sixteenth century the followers of Garcilaso formed two main groups, the school of Seville and the coterie at Salamanca; minor groups were those at Grenada and in Valencia and Aragon. The head of the school at Seville was Fernando de Herrera (1534-97), who is noted both for the purity of his style and the richness of his diction, best exhibited, perhaps, in his hymns on the battle of Lepanto and on the tragic fate of the Portuguese King, Dom Sebastian. The most important member of the Salamancan group was the charming poet Luis de León (1527-91), whose religious and mystic strains have never ceased to please. Allied to him in spirit are the other mystic poets San Juan de la Cruz (1542-91) and Malón de Chaide. The religious lyric may be seen at its best in the *Romancero espiritual* of Valdivielso (died 1636) and in the *Rimas sacras* of Lope de Vega; its vogue began to decrease when that of the conceptism of Ledesma and his fellows began to grow. An overstressing of the importance of the formal side of things and an undue straining of the means necessary to the attainment of perfection of style led, in the early years of the seventeenth century, to the adoption of the kind of lyric mannerism which is known in Spain as *culteranismo,* and which is paralleled by the Marinism of Italy, by the Euphuism of England, and by the préciosité of France. Luis de Góngora (1561-1627) was the founder of this artificial style, which is therefore often called Gongorism. Its characteristics of bombast, obscurity, and general extravagance are fully exhibited in the so-called *Soledades* of Góngora. Even contemporaries of so high an order of talent as Lope de Vega and Francisco Gómez de Quevedo (1580-1645), who at first opposed the Gongoristic movement, later adopted many of its methods. As a poet, Quevedo was most successful in his satires, which are full of the spirit of Juvenal. The lyric poets of the seventeenth century were legion: Mira de Amescua, Estéban Manuel de Villegas (1596-1669), Jacinto Polo de Medina, Francisco de Borja, Príncipe de Esquilache (1581-1658), and the dramatist Calderon were but a few of them. With the facilities now provided by the printing press, it became possible to make extensive collections of the ballads (*romances*), which, previous to the end of the fifteenth century, seem to have survived only through oral tradition.

There appeared during the *siglo de oro* more than two hundred poems belonging to the category of the artificial epic. Of these the most important deal with subjects appertaining to the national history; many treat religious matters, and many others are of the class of the chivalrous epic. They are mainly written in octaves, only occasionally in blank verse (*versos sueltos*). Chief among the epics of an historical character is the *Araucana* of Alfonso de Ercilla (1533-94), written by a soldier who here gives the results of his experience in the wars of the Spaniards with the Araucanian Indians. The historical value is still of a high degree in the *Elegías de varones ilustres de las Indias* (first part printed 1589) of Juan de Castellanos, and the *Argentina* of Centenera. The imagination plays a larger part than the historical fact in the *Austríada* of Juan Rufo (1547-c.1600). In the period of greatest dramatic productivity the historical epic gradually wanes in importance; the *Nápoles recuperada* of Francisco de Borja (1651) is one of the last. A place apart is occupied by the *Amantes de Teruel* (1616) of Salas, which the author pretended to be an historical account of the tragic fate of the famous lovers. The Vergilian epic was made known to many by the *Eneida* of Hernández de Velasco (1557); after the appearance of Boscán's *Fábula de Leandro y Hero*, mythological episodes from classic antiquity were made the theme of poems by Hurtado de Mendoza, Lope de Vega, Montemayor, Góngora, etc. The Italian epic of the *Cinquecento* was transplanted to Spain, and was made the subject, not only of verse translations, but also of amplifications and continuations, some of these latter dealing with Spanish history or legend. A religious epic deserving of note is Azevedo's *Creación del mundo* (1615), being remarkable in that, imitating the *Semaine* of Dubartas, it shows a resumption of literary relations with France. The mock heroic of Greece and Italy finds an echo in Juan de la Cueva's *Batalla de ranas y ratones*, Villaviciosa's *Mosquea* (1615), and Lope de Vega's *Gatomaquía*.

The tendency to fill Spanish prose with Latinisms, so strong in the preceding period, now yields to a feeling which finds a native dignity in the mother tongue. Juan de Valdés, in his *Diálogo de la lengua* (c.1535), initiated the scientific study of the grammatical and stylistic peculiarities of Castilian. Comparative perfection of form is attained in Mariana's *Historia de España* (1601, etc.), the first thoroughly good account of Castilian history based on the study of documents. In his *Agudeza y arte de ingenio*, Baltasar Gracián (c.1601-58) gave the lawbook of that system of literary mannerisms termed conceptism; he also got the attention of contemporaries and posterity by his aphoristic and sententious sayings of various kinds. Religious literature of a mystic and ascetic nature must occupy an important place in the annals of the time; it is best represented by the writings of Luis de León, San Juan de la Cruz (Saint John of the Cross), Malón de Chaide, Luis de Granada, and Santa Teresa de Jesús (Saint Theresa, 1505-82).

Preceding the period of activity of Cervantes, we have the continuation of the chivalric novel; the pastoral novel; the narrative form as exhibited in the *Celestina;* and the earliest of the picaresque novels. Of the posterity of the *Amadis*, the unsurpassable type of the romance of chivalry, are a number of continuations dealing with the adventures of Florisando, Lisuarte of Greece, Perión of Wales, Amadis of Greece, and similar heroes. Hardly less a favorite than the *Amadis* was an imitation of it entitled *Palmerín de Oliva* (1511), which in its turn was made the subject of other continuations and imitations. The books of chivalry prepared the way for the pastoral romance, introduced into Spanish by Jorge de Montemayor (c.1515-61), who founded his *Diana* on the *Arcadia* of the Italian Sannazaro. For contemporaries a good deal of the interest in the *Diana* and its kindred depended upon the personal allusions conveyed by the characters and in the dialogue. The *Tragicomedia de Calisto y Melibea* (later termed the *Celestina*) was published at Burgos in 1499, and appeared in an amplified form at Salamanca in 1500. Although it is called a tragicomedy, it cannot in its present form have ever been capable of scenic representation, and it is certainly more a novel than a play. On account of its spirited action and of the development which the *Celestina* gave to the handling of dialogue and the delineation of character, it exerted an influence upon later dramatists and novelists both. It soon provoked continuations and imitations, and a connection may even be traced out between it and the *Dorotea* of Lope de Vega. The realistic tendencies evinced in the *Celestina* are equally pronounced in the first of the picaresque novels, the anonymous *Lazarillo de Tormes* (1554), long ascribed to Diego Hurtado de Mendoza. In this novel we follow the career of a rogue (*pícaro*), who, beginning as the guide (*lazarillo*) of a blind beggar, deceives him, and, passing into the service of other personages representing various ranks of life, shows himself no less ready to beguile them. There is no attempt at palliation of the truth; it is a picture of the bald and iniquitous fact that is presented to us in the *Lazarillo* and its successors.

Realistic fiction of the *siglo de oro* culminates in the magnificent *Don Quijote* of Miguel Cervantes de Saavedra (1547-1616), a novel in which the matter-of-fact philosophy of Sancho Panza stands in sharp contrast with the grotesque idealism of his master. It is not improbable that Cervantes wrote the book in order to destroy the vogue of the chivalrous romances, although it may be urged that their popularity was already on the wane and that at the most he simply gave them the *coup de grâce*. *Don Quijote* (usually *Don Quixote* in English) has become one of the world's imperishable books. The first part of it was published in 1605; the second part was hurriedly prepared for the press in 1615. in order to baffle the designs of a certain Avellaneda. who had published a spurious sequel to the novel in 1614. Cervantes had much less success in another novel, the *Persiles y Sigismunda* (published posthumously), but that he could handle the shorter tale with skill is proved by his *Novelas ejemplares.* Among those who cultivated the tale after the time of Cervantes were Lope de Vega, Tirso de Molina (in his *Cigarrales de Toledo,* 1621), Montalban (*Para todos,* 1632), María de Zayas, Solórzano, Salas Barbadillo, and Luis Velez de Guevara (with his famous *Diablo cojuelo,* 1641, the source of Lesage's *Diable boiteux*). Quevedo (1580-1645) was the foremost of the prose satirists of the age; in his witty and sarcastic *Sueños, cartas del caballero de la tenaza,* etc., he cries out against abuses with which bitter personal experience had made him acquainted.

As a literary form the drama had been practically unrepresented since the end of the twelfth century; but now, at the end of the fifteenth century, it was to revive and receive an unsurpassed development. Juan del Encina (c.1468-1534) begins the new order. Encina spent some years in Italy; hence an Italian influence on his work is not improbable. The comic elements in some of the pieces may show an influence of the French *farce.* Disciples of Encina were Lucas Fernández, who employs the terms '*farsa*' and '*comedia*'; the Portuguese Gil Vicente; and Torres Naharro, whose art shows considerable progress over that of the master. In his plays we meet for the first time with a division into acts. The pieces of the foregoing authors were intended for the refined audiences of the Court; those of Diego Sánchez (c.1530-47) seem to have been meant for performance amid more popular surroundings. Italian influence is unmistakable in the *comedias* of Lope de Rueda, an actor (c.1540-66), famed for his short and witty *pasos* or *entremeses.* The Latin tragedy is obviously imitated in the first really important Spanish tragedy, the *Numancia* of Cervantes. Avendaño in 1533 first adopts the division into three acts instead of five. Juan de la Cueva (1550-1607), the first Spanish dramatist to deal with incidents taken from the national history, adopted a division into four acts.

But by common consent there is awarded to Lope de Vega (1562-1635) and to his younger compeer Pedro Calderon de la Barca (1600-81) supremacy among the many gifted dramatic authors. Inventive beyond conception and amazingly prolific in production, Lope is known to have composed over 1500 plays, irrespective of a number of *autos* (one-act plays of a religious and allegorical nature), *loas* (preludes), and *entremeses* (interludes); of these pieces about 500 are still extant. The number of enduring masterpieces among his pieces is remarkably large, especially in the case of his historical dramas, such as *El mejor alcalde el rey* and *Los Tellos de Meneses*; and we even still find hardly less interesting and powerful than they such a play as the *Estrella de Sevilla* and not a few of his *comedias de capa y espada* or plays dealing with every-day life. Lope's disciples included Mira de Amescua (c.1578-1641), Luis Vélez de Guevara (1570-1644), Montalbán, and Ruiz de Alarcón (died 1639). Alarcón wrote the comedy *La verdad sospechosa,* the model of Corneille's *Menteur.* In talent, Lope was most nearly approached by the cleric Gabriel Téllez (1570-1648; known also by the pseudonym Tirso de Molina).

After Lope's death Calderon reigned on the stage. Though less inventive, Calderon paid more attention to details of form, simplifying somewhat the multitudinous metrical forms in use in the drama. In philosophic insight he was inferior to Lope, yet in *La vida es sueño* ("Life is a Dream") he cannot really be deemed unsuccessful in his endeavor to give dramatic reality to one of the most transcendental of ideas. He first gave great importance on the boards to the *pundonor* (the point of honor) as an actuating impulse of the Spaniard's life, and he gave its greatest development to the stock figure of the *gracioso* or clown. He devoted no little attention to the type of religious play called the *auto sacramental.* Of his followers, two were men of distinguished talents: Francisco de Rojas Zorrilla (1607-c.1660), who produced the excellent play, *Del rey abajo ninguno,* and Agustín Moreto (c.1618-1669), to whom we owe *El desdén con el desdén.*

Swift and deep was the decline in Spanish letters that followed the *siglo de oro,* and it went hand in hand with a decay in things national and political, which the advent to the throne of the French Bourbon house could do little to check. By the opening years of the eighteenth century Gongorism had thoroughly vitiated lyric verse, the novel had become unimportant, and the stage was controlled by dull or absurdly fantastic imitators of the older national drama. Not a single Spanish writer of the first order made his appearance during the first three decades of the eighteenth century, and during that period the only event of importance was the establishment in 1714 of the Spanish Academy (La Real Academia Española), whose Dictionary appeared in 1726-39. With the fourth decade came a new movement, the chief object of which was to chasten popular taste by the introduction of foreign æsthetic canons, particularly those of France. The impulse to the new movement was given by Ignacio de Luzán (1702-54), a man of great talent and greater culture, who set forth in his *Poética* (1737) the principles that ought to govern poetic production. Luzán preached that the various literary genres should not be intermingled and that the Spanish drama should be subjected to the French system of unities. The doctrines which he thus laid down were taken up and applied by his disciples Nassare (1689-1751), Montiano (1697-1765), the author of two tragedies, and by Luis José Velázquez (1722-72), in his *Orígenes de la poesía castellana* (1749). In his *Teatro crítico* (1726-29) and in his *Cartas eruditas y curiosas* (1742-60), Benito Feijóo (1676?-1764) first made known to a large part of the Spanish nation many of the scientific developments and discoveries of the age. José Francisco de Isla (1703-81), in his amusing though rather long-winded novel, *Historia del famoso predicador, Fray Gerundio de Campazas* (1758), ridiculed unmercifully the extravagance, ignorance, and pedantry that characterized most of the pulpit eloquence of his time. Isla is also famous for his attempt to appropriate to Spanish literature the *Gil Blas* of Lesage.

A party headed by García de la Huerta (1734-87) strove, but ineffectually, to curb the growing tendency to imitate French models. On the other hand, the followers of Luzán formed a strong school, known as the Salamancan school. The foremost member of this new school was Juan

Meléndez Valdés (1754-1817). His little volume of lyrics shows more true poetic sentiment than anything that had preceded them since the days of the masters of the sixteenth and seventeenth centuries. Of considerable merit were Iglesias (1748-91), best known for his *letrillas;* Cienfuegos (1764-1809), whose lyrics come nearest to those of Meléndez in the expression of genuine feeling; and Diego González (1733-94). It was in the drama that the imported French classicism was to have its real triumph. To be sure, one writer of more than average ability, Ramón de la Cruz (1731-c.95), still kept alive the traditions of the Spanish stage of the Golden Age in his humorous little plays called *sainetes*, but, on his side, Ramon de le Cruz stood alone. It was only natural that men of taste, like Nicolás Fernández Moratín (Moratín the Elder, 1737-80) and the dramatist statesman Jovellanos (1744-1811), should, in their love for moderation and order, seek to elevate the fallen stage by adopting for their own compositions the rigid principles of the French theatre. But neither of these became a favorite with the masses, and it remained for Leandro Fernández de Moratín (1760-1828), the son of Nicolás, to compose dramas governed by the French rules, that could captivate Spanish audiences. Moratín the Younger brings us over the threshold of the nineteenth century; still he belongs properly to the eighteenth century. An enthusiastic admirer of Molière, he both imitated and translated plays of that great dramatist. But Moratín was more than a mere imitator or translator; for his mastery of dialogue, his pure style and his faithful description of the manners of his time show in him a talent of the highest order. Although he carefully applied the French system of unities, he did not disdain certain elements of the home stage. Thus, he divided his plays into three acts instead of five, as the French and classic Latin rules would have exacted, he employed the popular *romance* verse in a number of pieces, and, above all, he made a skillful use of the element of intrigue that had been so prominent in the dramas of the Golden Age and has ever remained dear to the Spanish heart. It was this happy blending of the spirit of romantic intrigue with the cold precision of French rules that made his masterpiece, the *Sí de las niñas* (1806), obtain at once the popularity that it has never since lost, and constitute it the only masterpiece produced for the Spanish stage since the days of Lope and Calderon.

Spanish literature of the nineteenth century begins with the patriotic poets, Manuel José Quintana (1772-1857) and Juan Nicasio Gallego (1777-1853), whose lyrics voice the sentiments of a party sprung up to combat the French invader. Quintana was the Tyrtæus of the struggle against the Napoleonic arms, and he attained his greatest success in the heroic ode (*Al armamento de las provincias contra los Franceses* and *A España después de la revolución de Marzo, 1808*). His friend Gallego is also seen at his best in the burning patriotic lyric, and although the bulk of his verse is slight, he was a good literary artist. The classic influence still dominated Quintana and Gallego, and is no less clearly marked in the members of a poetical coterie which from its centre may conveniently be termed the School of Seville. The members of this school, of whom the chief were Manuel María de Arjona (1771-1820), José María Blanco (1775-1841, known in the history of English literature as Blanco White), Alberto Lista (1775-1848), and Félix José Reinoso (1772-1841), sought to reform the prevailing bad taste by setting up the authority of a respectable classic tradition. They contributed efficaciously to the restoration of a proper æsthetic sense in Spanish literary aims, and they also helped to improve the purely formal side of Spanish verse by developing rhyme and metre.

In the thirties of the nineteenth century the romantic movement began to appear in the Spanish Peninsula, somewhat belated, indeed, but none the less sweeping in its effects. Two elements contributed to the establishment of romanticism in Spain: (1) the influence of foreign literatures; and (2) the influence of the older national literature, and in particular of the drama of Lope and Calderon and of the *romances*. Even this latter influence did not make itself felt until foreigners had aroused Spain to a realization of the worth of her dramatists of the Golden Age and of her ballads. Many of the young writers of the early part of the nineteenth century had opposed the despotic administration of Ferdinand VII., had been obliged to flee the land, and, going to France and England, they had had some contact with the romantic movements of those countries. The romantic writers whom political considerations did not force to abandon their native region founded, about 1830, a club called the *Parnasillo*, which, as the Cénacle had done in France, was to herald the new ideas.

In the lyrics of Manuel de Cabanyes (1808-33; *Preludios de mi lira*, 1833) there is no tinge of romanticism; but a transition stage is visible in the writings of Martínez de la Rosa (1789-1862), in the main a man of classic tastes, yet who in two plays, the *Aben-Humeya* and the *Conjuración de Venecia* (1834), entered into the domain of romanticism. José de Lazza (1809-37) in his novel *El doncel de Don Enrique el Doliente*, and in his play *Macías*, showed similar romantic tendencies. The triumph of romanticism was insured by the performance in 1835 of the drama *Don Alvaro* of Angel de Saavedra (1791-1865), one of the writers whom Ferdinand's tyranny had compelled to seek a refuge in England and France. The romantic principles to which he gave effect in this work governed also the composition of his lyric *El faro de Malta*, and of his epic poem *El Moro expósito*, in the latter of which he revived the Old Spanish legend of the Infantes of Lara. In the person of José de Espronceda (1810-42), the author of the magnificent though fragmentary poem *El diablo mundo*, and of the *Estudiante de Salamanca*, there are represented both the romantic element of revolt against social and literary conventions, which in England is strongly marked in the person of Byron, and that element of Bohemianism which characterizes so many of the French romanticists. Lyric supremacy is disputed with Espronceda by José Zorrilla (1817-93), who is, however, more justly celebrated for his treatment of legendary material from the Spanish Middle Ages than for his purely lyric endeavors. In the *Don Juan Tenorio* he gives a modern version of the story at bottom of the *Burlador de Sevilla*, a drama of the Golden Age. The Cuban poetess Gertrudis Gómez de Avellaneda (1816-73), who spent most of her life in Spain and there became famous, had affiliations with the romantic school. Her lyrics owe no small amount of their inspiration to Chateaubriand, Lamartine, and Hugo; her novels reflect the methods of Dumas the Elder and George Sand. Sentimentalism appears in two well-known dramas, the *Trovador* of Antonio García Gutiérrez (1813-84), on which Verdi's opera is founded, and the *Amantes de Teruel* of Juan Eugenio Hartzenbusch (1806-80), a play which gave new life to an old Spanish story of true love that did not run smoothly.

The passing of the romantic movement becomes evident after the beginning of the fifth decade of the century. The fertile playwright Manuel Bretón de los Herreros (1796-1873) had temporary connections with it, but he gained his repute mainly as a writer of lively dramas of manners, although in his masterpiece, the comedy entitled *Escuela del matrimonio* (1852), he paved the way for the coming psychological drama of Ayala and Tamayo y Baus. Adelardo López de Ayala (1828-79) gives us, in his mercilessly sociological play *El tanto por ciento* (1861), a detailed analysis of the modern greed for wealth that has stifled the nobler instincts of man and made him capable of the basest treachery; and in his *Consuelo* (1878) he makes another powerful attack upon the positivism and the lack of idealism in our modern life. The psychological development is also obvious in the work of Manuel Tamayo y Baus (1829-98). In *Lo positivo* (1862) he treats the positivism of the modern world with no less severity than does Alaya, and in his chief play, *Un drama nuevo* (1867), he portrays the slowly growing and finally all-pervading power of marital jealousy.

The particular glory of the second half of the nineteenth century in Spain has been the rise and growth of a new novelistic literature. To the development of this a considerable impetus was given by the essay on manners, which had already been handled with skill by Larra in the first half of the century, and was now taken up by Estébanez (1799-1867), and by Ramón de Mesonero Romanos (1803-82), who has left us excellent descriptions of life in older Madrid. These essayists on manners prepared the way for the tale of manners and the novel of manners (*novela de costumbres*). The former was cultivated, though with no brilliancy, by Antonio de Trueba (1821-89); the latter was written, in a way to attract attention and applause, by Cecilia Böhl von Faber de Arrom (1797-1877), familiar still by her *nom de guerre* Fernán Caballero. A thoroughly delightful figure appeared in the person of the short-lived story-teller and poet Gustavo Adolfo Bécquer (1836-70). All his work is permeated by the highly subjective qualities that are more common in Northern Europe. His tales are all of a legendary cast and are everywhere actuated by the instinct of mystery.

Pedro Antonio de Alarcón (1833-91) is most felicitous in the composition of the short tale of manners or adventure of the type; he is less successful in the more ambitious novel, although the less lengthy among the novels, particularly the *Sombrero de tres picos* and the *Capitán Veneno*, continue to delight and amuse their readers. An incomparably greater artist is Juan Valera y Alcalá Galiano (born in 1824), whom a protracted career in the diplomatic service of his country has made one of the most cosmopolitan and cultured of moderns. In his novels Valera differs from the majority of his contemporaries in that he consciously tends toward idealism, whereas they seek rather to render the living fact. The novel of manners has been raised to a higher level than ever before by José María de Pereda (born 1834), who, in his chief works, has portrayed life on the mountains and at the seaside in a way hardly to be excelled for detail and charm of description. The *Don Gonzalo González de la Gonzalera* and the *Sotileza* show Pereda in the fullness of his power; where he leaves the scenes of rustic life and ventures into the city and the fashionable whirl, as in the *Pedro Sánchez*, he is still a master novelist, but he treads on uncertain ground. The work of Benito Pérez Galdós (born 1845) from first to last has been marked by tendencies frankly revolutionary. One of the most admirable and important divisions of his labors has been the composition of the collection of novels forming the *Episodios nacionales*, but it is by his psychological novels that Galdós has attracted most attention abroad. At least two other novelists of the first rank must be mentioned here, Armando Palacio Valdés (born 1853) and the remarkable woman Emilia Pardo Bazán (born 1851). Both have had tendencies toward a naturalism not unlike that which has so profoundly affected the French novel of the second half of the nineteenth century.

In the recent period we meet with only two poets of importance, Ramón de Campoamor y Campoosorio (1817-1901), who will continue to be pleasantly remembered for his philosophical and humoristic *Doloras* and a few descriptive poems, and Núñez de Arce, the virile author of the *Gritos del combate*. The latter has had disciples both at home and in Spanish America, but none of them have displayed superior talent. Criticism has flourished, principally through efforts of Marcelino Menéndez y Pelayo (born in 1856), who in his *Historia de las ideas estéticas en España* (1884-91) has raised a noble monument to the glory of his country.

Bibliography. The best collection of the Spanish classics is Rivadeneyra's *Biblioteca de autores espanoles* (71 vols., Madrid, 1846-80), embracing texts of Spanish masterpieces from the earliest times down to the opening of the nineteenth century; note also *Colección de escritores castellanos* (106 vols., ib., 1882-96); Ochoa, *Colección de los mejores autores españoles* (60 vols., Paris, 1837-60); and *Colección de autores españoles* (48 vols., Leipzig, 1860-86). For the history, consult: Baist, "Die spanische Litteratur," in Gröber's *Grundriss der romanischen Philologie* (Strassburg, 1894-97); Ticknor, *History of Spanish Literature* (4th ed., Boston, 1871); Fitzmaurice-Kelly, *A History of Spanish Literature* (New York, 1898); Bouterwek, *Geschichte der spanischen Poesie und Beredsamkeit* (Göttingen, 1804), continued by Brinckmeier, *Die Nationallitteratur der Spanier seit Anfang des 19. Jahrhunderts* (ib., 1850); Lemcke, *Handbuch der spanischen Litteratur* (Leipzig, 1856); Klein, *Geschichte des spanischen Dramas* (ib., 1871-75); Schack, *Geschichte der dramatischen Litteratur und Kunst in Spanien* (Berlin, 1846;

supplement, Frankfort, 1855); id., *Poesie und Kunst der Araber in Spanien und Sizilien* (Stuttgart, 1877); Schäffer, *Geschichte des spanischen Nationaldramas* (Leipzig, 1890); Balaguer, *Historia de los trovadores* (Madrid, 1888); Menéndez y Pelayo, *Calderon y su teatro* (ib., 1881), *La ciencia española* (ib., 1889), *Estudios de crítica literaria* (ib., 1895), *Antología de poetas líricos castellanos* (ib., 1890 et seq.); De Puymaigre, *Les vieux auteurs castillans* (Paris, 1888-90); Menéndez Pidal, *La leyenda de los Infantes de Lara* (Madrid, 1896); Cotarelo y Mori, *Iriarte y su época* (ib., 1897).

SPANISH MACKEREL, or SIERRA. Any of several mackerels of southern waters, especially *Scomberomorus maculatus*, a slender, compressed, fusiform fish, bluish green above, a beautiful satiny white below, with yellowish spots on the back and sides, weighing usually from two to four pounds, although sometimes much larger. They are natives of tropical seas, but they range along the Atlantic coast from Brazil to Cape Cod. They are among the very finest of fish for the table. A California species of high quality for the table is the Monterey Spanish mackerel (*Scomberomorus concolor*), the male of which is steel blue, without spots on its silvery sides, while the female has dusky cloudings and two series of dark spots along the sides. The 'Spanish mackerel' of England is a typical mackerel, known in the United States as 'chub mackerel' (q.v.). Compare MACKEREL; and see Plate of SPANISH MACKERELS.

SPANISH MOSS. See BROMELIA.

SPANISH MUSIC. Spanish music has always been imitative. At first the influence of the great school of the Netherlands predominated. This period was followed by a prevalence of Roman influence, especially that of Palestrina. The sixteenth century may be regarded as the time when music in Spain was at its height, for then it boasted Morales, whose compositions are still sung at Rome, and the great Vittoria, the master who most closely resembles Palestrina. With the appearance of Italian opera, Spanish composers not only imitated the Italians, but actually wrote Italian operas. With Wagner's innovations Spain was again ready to adopt the new tendencies. At this juncture the name of Pedrell deserves special mention. Stimulated by the attempts of Russian, Scandinavian, and Bohemian composers to establish a national school of music, Pedrell chose for his operas national subjects. His most ambitious undertaking is a trilogy, *Los Pireneos*, somewhat after Wagner's *Nibelungen*. The rise of the Spanish drama in the seventeenth century exerted a beneficial influence upon lighter music. The earlier musical dramas of the Florentine school had no overture. Instead, a *madrigal* was sung before the curtain rose. The Spaniards adopted this custom for their purely dramatic representations, so that before very long even the most serious tragedies were preceded by such 'curtain-raisers.' These were called *cuatros de empezar*, and were always performed by the women of the company to a harp accompaniment. At first the *cuatros* were choruses for four voices; but with the rise of the monodic style polyphonic writing was abandoned and an action was introduced. When the 'curtain-raisers' had been developed so far, they were called *tonadillas*. This custom of beginning all dramatic representations with a *tonadilla* was adopted by the Italians, who called the tonadilla *intermezzo*, and soon developed this latter into the *opera buffa*. (See INTERMEZZO.) Then the Spaniards again imitated the Italians; and the result was the development of the *tonadilla* into the *zarzuela*. This was a kind of comic opera, operetta, or vaudeville, generally in two acts and with spoken dialogue. The name is derived from the castle of Zarzuela, where, in the seventeenth century, the first representations of this kind took place. This form has always been very popular in Spain, and about 1850 Hernando gave it a new impetus. Among the numerous composers who devoted their talents to this form, four deserve mention: Oudrid, Gaztambide, Barbieri, and Arrieta.

But for originality and characteristic traits we must turn to Spanish folk-music. Here we notice that the real folk-songs are almost exclusively used as accompaniments to dances. The limitations of the national instrument, the guitar, influenced the melodies and rhythms to a great extent, rendering the latter more attractive than the former. Of the old folk-songs composed in the time of the Troubadours a great number have been preserved in literary collections called *cancioneros*, but the music has been lost. The music of the folk-songs of the fifteenth and sixteenth centuries, however, has been transcribed from the actual performances of blind singers, who even now, as formerly, wander from town to town. The melodies of Andalusia, which are in all respects superior to those of the northern provinces, show undoubted traces of Moorish influences, as shown by the elaborate embellishments of the notes of the melody, peculiar intervals foreign to European scales, and a strange combination of distinct rhythms in the several parts. This foreign element has always attracted composers, who by this means have succeeded in creating a local atmosphere in their works. In this connection it is only necessary to mention the names of Bizet (*Carmen*), Massenet (*Le Cid, La Navarraise*), Weber (*Oberon*), and Moszkowski (*Boabdil*). The best known Spanish dance-forms are the bolero, cachucha, fandango, jota, malagueña, rondeña, and seguidilla, which are accompanied by the guitar and castanets. Consult: Soriano-Fuertes, *Musica española hasta el año 1850* (Madrid, 1857); Juan F. Riaño, *Critical and Biographical Notes on Early Spanish Music* (London, 1887); A. Soubies, *Histoire de la musique. Espagne* (Paris, 1900).

SPANISH NEEDLES. See BUR MARIGOLD.

SPANISH POLITICAL PARTIES. See SPAIN; POLITICAL PARTIES, section on *Spain*.

SPANISH SUCCESSION, WAR OF THE. See SUCCESSION WARS.

SPANISH TOWN. A town in Jamaica, British West Indies, on the Cobre River, about 10 miles west of Kingston (Map: West Indies, J 6). It was founded by Diego Columbus in 1525 and was the capital of Jamaica until 1871. Population, over 5000.

SPANISH WAR VETERANS. A patriotic society incorporated in Washington, D. C., on November 2, 1899. It admits to membership any soldier or sailor of the regular and volunteer army and navy and marine corps of the United

States who honorably served during the war with Spain or the war in the Philippines. The National Auxiliary of this order admits to membership mothers, wives, sisters, and daughters of members, and other women, as nurses, who rendered species service during the war.

SPANKER. A fore-and-aft quadrilateral sail set on the mizzenmast of ships and barks (q.v.). It was formerly called the driver.

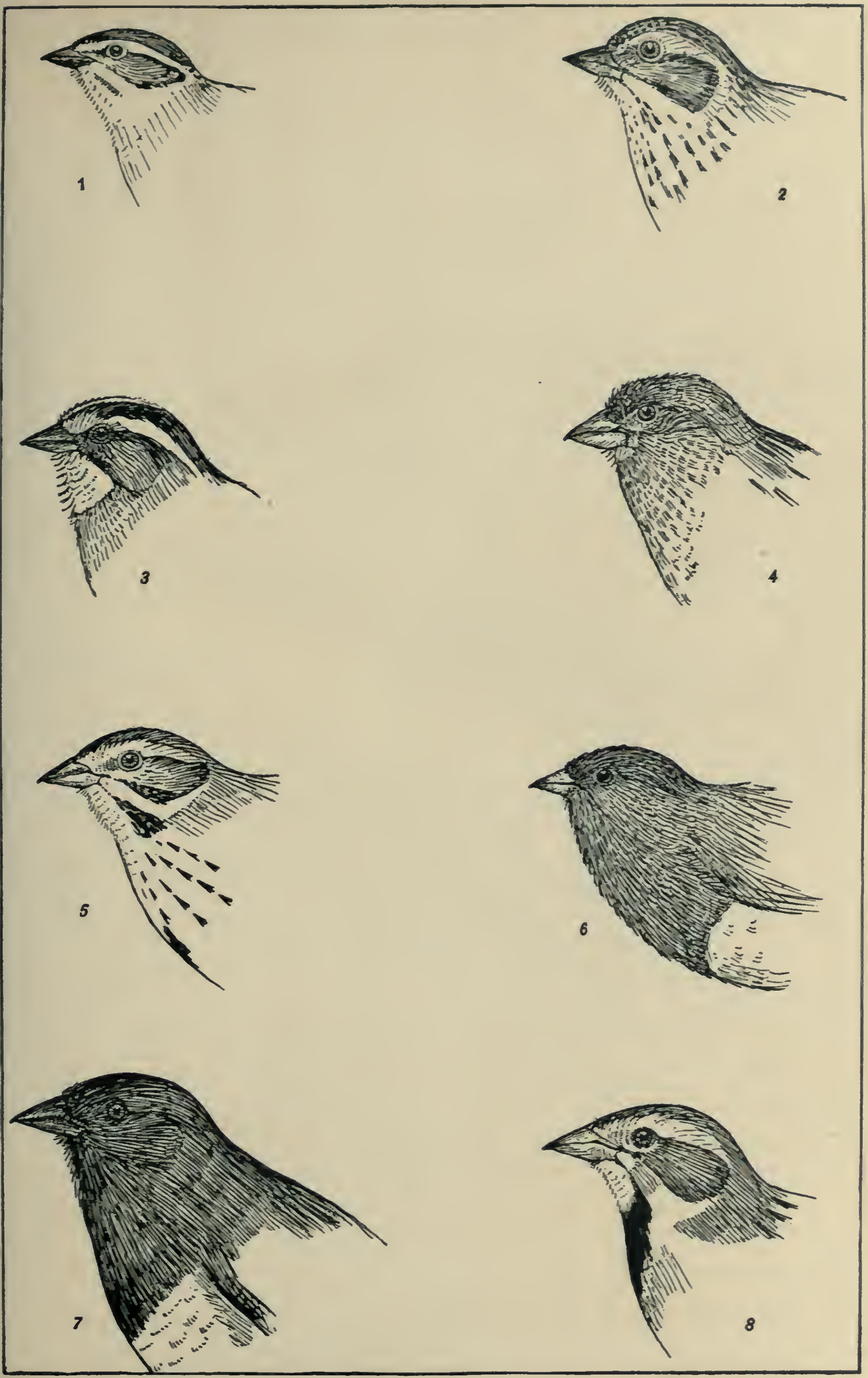
SPAR (AS. *spær*, Ger. *Spar*, gypsum). A term used by miners to denote any bright crystalline mineral, and which has been adopted by mineralogists in the names of a number of minerals, as calcareous spar, fluor spar, etc., in which, however, it has no proper generic significance.

SPARIDÆ (Neo-Lat. nom. pl., from Lat. *sparus*, from Gk. *σπάρος*, gilt-head, sort of fish). An important family of spiny-rayed fishes, to which belong the porgies, sheepshead, scup, etc. (qq.v.). The body is elongate, with the dorsal side more or less elevated. The scales are rather large. There is a single dorsal fin, the anterior portion being spinous. The family contains about 100 species. They are shore fishes, carnivorous in habit, most common in the tropical seas.

SPARKS, Jared (1789-1866). An American historian, editor, and educator, born at Willington, Conn. He graduated at Harvard College in 1815. Here, after teaching school, he was (1817-19) tutor in mathematics and natural philosophy. During this time he studied theology and (1817-18) edited the *North American Review.* From 1819 to 1823 he was pastor of a Unitarian church in Baltimore; in 1821-23 he edited there the *Unitarian Miscellany and Christian Monitor* (monthly); and from 1824 to 1831 again edited the *North American Review*, of which he was chief proprietor. In 1830 he founded and was the first editor of the *American Almanac and Repository of Useful Knowledge*, published annually until 1861. In 1839 he became professor of history at Harvard, of which institution he was president from 1849 to 1853. During this time he reformed administrative methods, insisted upon the recognition by the Massachusetts Legislature of Harvard's chartered rights, and vigorously opposed the elective system. He is best known, however, as a biographer, and as an editor and collector of documents relating to American history. In this field he was a pioneer and rendered services of great value. As an editor he was severely criticised for taking liberties with his materials, such as failing to reproduce letters and documents accurately, making many verbal and other changes, and omitting numerous passages; but the extent to which he took such liberties has been greatly exaggerated. Perhaps his best known work is his edition of the *Writings of George Washington* (12 vols., 1834-37), the first volume of which is an excellent biography of Washington, frequently published separately. This edition met with much criticism, involving Sparks particularly in a controversy with Lord Mahon, and it has since been superseded in many respects by that of W. C. Ford. Sparks also edited: *The Library of American Biography* (first series, 10 vols., 1834-38; second series, 15 vols., 1844-47), to which he himself contributed several biographies; *The Diplomatic Correspondence of the American Revolution* (12 vols., 1829-30), since superseded in most respects by Wharton's *Revolutionary Diplomatic Correspondence of the United States* (6 vols., 1889); *The Works of Benjamin Franklin with a Life of the Author* (10 vols., 1836-40), since superseded by Bigelow's *Complete Works of Benjamin Franklin* (10 vols., 1887-89); and *Correspondence of the American Revolution; Letters of Eminent Men to George Washington* (4 vols., 1853). He also published a *Life of Gouverneur Morris, with Selections from His Correspondence and Miscellaneous Papers* (3 vols., 1832). He left voluminous manuscript journals, and a mass of valuable documentary material relating chiefly to the diplomatic history of the American Revolution, which was collected by him during several trips to Europe, and which he bequeathed to the Harvard Library. Consult: H. B. Adams, *Life and Writings of Jared Sparks* (2 vols., Boston, 1893).

SPARROW (AS. *spearwa*, *spearewa*, Goth. *sparwa*, OHG. *sparo*, *sparwe*, sparling; connected with OPruss. *sperglas*, *spurglas*, sparrow, and probably ultimately with Eng. *spur*, *spurn*). A small bird of the finch family (Fringillidæ), generally with dull plumage and slight powers of song, feeding on the ground or among underbrush or weeds, and nesting in bushes or low trees or on the ground. Originally the name belonged specifically to the common European sparrow (see House Sparrow), but now has been inaccurately extended to include certain warblers, weaver-birds, and others. Of American sparrows probably the most familiar is the common chipping sparrow (see Chippy), a small grayish bird. The field-sparrow (*Spizella pusilla*) is a very similar species, which occurs throughout the Eastern United States in summer, distinguished by its brighter rufous color and flesh-colored bill. A third species of this genus, the tree-sparrow (*Spizella monticola*), occurs in the United States only in winter, breeding in Labrador and the Hudson Bay region. It is considerably larger than the chippy and has a conspicuous black spot on the grayish-white breast. Next to the chippy the best known American sparrow is probably the song-sparrow (*Melospiza melodia* or *cinerea*), which in some one of its varieties ranges throughout practically the whole of North America. It is between six and seven inches in length, the general shade of the upper surface brown, of the under surface dirty white, but everywhere more or less streaked with black or rufous brown, the streaks on the centre of the breast tending to form one large characteristic blotch. This is one of the earliest spring songsters in the Northern States, and its refrain, although not extended, is remarkably clear and sweet. Its nest is composed of grasses, rootlets, and the like, lined with fine grasses and long hairs, and is frequently placed on the ground. The eggs are very variable in color and form, the ground shade ranging from nearly white to deep blue thickly marked with reddish brown. Two broods are often raised in a season. Two other species of Melospiza range through Eastern North America, the swamp-sparrow (*Melospiza Georgiana*) and Lincoln's sparrow (*Melospiza Lincolni*). They resemble the song-sparrow in appearance, but are much more shy and retiring in their habits. Some twenty or thirty other birds are called sparrows in the United States, among

FAMILIAR SPARROWS



1. CHIPPY (Spizella socialis).
2. VESPER SPARROW (Poōcætes gramineus).
3. WHITE-THROAT (Zonotrichia albicollis).
4. PURPLE FINCH (Carpodacus purpureus).
5. SONG SPARROW (Melospiza melodia).
6. BLUE SNOWBIRD (Junco hyemalis).
7. CHEWINK (Pipilo erythrophthalmus).
8. BLACK-THROATED SPARROW (Euspiza Americana).

which the vesper-sparrow (*Poocætes gramineus*), the savannah sparrows of the genus Ammodramus (which also includes the sharp-tailed and seaside sparrows), the crowned sparrows of the genus Zonotrichia, the wood-sparrows or summer finches of the genus Peucæa, and the large fox-sparrow (q.v.) are especially worthy of mention, while the sage-sparrows (Amphispiza) and the lark-sparrows (*Chondestes grammacus*) are characteristic Western forms. The former group includes the black-throated sparrow (*Amphispiza bilineata*), found on the Western plains. The vesper-sparrow is often called grass-finch or bay-winged bunting, but its more common name has reference to its fondness for singing late in the afternoon. It is essentially a ground-loving species, feeding and nesting only on the ground. The outer tail-feathers of each side are white and are exposed by the bird when it flies. Ammodramus includes upward of a dozen species, widely distributed, but popularly little known, on account of their retiring habits. They are chiefly shy, elusive little birds of fresh and salt marshes. The crown-sparrows are large, handsome birds, of which the common white-throated Peabody-bird (*Zonotrichia albicollis*) is the best known. The conspicuous black and white and sometimes golden-yellow markings on the head make the crown-sparrows conspicuous among their more plainly colored relatives. The wood-sparrows are a group of Southwestern and Mexican species of medium or rather small size, with short rounded wings, one species of which, known as Bachman's finch or the pine-woods sparrow (*Peucea æstivalis*), occurs in the South Atlantic States, especially Florida, and is noted as a very superior songster; a variety of this species, the oak-woods or Bachman's sparrow, is found in the Mississippi Valley as far north as Illinois. The lark-sparrow is notable for the fact that, unlike other sparrows, the sexes are very unlike in color; while the female is streaked grayish brown, the male is black with a large white patch on the wings. This is a prairie species abundant on the central plains, ranging eastward to Illinois, and occasionally, as a straggler, to the Atlantic Coast. Consult Ridgway, *Birds of North and Middle America*, part i. (Washington, 1901), and authorities there cited. See Plate of FAMILIAR SPARROWS; and Colored Plate of EGGS OF SONG-BIRDS.

SPARROW-HAWK. Any of several distinct species of small hawks, whose prey consists chiefly of sparrows and other small birds, insects, and mice. In America the name is universally given to *Falco sparverius*, a handsome little falcon less than a foot long. It is very courageous and very active, and lives largely on mice and insects. It is rufous above, barred with black; most of the head is slaty blue, and underneath it is buffy. It breeds from Florida to Hudson Bay, and winters from New Jersey southward, and is everywhere one of the commonest species of hawk. It nests in a hole in a tree and lays from three to seven creamy or reddish eggs, finely marked with darker tints.

The Old World sparrow-hawk (*Accipiter nisus*) is very similar, and has often been trained for the purposes of falconry, to take land-rails, partridges, and similar game. See FALCON; FALCONRY; and Plate of EAGLES AND HAWKS.

SPAR'TA (Lat., from Gk. *Σπάρτη*, *Spartē*, Doric *Σπάρτα*, *Sparta*), also LACEDÆMON. The capital of Laconia, and the most famous city of the Peloponnesus. It occupied partly a group of low hills on the right bank of the Eurotas, and partly the intervening plain. Its appearance in its palmiest days was by no means equal to its renown, for it was little better than a group of five villages, with plain and even mean private houses, though there were a few notable public buildings, such as the shrine of Athena or the Bronze House, whose walls seem to have been lined with bronze, probably decorated with reliefs. The passes which lead into the valley of the Eurotas are so easily defensible, and the distance from the sea is so great, that Sparta continued without walls down to the end of the fourth century B.C., and, indeed, was not regularly fortified till the time of the tyrant Nabis (B.C. 195). The five districts or villages, Cynosura, Limnæ, Mesoa, Pitane, and Dyme, were united in the worship of Artemis Orthia and Athena, and had a common agora, or market-place, on which stood the public buildings—the senate-house, and the offices of the ephors and other magistrates. Famous public places were the *Choros*, where the youths danced in honor of Apollo; the *Dromos*, or race-course, where the gymnastic exercises took place, and where were also temples of the Dioscuri and other gods; and the *Platanistas*, a broad level space, shaded by plane-trees, and reached by two bridges where the Spartan youth, divided into two bands, met in strenuous personal conflict. Probably the so-called Acropolis, which was crowded with temples, was situated on the hill to the northwest, on whose southern side the theatre can still be traced. Not far from here excavations conducted by the American School at Athens in 1892 and 1893 brought to light the foundations of a circular building, which had contained a colossal statue, and may have been identical with one mentioned by Pausanias as containing statues of Zeus and Aphrodite, said to be a foundation of Epimenides of Crete.

After the Dorian conquest of Laconia the supreme power always remained in the hands of the pure-blooded Dorian families of Sparta. The farmer population and the lesser Dorian towns seem to have been reduced to Periœci (q.v.), or to Helots (q.v.). Their situation, amid a subject population largely in excess of their own numbers, practically forced upon the Spartans a strict military discipline, and this formed the basis of their whole system. Sparta was little else than a permanent camp. At the birth of a child, the elders decided whether it was strong enough to be reared. A weakling was exposed on Mount Taygetus. After the seventh year the boys entered on a course of severe training, designed to develop physical strength and courage, as well as the uncomplaining endurance of hardship and cunning such as might serve the soldier. Music and the dance were added, and perhaps the elements of letters. Girls, too, passed through a training in gymnastics and the dance, that they might be fit consorts and bearers of strong children. Sentiment played but little part in the Spartan system, and the function of marriage was only the perpetuation of the State. At the age of twenty the young Spartan was liable to active service, was admitted to the public meals, and was now allowed to marry, though he could only obtain stolen interviews with his bride, since he was still obliged to live with his companions. At thirty he became a full citizen. Discipline, however, was not relaxed. He must still eat regularly at his *Phiditia*, or mess, and contribute regularly to its support from the produce of his farm, which was cultivated by Helots. The government was a development from the old Homeric form of the king and council of elders. In Sparta there was a double kingship. The two lines claimed descent from the twin sons of Aristodemus, Eurysthenes and Procles, but were named from the second generation, Agis and Eurypon, Agidæ and Eurypontidæ. These two kings were the religious representatives of the State, on whose behalf they offered stated sacrifices, and also exercised limited legal functions. Their chief duty was, however, the command of the army, over which in early times they exercised unlimited power, though in the fifth century B.C. they were subject to the ephors and the Assembly. In the field their power was absolute. Associated with the kings was a council (the Gerousia) of 28 elders, men over 60 years of age, chosen for life from certain noble families by acclamation in the popular assembly. They discussed and prepared the orders to be submitted to the assembly, and also sat as a court of criminal jurisdiction in crimes against the State, especially where the kings were involved. Once a month the assembly of the citizens (Apella) met at the call of the kings, though in the fifth century B.C. the ephors presided. The body seems ordinarily to have simply voted on the business presented to it. Speeches were in general delivered only by the officials, and there was certainly no general discussion. Into this government were introduced, at an early date, the ephors, who, during the period of Spartan greatness, were the real rulers. (See EPHORI.) They exercised a general oversight over the community and maintained the authority of the established order. Elected for one year, they had the power to call any magistrate to account and even to suspend him from office. They presided over the Gerousia, and could impeach any citizen before that court. Their short term of office and accountability to their successors were really almost the sole limits to their power. Under the iron discipline of this constitution, which was attributed to the mythical Lycurgus (q.v.), the Spartan State gradually extended its power until it had gained complete control over Laconia and Messenia, and the recognized leadership of a somewhat loosely joined confederacy, which included most of the Peloponnesus outside of Argos. At the time of the Persian wars Sparta was the leading State in Greece, but the constitution was not adapted for military operations requiring prolonged absence from home, and with the transfer of the war to Asia the Spartans soon withdrew from the scene. (The leading events other than domestic in the history of Sparta have been given under GREECE.) The creation of the fleet which decided the Peloponnesian War put a severe strain upon the ancient customs, and long absences in foreign lands, often with free opportunity for luxury, rendered men unwilling to submit to stern discipline on their return. The hegemony of Greece, which had fallen to Sparta on the overthrow of Athens, was used solely as a means of aggrandizement and profit, and in a short time led to renewed wars. In B.C. 371 the defeat at Leuctra at the hands of the Thebans broke forever the power of Sparta, and the disintegration, which had begun with naval empire and the accumulation of the gold and silver, forbidden by the ancient laws, went rapidly forward. The attempt of Agis IV. (c.244-240 B.C.) to reform the State was defeated and Agis put to death, but Cleomenes III. (c.235-219 B.C.) carried through a serious of sweeping changes, which increased largely the number of citizens, and reëstablished the Lycurgean order. After his death Sparta was ruled by the tyrants Machanidas and Nabis, was then forced into the Achæan League, and finally with the rest of Greece passed under the rule of Rome. Treated with favor by the Romans, the city prospered; the old laws of Lycurgus were once more placed in force, and the old training practiced at least nominally, though the forms of government seem to have been much altered. In the thirteenth century the Acropolis was fortified by a wall, which may still be traced. The Frankish lords of the Peloponnesus built a strong fortress at Mistra (1248-49) on a spur of Taygetus, west of Sparta, and its superior security led to the abandonment of the ancient city. After the Greek Revolution a new town of Sparta was laid out as the capital of the Nomarchy of Laconia.

Consult, on the topography: Curtius, *Peloponnesus II.* (Gotha, 1852); Leake, *Travels in the Morea* (London, 1830); N. E. Crosby, "Topography of Sparta," in *American Journal of Archæology*, vol. viii. (Princeton, 1893); Frazer, *Pausanias*, vol. iii. (London, 1898). On the ancient constitution, consult: Hermann, *Lehrbuch der griechischen Antiquitäten*, vol. i., 6th ed., by V. Thumser (Freiburg, 1889); Busolt, "Griechische Staats- und Rechtsaltertümer," in Müller's *Handbuch der klassischen Altertumswissenschaft* (Munich, 1892), both of which contain full bibliographies.

SPARTA. A city and the county-seat of Monroe County, Wis., 26 miles east by north of La Crosse; on the La Crosse River, and on the Chicago, Milwaukee and Saint Paul and the Chicago and Northwestern railroads (Map: Wisconsin, C 5). It has an attractive situation and artesian mineral wells, and is a much frequented summer resort. There are in Sparta a public library, the State Public School for Dependent and Neglected Children, and Saint Mary's Convent. The city is the shipping centre for a rich farming and stock-raising section, and manufactures flour, paper, and iron products. The water-works are owned by the municipality. Population, in 1890, 2795; in 1900, 3555.

SPARTACUS. The leader in the great insurrection of Roman slaves in Southern Italy which took place B.C. 73. He was a native of Thrace, originally a shepherd, but afterwards a robber chief. He was taken prisoner and placed in a gladiatorial school at Capua. Seventy gladiators, including Spartacus, escaped and forced their way through the streets of Capua, defeated a detachment of Roman soldiers sent to bring them back, and established themselves on Mount Vesuvius, where they received considerable accessions, chiefly runaway slaves. Spartacus was chosen leader, and proclaimed freedom to all slaves. Thousands rushed to his standard.

After defeating Claudius Pulcher, Spartacus routed and slew Cossinius, legate of P. Varinius Glaber, the prætor; then he worsted Varinius himself in several engagements, capturing his lictors and the very horse on which he rode. All the southern part of the peninsula now fell into his hands; the country was devastated, the cities either pillaged or garrisoned. After the defeat and death of his lieutenants, who had separated from him, B.C. 72, he marched northward through Picenum toward the Po, overthrew first one consular army under Cn. Cornelius Lentulus and then another under Gellius Poplicola, and at the head of a large force meditated a march upon Rome. Servile indecision saved the city. Spartacus was forced by his followers to retreat south, and took up his winter headquarters at Thurii. In B.C. 71 the proconsul, C. Cassius Longinus, and the proprætor, Cn. Manlius, were defeated; in Picenum, Mummius, a legate of Crassus, was utterly routed; at last, however, Crassus succeeded in forcing Spartacus into the narrow peninsula of Rhegium. Crassus now built lines of circumvallation to hem him in and force him to surrender; but one stormy winter night Spartacus broke out of the toils prepared for him, and resumed the offensive. Near Petelia, Spartacus once more defeated his adversaries; but seeing clearly that with such wretched materials as he had he could not hold out much longer, he made a dash for Brundusium, hoping to seize the shipping in the harbors, and get safely across the Adriatic to his native shore, but was baffled by the presence of Lucullus (q.v.). There was nothing left for Spartacus but to die gallantly as he had lived. Drawing up his army in battle array, and solemnly slaying his war-horse, he began his last fight in a spirit of heroic desperation, and after performing prodigies of valor he fell unrecognized among the heaps of his slain foes. After his death the slave insurrection was at an end.

SPAR′TANBURG. A city and the county-seat of Spartanburg County, S. C., 93 miles northwest of Columbia; on several branches of the Southern and the Atlantic Coast Line railroads (Map: South Carolina, C 2). It has the Kennedy Public Library, and is the seat of Converse College, a non-sectarian institution for women, opened in 1890, Wofford College (Methodist Episcopal, South), opened in 1854, and the State Deaf, Dumb, and Blind Institute. Spartanburg is situated in a rich cotton-growing and farming section, which also has deposits of gold, limestone, and granite, and other mineral wealth. It is the centre of a large cotton-manufacturing district, containing some 30 mills with more than 400,000 spindles. There are several large cotton mills in the city and suburbs; also iron works, lumber mills, and manufactories of brooms and soap. The government, under the charter of 1901, is vested in a mayor, chosen every two years, and a unicameral council. Population, in 1890, 5544; in 1900, 11,395.

SPARTEINE (from Neo-Lat. *Spartium*, from Lat. *spartum*, *sparton*, from Gk. σπάρτον, Spanish broom, cable). A volatile, oily liquid alkaloid obtained from the tops of the broom-plant (*Cytisus Scoparius*), a European shrub of the order Leguminosæ. Sparteine is odorless, very bitter, soluble in alcohol, ether, and chloroform, but insoluble in water. Its sulphate, which is used in medicine, is a colorless, crystalline powder, soluble in water and in alcohol. It is a cardiac stimulant, acting at times when others fail, and used under these circumstances or when it is necessary to obtain a substitute for other drugs of its class. It increases the amount of urine excreted.

SPARTIUM, spär′shĭ-ŭm. A genus of plants. See BROOM.

SPASM (Lat. *spasmus*, from Gk. σπασμός, *spasmos*, σπάσμα, *spasma*, spasm, from σπᾶν, *span*, to draw, rend). Involuntary and sudden muscular contraction, due to central nerve disturbance, to peripheral irritation, or to reflex conditions from irritation of other parts. There are two kinds of spasm: tonic and clonic. Tonic spasm is a prolonged involuntary rigidity of a muscle or a group of muscles. Such spasm occurs at the beginning of an epileptic attack, during hysteria major, tetanus, angina pectoris, and meningitis. It also occurs in the muscles of the calves of the legs in swimmers, attended with pain, when it is called cramp (q.v.). Clonic spasm is an involuntary contracting and relaxing of groups of muscles, causing twitching, jerking, and rolling movements and contortions. It is the common convulsion, or fit. Such a spasm occurs in epilepsy, hysteria major, uræmia, chorea, hydrophobia, and in some cases of indigestion and worms. In asthma (q.v.) there is spasm of the muscles controlling the bronchial tubes, as also in whooping cough (q.v.), together with hyperæsthesia. Spasm occurs also in colic.

The treatment of spasm consists of the use of antispasmodics such as asafœtida, galbanum, musk, sumbul, valerian, belladonna, cannabis indica, opium, the bromides, and stramonium, and the administration by inhalation of choloroform or amyl nitrite, or by outward application of heat in a prolonged hot bath.

SPAVIN, BOG (OF. *esparvain*, *esparvent*, Fr. *éparvin*, spavin; possibly from Goth. *sparwa*, OHG. *sparo*, *sparwe*, AS. *spearwa*, *spearewa*, Eng. *sparrow*; in allusion to the hopping gait of a spavined animal). A lesion of the true hock-joint of the horse, consisting in distention of the capsule inclosing the joint. It usually arises suddenly from a sprain in action, from overwork, or wounds.

SPAVIN, BONE. An inflammation of and bony deposit on the flat bones of the lower and inner part of the hock-joint of the horse. At first there is tenderness, local heat, swelling, and lameness, but as the inflammatory stage passes the lameness is less perceptible, although the horse still continues to go stiffly. If the lameness is only slight it usually disappears after a little exercise. The animal should be given rest.

SPAWN-EATER. The spotted-tailed minnow (*Notropis Hudsonius*). See MINNOW.

SPEAKER. The name given to the presiding officer in various legislative bodies. In the English House of Commons the office of Speaker seems to have existed as early as the reign of Henry III., but the title Speaker was first given to Sir T. Hungerford in the reign of Edward III. (1377). The Speaker of the House of Commons presides over the deliberations of the House, and enforces the rules for preserving order. He puts the question and declares the determination of the House. As the representative of the House, he communicates its resolutions to others, and conveys its thanks or its censures. He issues warrants in execution of the orders of the House for the commitment of offenders, for the issue of writs, the attendance of witnesses, the bringing up prisoners in custody, etc. He cannot speak or vote on any question, but on an equality of voices he has a casting vote. The office is non-political; and hence a Speaker may hold during several successive and opposing administrations. A retiring Speaker is usually rewarded with a peerage. See PARLIAMENT.

Unlike the English prototype, the Speakership of the United States House of Representatives is a political office of the highest importance. The first Speaker, chosen in 1789, was a moderator on the British pattern. But beginning with the right to appoint the standing committees in 1790, the powers of the office have gradually expanded until the Speaker has become the acknowledged leader of the House and the chief of his party. Henry Clay (1811-25) developed the political resources of the office, especially through the constitution of committees. The modern Speaker has been well called the American Premier. So far has the office departed from its original character that the Speaker now has the right to dispense the privileges of the floor in the interest of his party. He may even refuse to 'recognize' on the ground of personal dislike. Moreover, since 1860, as chairman of the Committee on Rules, he may in effect control the whole course of legislation. He "practically decides what shall be considered, how long debates shall last, and when the votes shall be taken." Through this function a kind of substitute for the right of the English Ministry to introduce and promote so-called 'Government bills' has been found. The Speaker is a member of the House chosen by the members; and he freely exercises his privilege of voting on any measure. Since 1874 his salary has been $8000 a year. He signs all bills, resolutions, and acts of authority; certifies to the mileage, etc., of members; and appoints three of the regents of the Smithsonian Institution. He may be removed from his office by an act of the House.

For the early history of the Speakership, consult Stubbs, *Constitutional History*, and in general, Todd, *Parliamentary Government* (London, 1869). The most important work on the American office is Follett, *The Speaker of the House of Representatives* (New York, 1896). This was preceded by Hart, "The Speaker as Premier," in *Atlantic Monthly*, March, 1891; reprinted in his *Practical Essays* (New York, 1893).

SPEAKING TRUMPET. An instrument for concentrating the waves of sound originated by the articulation of the human voice, and thereby enabling the sound to be conveyed to a greater distance. It was used on shipboard in enabling the officers to convey orders during windy weather from one part of the deck to another, or to the rigging, and in its more modern form, the megaphone (q.v.) is extensively employed. The invention is ascribed to Sir Samuel Morland (1625-1695) in 1670, though Athanasius Kircher laid claim to it. Morland's trumpet was shaped like a truncated cone, with an outward curve or lip at the opening.

SPEARFISH, or SPIKEFISH. The great 'billfish' or 'aguja blanca' (*Tetrapturus albidus*) of West Indian waters, which is dark blue above, whitish beneath, and may be seven feet long, including the spear-like jaws, and weigh 100 pounds. It is probably identical with the Mediterranean species, and others occur in the Eastern tropics. Their habits are similar to those of their relatives the sailfishes and swordfishes. See Plate of SPEARFISH AND SWORDFISH.

SPEARMINT. See MINT.

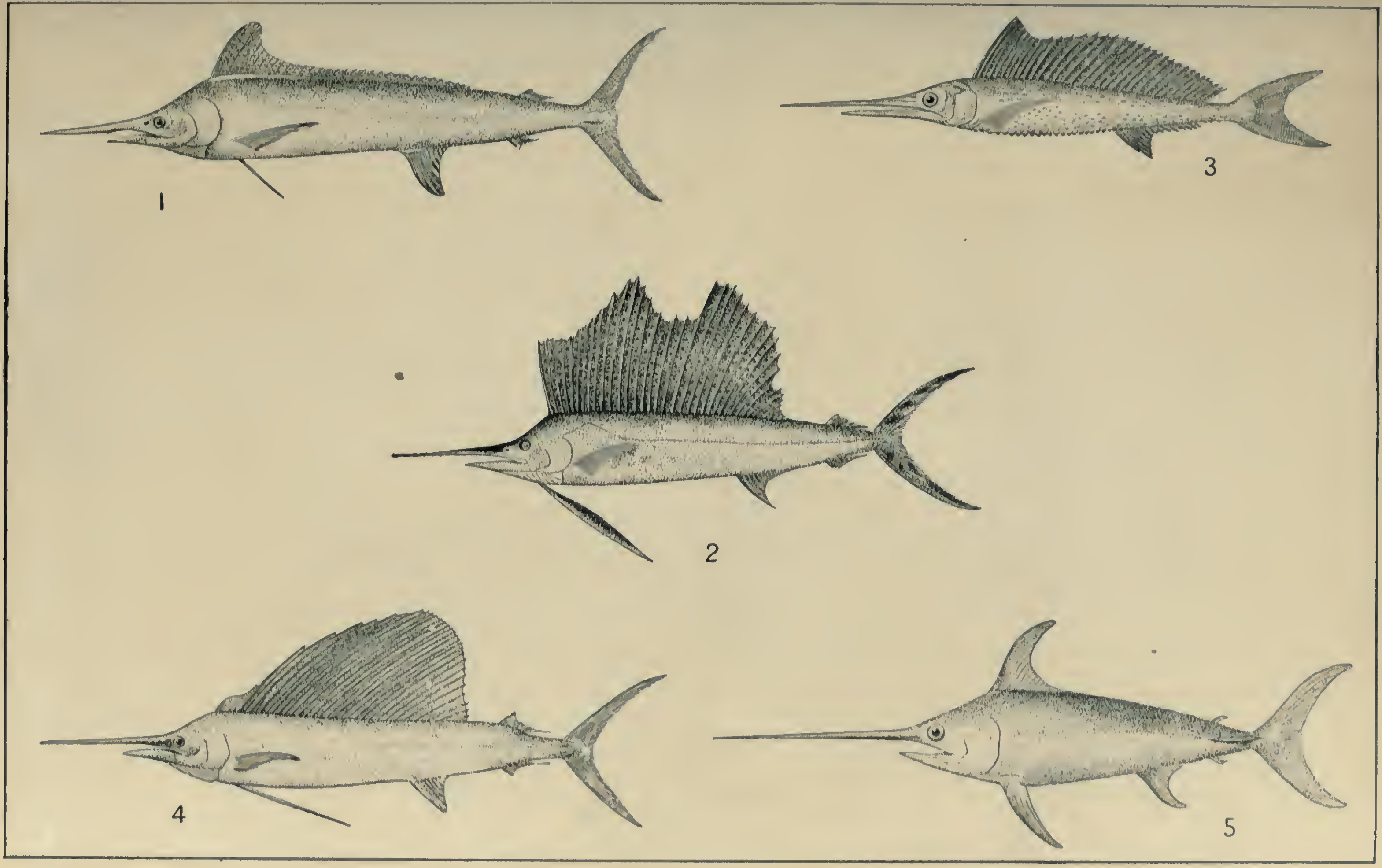
SPEARS, JOHN RANDOLPH (1850—). An American author and journalist, born at Van Wirt, Ohio. In 1875 he became editor of the East Aurora *Advertiser*, and the next year he founded the Silver Creek *Local*. He was a reporter on the Buffalo *Express* from 1880 until 1882, when he joined the staff of the New York *Sun*. His publications include: *The Gold Diggings of Cape Horn* (1895); *The Port of Missing Ships and Other Stories of the Sea* (1896); *The History of Our Navy* (1897); *Our Navy in the War with Spain* (1898); *The Fugitive* (1899); and *History of the American Slave Trade* (1900).

SPECIAL ASSESSMENT. A compulsory contribution levied in proportion to the special benefits derived from a public improvement, and designed to cover, entirely or in part, the cost of that improvement. A special assessment is levied most frequently in connection with the opening or improvement of streets or highways. It differs from a tax in that it is levied in proportion to the benefit directly derived from the uses to which the contribution is put. (See TAXATION.) Charges of the nature of special assessments were imposed in France as early as 1672. In 1807 a general law was passed authorizing such levies, but it has rarely been invoked. In Prussia, since 1875, the expenses of certain street improvements have been partially defrayed in this manner. In England contributions of the nature of special assessments were imposed in 1427 and in 1667. The Public Health Act of 1875 permits urban authorities, under certain contingencies, to recover the cost of improvements from property-owners, in proportion to the frontage of their premises. In England, however, no general policy of covering the costs of improvements by special assessments exists.

The principle of special assessments first appeared in America in a law of the Province of New York of 1691. By that law, however, all houses in the city of New York might be assessed in proportion to benefits derived from public improvements. By a law of 1787, assessments were limited to the owners of property which was intended to be benefited. In other States this form of revenue appeared about 1830. After the Civil War the principle became far more extended, and is now throughout the United States a recognized principle of local finance. In a typical case, when a street is graded or paved, after the improvement has been made a board of assessors is appointed, who apportion the cost in proportion to benefits received. Such assessments are usually subject to legal limitation as to amount. Consult Rosewater, *Special Assessments* (New York, 1893).

SPECIAL JURY. In the English law, a jury consisting of men who are entitled to be

SPEARFISH AND SWORDFISH



1. SPEARFISH (Tetrapturus albidus). 2. WEST INDIAN SAILFISH (Histiophorus nigricans). 3. YOUNG OF SWORDFISH (No. 5).
4. SAILFISH (Histiophorus gladius). 5. SWORDFISH (Xiphias gladius).

called esquires, or persons of higher rank, bankers, merchants, and persons who occupy private dwelling houses, or possess certain other property qualifications. Under the 'Juries Act' of 1870, either the plaintiff or the defendant in an action is entitled to demand a special jury, but the one making such demand must bear the additional expense, unless at the end of the trial he can obtain a certificate from the trial judge to the effect that the case was a proper one to be tried by a special jury. In some of the United States no provision is made for special juries; but in a few States *struck* or special juries may be ordered, in the discretion of the court, in important cases. See JURY.

SPECIAL PROCEEDING. Under modern codes of procedure, any civil proceeding which is not an action (q.v.). Under the New York Code of Civil Procedure, the following have been held to be special proceedings: An application for admission to the bar; supplementary proceedings; a proceeding to vacate an assessment; proceedings for contempt; proceedings for condemnation of land; habeas corpus. See ACTION, and consult Fiero, *Special Proceedings* (2d ed., New York, 1899).

SPECIAL SESSIONS. Under the English judicial system, where two or more justices of the peace sit together for the trial of some important cause, or to transact other urgent judicial business, the sitting is known as Special Sessions. In New York a criminal court for the trial of misdemeanors and petty criminal cases is called the Court of Special Sessions. See COURT; PETTY SESSIONS.

SPECIALTY. In law, in its broadest sense, any formal, as distinguished from a simple, contract, including judgments, recognizances, statutes staple, statutes merchant, and deeds of grant; but the term is more frequently used as synonymous with contract under seal. Contracts under seal were the earliest form of contract known to the law, having been used from the earliest time both under the common and the Roman law system. Unlike simple contracts, no consideration is required to give them validity at law, their validity, as in the case of all other specialties, depending on their form and the method of their execution. They must be written or printed on paper or parchment and they must be sealed and delivered by the grantor or obligor. It is said that signing a deed by the obligor is not essential to the validity, although it is now the universal practice to execute the instrument by signing as well as by sealing and delivering it. Delivery is effected by an actual delivery of the instrument by the person executing it to the obligor or to another for the obligor with the intent that it should become operative as a deed or contract under seal. After sealing and delivery the instrument remains in full force even if the person executing it take it back into his possession. One executing a specialty may, however, make a qualified delivery of it called a delivery in escrow (q.v.). Formerly specialties were classified as deeds poll and indentures (see DEED), but now the most satisfactory classification of specialties (using that term as applicable only to instruments under seal) is into grants, bonds, and covenants (qq.v.). All statements contained in a specialty are absolutely conclusive against the party making them and executing the instrument, that is, he is conclusively estopped to deny them. Whenever a specialty contract is given on account of or in place of a simple contract, the simple contract is merged in the specialty contract and thereby becomes extinguished. (See MERGER.) The statute of limitations provides a much longer period of limitation for specialties than other forms of obligations, the usual period being twenty years. (See LIMITATION OF ACTIONS.) In case of the death of the obligor the holder of specialty obligations executed by the deceased had at common law much higher rights against his estate than the holder of simple contract obligations. (See ADMINISTRATION.) Although consideration is not necessary to give legal validity to a specialty, courts of equity will not grant their peculiar form of relief by way of specific performance to one who has not given consideration for the specialty obligation which he holds. See SPECIFIC PERFORMANCE; TRUST; USE.

It was formerly held that a corporation could contract only by specialty under its corporate seal. This, however, is no longer the rule in the United States, where it is held that a corporation may enter into contracts by its proper officers without the use of its seal, wherever a private individual might so contract. For further information consult such titles as CONTRACT; BOND; DEED; COVENANT; SEAL; EQUITY; CONSIDERATION, etc., and consult the authorities referred to under CONTRACT and SEAL.

SPECIAL VERDICT. A verdict in which the jury find merely the facts as proved by the evidence and do not apply the law to the facts, but leave it to the discretion of the court as to whether in its opinion the plaintiff or defendant shall succeed. The matter is now regulated by statute in most jurisdictions. In some States such a verdict is said to be 'subject to opinion.' See JURY; VERDICT.

SPECIE PAYMENTS (abbreviation of ML. *in specie*, in coin, Lat. in kind, from *in*, in, and *specie*, abl. sg. of *species*, kind), SUSPENSION AND RESUMPTION OF. The circulating medium of modern States consists both of metallic money and of credit money, issued either by banks or by the Government, which in normal times is convertible into metallic money on demand. (See MONEY.) But there are few States which have not passed through crises when the metallic covering of its paper money has become too scanty, and the convertibility of the paper has been suspended. Such a general suspension of specie payments is legalized either directly or tacitly by the Government. The issues of credit money are usually in such close relation with the Government that such an action must receive governmental sanction. The effect of suspension is to relax the restrictions upon the issue of paper money, and the general result is a redundancy of such money and its depreciation. This does not happen immediately, as the action generally leads to the hoarding or export of such metallic money as remains in the country, thus causing a void in the monetary circulation which the issues of paper money do not at once fill. The extent of the depreciation of the paper money usually depends upon the facility with which it is issued. On the suspension of specie payments by the Bank of England in 1797, the effect of increased note issues was only gradually felt, for the bank followed in the main a conservative policy. This was true also of the suspension by the Bank of France in 1870. On the other hand, during the suspension of specie payments in the United States in 1813, the banks issued notes recklessly and the depreciation was considerable. When the banks of the United States, on December 30, 1861, again suspended specie payments and the Government followed their example, the large issues of legal-tender notes caused a like result.

The resumption of specie payments is usually a slow and tedious process. The first step toward resumption is the gradual restriction of the paper issues; in the case of Government notes redemption is accomplished by the aid of taxation, while in the case of bank notes resumption occurs through pressure of the Government by taxation of excessive issues or by other means. The second step is to procure a fund of metallic money sufficient to meet probable demands for redemption. To effect this end the Government credit is usually called into requisition. The resumption of specie payments restores the convertibility of credit money, but does not destroy the money itself. It provides for the redemption in metallic money of such sums as may be presented, but not the compulsory redemption of the whole.

The financial history of the United States in the years succeeding the Civil War illustrates the process of resumption. The close of that war found the monetary circulation of the United States exclusively paper, Government issues, State bank notes, and national bank notes. Specie payments had been suspended since 1861, and a return to them seemed the first duty of financial policy. The fear of a contraction of the currency, however, made the first steps in this direction hesitating and uncertain. The gradual redemption of the United States notes, which in January, 1864, had stood at $449,000,000, undertaken under the law of April 12, 1866, had been arrested in February, 1868, when the amount stood at $356,000,000. In the financial troubles of 1873, the Secretary of the Treasury, upon somewhat dubious authority, had increased the volume, but by act of June 20, 1874, Congress stopped this increase when the issue had reached $382,000,000. The task of resumption was earnestly taken in hand early in 1875, when an act was passed providing for resumption on January 1, 1879. In its several provisions and as a whole the act was in the following years the object of repeated attack, but all efforts to repeal it failed. This law removed the limitation which had heretofore rested upon the aggregate issue of national bank notes. It provided, moreover, that as new notes were issued, United States notes to the extent of 80 per cent. of the new bank issues should be retired and canceled. Under this provision the volume of the legal-tender notes diminished by May 31, 1878, when this provision was repealed, to $345,000,000. The resumption act further authorized the Secretary of the Treasury, by the accumulation of surplus revenues and by the sale of bonds, to collect a supply of gold wherewith to resume. The amount to be collected and the amount to be maintained after resumption became a fact were left to his discretion. By the sale of bonds at favorable opportunities the Secretary had on hand on the day of resumption $140,000,000 in gold. As the day approached, the growing strength of the Treasury had produced a diminishing premium on gold, and the first of January, 1879, passed off without the dreaded shock. Only a small amount of paper money was actually presented for payment. See MONEY.

SPECIES. See CLASSIFICATION; EVOLUTION.

SPECIFICATION. In the law of patents, a technical description of the invention mentioned in an application for a patent, and when used without the word 'claim' it includes the claims or arguments of the inventor as to the novelty, usefulness, etc., of his invention. See PATENT, and the authorities there referred to.

SPECIFIC GRAVITY (ML. *specificus*, specific, particular, from Lat. *species*, kind). The ratio between the weights of equal volumes of any substance and of some other, chosen as a standard. For solids and liquids the standard substance is water, for gases, air, or sometimes hydrogen. Since the volume of a given weight of a substance changes with temperature, it is necessary for exact determinations that the standard selected should be at a certain fixed temperature. Thus specific gravity is not the ratio of an equal volume of a given substance to water at any temperature, but only at the standard temperature which is selected, as described below. Likewise for a specific gravity determination to be of value the temperature of the substance at the time of making the measurement should be given. For gases not only the temperature, but the pressure must be mentioned. For many purposes the term density has replaced specific gravity, but the two are not synonymous. The density of a substance (at a given pressure and temperature) is the mass of that substance in a unit volume, provided it is homogeneous; otherwise it is the mass of a volume so small as to be homogeneous, divided by the volume. Thus density is an absolute term, expressing the quantity of a certain kind of matter in a given space, while specific gravity is merely relative, being in fact the ratio of the density of the substance to the density of the standard. The specific gravity of a gas or vapor is usually referred to air at the same pressure and temperature as that of the gas, but also frequently to hydrogen under like conditions. In terms of the latter it is equal to half the molecular weight of the gas. See MOLECULES—MOLECULAR WEIGHTS.

The specific gravity of solids and liquids is variously referred to water at 4° C., 15° C., or 62° F., and sometimes still other temperatures. Specific gravities on these scales are respectively as 1.000045, 1.000913, 1.001180—the density of water at these temperatures being inversely as these numbers. The difference is obviously not of importance except for purposes of extreme accuracy. Density in the metric system is measured in grams per cubic centimeter (kilograms per liter). If a liter of water at 4° C. weighed exactly a kilogram, as was intended, the density of water at this temperature would be one and metric density and specific gravity referred to water at 4° C. would be identical. The density of water at this temperature is actually .999955, so that specific gravity referred to water at 4° is equal to density × 1.000045. Specific gravity referred to air at 0° C. and 76 centimeters pressure is equal to metric density divided by the density of air = .001293.

On the English system density is variously expressed in pounds per cubic foot, pounds per cubic inch, grains per cubic inch. To reduce specific gravity referred to water at 62° F. to density on these scales multiply by 62.3546, .0360848, 252.593, respectively.

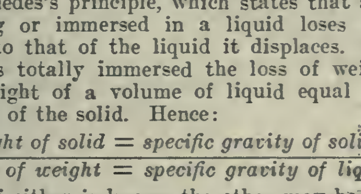
Methods of Measurement. I. Density. Two courses may be pursued to determine the density of a substance: (1) Weigh a portion of it and measure its volume; (2) determine its specific gravity referred to a substance of known density. For approximate purposes the former is best, particularly in the case of solids of regular shape. To attain a high degree of accuracy, however, is difficult, since the direct determination of volume is subject to many errors. Hence the density of most substances is found by determining, by one of the methods below, its specific gravity referred to water or hydrogen, the density of each of these having been carefully investigated. The density of water is found by observing the loss in weight of a solid of regular shape when immersed in water, some of the best results being obtained with a glass cube whose exact dimensions were found by a method based on the interference of light.

II. Specific Gravity of Solids and Liquids. Most of the methods given below are based on Archimedes's principle, which states that a solid floating or immersed in a liquid loses weight equal to that of the liquid it displaces. Hence if it is totally immersed the loss of weight is the weight of a volume of liquid equal to the volume of the solid. Hence:

Weight of solid = specific gravity of solid.
Loss of weight = specific gravity of liquid.

Thus if either is known the other may be found. For exact purposes the temperature of the liquid must be known, weighings in air must be corrected for the buoyancy of the latter, and the solid must be supported in the liquid so that only a single fine wire cuts the surface. Air bubbles are also a serious source of error, and for this reason water when used should be freely distilled or boiled.

(A) Hydrostatic Balance. A chemical balance (see **Balance**) so arranged that a vessel of liquid may be placed under one end of the beam without resting on the pan. This is done by replacing the ordinary pan by a shorter (Fig. *a*) or else by resting the vessel on a bridge (Fig. *b*) over the pan.

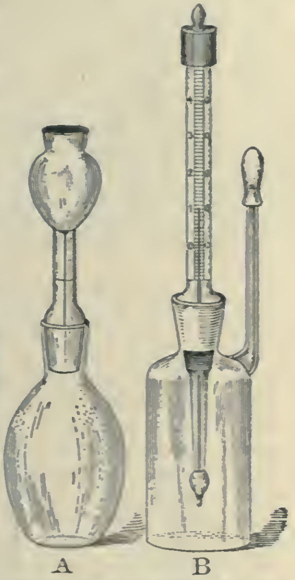


BRIDGE AND PAN FOR USE WITH BALANCE.

The solid is weighed in air, then suspended from a hook on the pan or pan support by a wire of known weight, so that it hangs totally submerged in the vessel of liquid, and again weighed.

(B) Jolly Balance. A large delicate spiral spring supported by a vertical rod of adjustable length and carrying at the bottom two pans, one below the other. For description see **Jolly Balance**.

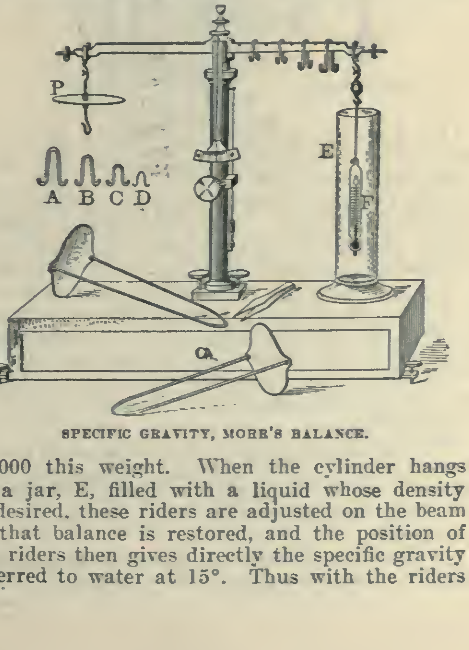
(C) Specific Gravity Bottle. A light glass flask with a ground stopper generally pierced with a fine hole so that it may be completely filled. The flask is weighed empty, then full of water. Knowing the density of water, the internal volume is calculated. The bottle may now be filled with a liquid of unknown density and weighed and the density calculated. Or a weighed amount of solid in small pieces may be put in the bottle, which is then filled up with water and weighed. The difference between the weight of the solid plus that of the bottle entirely filled with water and the weight observed is the weight of water displaced by the solid. This is the most accurate method for liquids and solids in small bits.



SPECIFIC GRAVITY BOTTLE OR PYKNOMETER.

A, simple form; B, with thermometer.

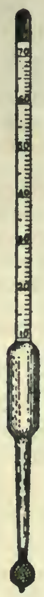
(D) Mohr's Balance. A balance beam divided into tenths carries suspended from one end by a platinum wire a glass cylinder, F, almost solid. On the other end is a counterpoise, P, balancing the cylinder in air. Riders, A, B, C, D, are provided of weight equal to the loss of weight of the cylinder in water at 15° C. and of 1-10, 1-100, 1-1000 this weight. When the cylinder hangs in a jar, E, filled with a liquid whose density is desired, these riders are adjusted on the beam so that balance is restored, and the position of the riders then gives directly the specific gravity referred to water at 15°. Thus with the riders



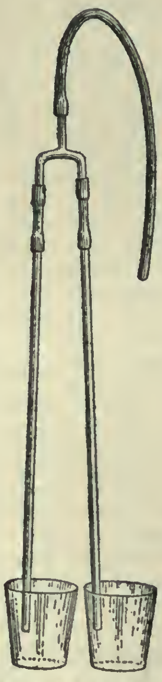
SPECIFIC GRAVITY, MOHR'S BALANCE.

as in the figure the specific gravity would be .8642. The glass cylinder carries a small thermometer, and the temperature should be adjusted to about 15°. The method is extremely convenient to three places of decimals. The fourth requires many corrections.

(E) HYDROMETER. A long hollow glass cylinder or 'stem' weighted at one end by a bulb containing shot or mercury so that it will float upright in a liquid. The stem is graduated and the specific gravity is given by the mark to which it sinks, read *through* the liquid. The graduations are sometimes in specific gravity or density, but often according to established arbitrary scales, those of Beaumé and Twaddell being best known. Instruments are made of different styles for milk, spirits, oil, acids, etc. See HYDROMETER.



HYDROMETER.



APPARATUS FOR METHOD OF BALANCING COLUMNS.

(F) BALANCING COLUMNS. A tube such as that shown is supported vertically in two jars containing two liquids. These are drawn up into the tubes by suction on the tube at the top, which is then closed. The height of the liquids in the tubes above their surfaces in the tumbler are inversely as their densities. If the liquids do not mix a simple inverted U tube may be used, one liquid being poured into each arm. If tubes less than half an inch in diameter are used the liquids should be drawn up only a little, heights measured, then as far as possible, and the ratio of the *increase* in lengths of the columns taken.

(G) The specific gravity of a solid lighter than water is found by either the hydrostatic or Jolly's balance, a weight being attached sufficient to sink it. This weight should hang under water throughout.

III. SPECIFIC GRAVITY OF GASES. BUNSEN'S METHOD. The rate of effusion of a gas, i.e. the volume which escapes per second through a very small opening, is for a given opening and difference of pressure inside and out, inversely as the square root of its density.

Near the top of a long vertical glass tube is a partition consisting of a disk of platinum pierced by a hole about .0005 inch in diameter. Above this the tube is closed by a ground stopper. The tube is filled with gas and plunged into a deep bath containing mercury and adjusted until a glass float carried by the mercury stands at a fixed level. The stopper is removed and the time required for the float to rise to another fixed level as the mercury drives out the gas is measured. The experiment is then repeated in exactly the same manner with the standard gas. The ratio of the times observed is the square of the ratio of the densities, i.e. the specific gravity of the unknown gas referred to the standard gas. See MOLECULES—MOLECULAR WEIGHTS.

For tables of density and specific gravity, consult *Smithsonian Physical Tables* (Washington, 1896). Methods of determining the specific gravity of a substance will be found in any standard text-book on physics.

SPECIFIC HEAT. See HEAT.

SPECIFIC LEGACY. See LEGACY.

SPECIFIC PERFORMANCE. A technical legal term employed to denote the equitable doctrine and rules under which a court may compel a party who has refused to perform his part of an agreement to carry it out according to its terms. In an action at law for the breach of a contract the only relief possible is damages, but as money is not always an adequate compensation for the loss which may be suffered, the courts of equity will in certain cases decree a specific or actual performance of the terms of the contract. It lies in the discretion of the court whether or not to grant this relief, but precedents must be followed as a guide. In general, to obtain a decree of specific performance the plaintiff must satisfy the court that the remedy at law is entirely inadequate; that there was a valid, fair, and reasonable contract between the parties; and that he has done nothing inequitable on his part. It is a general rule to grant specific performance of contracts for the conveyance of real estate. It is only in exceptional cases that the relief will be granted in cases of contracts to convey personal property, and then only when the article is unique in its character and practically unobtainable elsewhere, such as a rare picture which could not be duplicated. In a few cases specific performance of a contract to do some act, such as build a structure, will be decreed. For example, where a railroad agreed to build an ornamental bridge over a private roadway in consideration of the right of way through a man's premises, the court decreed that the company should construct the bridge according to the terms of their contract. Consult Fry, *On Specific Performance.* See also CONTRACT, and authorities there referred to.

SPECTACLED BEAR (so called from the marking on the face). The small bear of the northern Andes. See BEAR.

SPECTACLES (Lat. *spectaculum*, show, from *spectare*, to behold, from *specere*, to see; connected with Gk. *σκέπτεσθαι*, *skeptesthai*, to look, Skt. *spaś*, to see, OHG. *spehōn*, Ger. *spähen*, to spy). A device for the purpose of aiding the sight when impaired by age or otherwise. (See SIGHT, DEFECTS OF.) They were invented during the thirteenth century. The credit is attributed by some to Alessandro di Spina, a Florentine monk, and by others to Roger Bacon. The lenses are nearly always made of the best optical glass, and by the best makers are ground with extreme care. Lenses may be mounted in either eye-glass or spectacle frames, care being taken that the centre of the lens is opposite the pupil and that the glasses are tilted at a proper angle for reading or distance as desired. When separate lenses are required for these purposes the so-called bifocal glasses may be used. They are made by cementing a small strong lens upon the lower part of the other, so that when the eyes are lowered, as in reading, the line of vision passes through that portion. Lenses are now numbered, with one of a focus of one meter as a unit, known as one diopter. One with four times that strength has a focal distance of one-quarter of a meter and is known as 4 D. (diopters). Convex spherical lenses are used in hypermetropia, presbyopia, and after removal of the crystalline lens for cataract. Concave spherical lenses are employed in myopia. If astigmatism exists a cylindrical lens, either concave or convex as required, is used. As the astigmatism may be in only one meridian, while that at right angles to it is normal, or as there may be either hyperopic or myopic astigmatism in both, or hyperopic in one and myopic in the other, it is sometimes necessary to employ cross-cylinder lenses, a combination of two cylinders with their axes at right angles to each other. Prismatic glasses are used in cases with weakness of ocular muscles, one being chosen which will make the images seen by the two eyes coincide. Combinations of cylindrical and spherical lenses and prisms are needed when errors of refraction or accommodation are combined with astigmatism and muscular weakness, which cause double vision.

SPECTATOR, THE. (1) A famous periodical published daily in London from March 1, 1711, to December 6, 1712, to which Addison and Steele were the principal contributors. Addison wrote 274 papers, Steele 240. Addison's essays, almost perfect in form, fixed a new standard in manners, morals, and taste, whose influence lasted for years. The *Spectator* was revived in 1714, when 80 numbers were issued, of which Addison contributed 24.

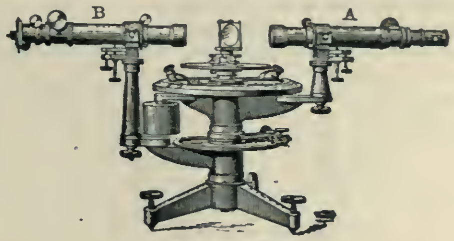
(2) A London weekly periodical, founded in 1828, devoted at first solely to literature and social questions; politics were, however, introduced and it became a strong advocate of the Reform Bill. The first editor was Robert S. Rintoul, who continued in office till his death in 1858. John Stuart Mill was a member of the staff. From 1861 to 1897 it was edited by Richard Holt Hutton, who wielded great influence in literature and theology, while his partner, Meredith Townsend, managed politics, which were liberal until 1886. He was succeeded as editor and owner by John St. Loe Strachey, the political attitude of the paper being Liberal-Unionist.

SPECTRAL BAT. See BAT and Colored Plate of MAMMALIA.

SPECTRE (from Lat. *spectrum*, appearance, image, apparition). A fanciful book-name for one of the small lemurine animals of the Malayan region, the tarsier, on account of its gaunt form, enormous eyes and nocturnal appearance. Many superstitious notions attach to these and related animals (see LORIS) among the natives of the East Indies, causing them to be regarded with more dread than curiosity. Their nocturnal and irregular appearance have caused certain bats and small owls also to be called 'spectral.'

SPECTROGRAPH (from Lat. *spectrum*, appearance, image, apparition, from *specere*, to see + Gk. *γράφειν*, *graphein*, to write). A particular form of spectroscope (q.v.) in which the apparatus to record the radiations is a photographic plate. The apparatus, then, consists of a collimator, a prism or a grating, and a telescope in which the eyepiece is replaced by a photographic camera.

SPECTROMETER (from Lat. *spectrum*, appearance, image, apparition + Gk. *μέτρον*, *metron*, measure). An instrument especially designed to determine the index of refraction of transparent bodies. The ordinary type of instrument is illustrated in the cut, and, as shown, consists essentially of two arms which are movable around an axis carrying a platform on which rests a prism of the substance to be investigated. One of the arms carries a telescope, A, while the other supports what is known as the 'collimator,' B. This consists of a tube at one end of which is a slit made by two movable parallel edges, and at its other end is a lens so placed that the slit is in its principal focus. If a source of light, for instance a sodium flame, is placed in front of the slit, a beam of parallel light will proceed from the collimator lens, fall upon the prism, suffer deviation, enter the telescope and be focused by the objective on the cross-hairs of the eyepiece. The angles made between the telescope and collimator may be read on a scale attached to the platform of the instrument.



SPECTROMETER.

To determine the index of refraction of a substance in the form of a prism, for radiations of a given wave length, it is necessary to know: First, the angle of the prism, that is, the angle made between the two plane faces of the prism; second, the angle of minimum deviation for the given radiations. Both these quantities can be measured with the spectrometer, care being taken to have the axes of the telescope and collimator perpendicular to the axis of the instrument, and the edge of the prism parallel to it. The following formula then gives the index of refraction, in which A represents the angle of the prism and D the angle of minimum deviation:

$$\text{Index of refraction } n = \frac{\sin \frac{A+D}{2}}{\sin \frac{A}{2}}$$

SPECTRO-PHOTOMETRY (from Lat. *spectrum,* appearance, image, apparition, + Gk. *φῶς, phōs,* light + *-μετρία, -metria,* measurement, from *μέτρον, metron,* measure), or SPECTRAL PHOTOMETRY (see also SPECTROSCOPY and PHOTOMETRY). The study of the relative intensities of light of various colors from the same source or from different sources. Not only, as an ordinary photometry, may the relative intensities of two sources of white light or of monochromatic light be compared, but spectro-photometers are provided with dispersing prisms so arranged that the various colors of one beam of white light may be compared with the corresponding colors of another. The general method is to bring some of the light from one source and some from the other source side by side in the same field of view, and by suitable means to alter the intensity of either beam (or of both) in a known degree until a 'match' or photometric equality is secured; this condition of equality being determined by the vanishing of the line of separation between the two portions of the field of view, illuminated respectively by the two sources to be compared. There is also a so-called 'method of contrast' devised by Lummer and Brodhun.

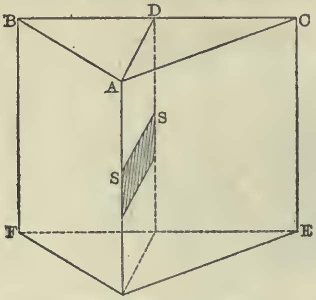


FIG. 1. DOUBLE PRISM, BRACE'S SPECTRO-PHOTOMETER.

The most recent and efficient form of spectrophotometer is that devised by Professor Brace of the University of Nebraska. It consists essentially (see Fig. 1) of a double prism P with a narrow silvered strip SS on the face AD of the right half. T and T′ are two similar collimators symmetrically situated with respect to the prism and provided with adjustable slits through which the light from the two sources enters the optical system of the photometer. The amount of light entering the system through either collimator depends upon the width of its slits. The width of one slit, say T, is, after the initial adjustments of the instrument, kept fixed throughout any one series of observations, while the width of the other collimator-slit (T′) may be altered at will to secure a match in intensity of the two beams. Light of the same wave-length (i.e. of the same color) is thus brought by direct transmission from the collimator T, and after reflection at the silver strip from T′, to the same focus in the observing telescope R. When the eyepiece is removed and the prism viewed through a slit in the focal plane of R, the eye sees three fields (as in Fig. 3), the central one, ABCD illuminated by light from the right collimator, T′, and the upper and lower ones, ACF and BDG, by light from the left collimator, T. The fields meet in the sharp edges of the silver strip. A match in intensity is secured by altering the width of the slit T′, which is controlled by an accurately turned screw carrying a graduated drum so that the width of T′ can be altered at will by a known amount and thus the total amount of light passing through this collimator can be changed as desired. The intensities of two beams will be inversely proportional to the slit-widths required for a match between them and the light coming through the fixed slit T. (This simple relation is not quite true; the deviations from it are treated in the articles cited below.) The amount of light coming through the collimator with the fixed slit may be altered without changing the width of the slit by means of a rotating disk mounted directly in front of the fixed slit, so as to cut off the light during a certain fraction of each revolution. This device greatly increases the range of the instrument.

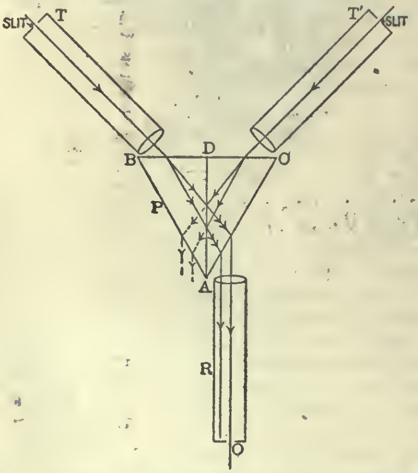


FIG. 2. OPTICAL SYSTEM, BRACE'S SPECTRO-PHOTOMETER.

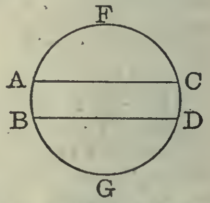


FIG. 3. FIELD VIEW OF SPECTRO-PHOTOMETER.

By turning the telescope R through a small angle the various colors of the spectrum may be brought into the field of view in succession, and the relative intensities of the two sources for each color determined.

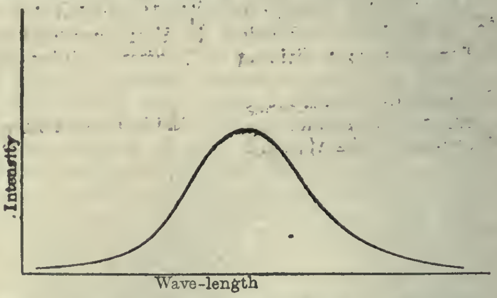


FIG. 4. INTENSITY CURVE, INCANDESCENT BODY GENERALIZED.

According to the measurements of Fraunhofer, Koenig, Brodhun, and others, the distribution of intensity in the spectrum of the sun and other incandescent bodies corresponds roughly to the curve in the accompanying diagram, Fig. 4. A comparison of the intensity-distribution in the spectra of the electric incandescent and arc lights with that of the sun gives the following results, calling unity the relative intensity of each with respect to the sun for sodium light (D line):

WAVE-LENGTH	$\frac{\text{Inc.}}{\text{sun}}$	$\frac{\text{Arc}}{\text{sun}}$
800 $\mu\mu$	11.86	1.67
Line A	4.88	1.37
" B	2.68	1.28
" C	1.25	0.97
" D	1.00	1.00
" E	0.38	0.77
" F	0.17	0.56
" G	0.10	0.83
" H	0.05	1.21

The reflecting power of a polished plane surface or the absorbing power of a thin film or plate of an absorbing medium can be determined for various colors by means of a spectro-photometer, by placing the mirror or the thin film in front of the adjustable slit T′, and comparing the intensity of the light after reflection or transmission with the intensity of the light coming directly to the other collimator of the photometer. For example, a polished silver surface reflects 95 per cent. of the red light falling on it normally, while for the blue only 60 per cent. is reflected. A mirror of solid cyanine reflects 15 per cent. of the orange, 2 per cent. of the green, and 6 per cent. of the violet.

Bibliography. The methods of observation and of calibration, and the sources of error are fully treated in the following articles: Lummer und Brodhun, *Zeitschrift für Instrumentenkunde*, 1889, p. 42, and 1892, p. 137 (Berlin); Murphy, *Astro-Physical Journal*, 1897, p. 1 (Chicago); Brace, *Philosophical Magazine*, 1899, p. 420 (London), and *Astro-Physical Journal*, 1900, p. 6 (Chicago); Capps, *Astro-Physical Journal*, 1900, p. 25 (Chicago); Tuckermann, *Astro-Physical Journal*, 1902, p. 145 (Chicago).

SPECTROSCOPE (from Lat. *spectrum*, appearance, image, apparition + Gk. σκοπεῖν, *skopein*, to view). An instrument designed to investigate the nature of the radiations emitted by various sources of 'light,' it being understood that this term includes *all* waves in the ether, although only those within certain narrow limits of wave-length affect the sense of sight. It is shown in the article on Spectroscopy that radiations are being sent off in the ether from all natural bodies, and that these are in the form of waves of different wave-length. When these waves pass through a spectroscope they are dispersed in such a way that the waves of certain wave-length are brought to focus at a point different from that to which waves of a different wave-length are brought. In this way the radiations from any source are analyzed and spread out in what is called a 'spectrum.' The essential features of a spectroscope are then: First, a slit, or extremely small source of radiation; second, some means of producing dispersion; third, a lens or other means of focusing the radiations at the eyepiece of a telescope, upon a screen, or upon some suitable recording instrument. If the radiations are of such a nature as to affect a photographic plate, that is, if they are in the ultra-violet or in the visible portion of the spectrum, methods of photography may be used in connection with the spectroscope. (See Spectrograph.) If the radiations are in the infra-red, that is, if the wave-lengths are so long that they do not affect the sense of sight, instruments must be used which are sensitive to such radiations; for instance, a thermometer, bolometer, radio-micrometer, radiometer, or other heat-registering device. It has been found that if a plate of glass covered with some phosphorescent substance, such as Balmain's paint, is exposed to light and then carried into a darkened room, it will continue to be luminous for some time; but, if exposed in a spectroscope to infra-red radiations, the phosphorescence at those points reached by the radiations is destroyed. This furnishes a method, therefore, for the study of these long waves.

As ordinarily constructed, a spectroscope has the same general appearance as a spectrometer (q.v.). There is, however, in addition, in case prisms are used to produce dispersion, some auxiliary apparatus for the purpose of enabling the observer to record numerically the positions occupied by the waves which he is observing, in comparison with other waves. One method which is in common use is to attach to the instrument a tube containing at one end a transparent scale, and at its other end a lens, the tube itself being so placed that when the scale is illuminated by a lamp the waves proceeding from it fall upon the last face of the last prism and are *reflected* in such a manner as to be brought to focus in the same plane as are the radiations under investigation. By this means there is produced across the spectrum a series of lines regularly spaced and numbered, and the position of any radiation can be recorded.

Various means are used to produce dispersion, but the two methods most generally adopted are (1) to interpose a prism or train of prisms between the collimator and telescope, or (2) to allow the light from the collimator to fall upon a diffraction grating (q.v.). The dispersing action of a prism and of a grating has been explained before (see Diffraction and Diffraction Gratings); but there are several important differences between the spectra obtained by these two instruments. Prismatic spectra are said to be 'irrational' because there is no simple relation between the material and shape of the prism and the dispersion produced by it; and, further, because prisms of the same shape and size produce quite different spectra, in the sense that the relative deviations of the same waves differ widely when different prisms are used. See Dispersion.

The spectra produced by plane gratings, on the other hand, obey a definite law, there being an extremely simple relation between the constants of the grating and the deviation of a given train of waves, which is independent of the material of the grating, and which enables one by simple means to measure the wave-length of the radiations being studied. If a concave grating is used in place of a plane one, as was first done by Rowland in 1882, it is not necessary to have lenses in the spectroscope, the essential parts of the instrument then being simply a slit, a grating, and some receiving apparatus, such as a photographic plate. There is a further advantage in the use of a concave grating (which may also be obtained with a plane grating if suitably adjusted) if this instrument is used in the standard manner, in the fact that the spectra produced are of such a kind that the distances along the photographic plate are proportional to differences in wave-length of the waves which are thus recorded. A spectrum of this kind is said to be 'normal.'

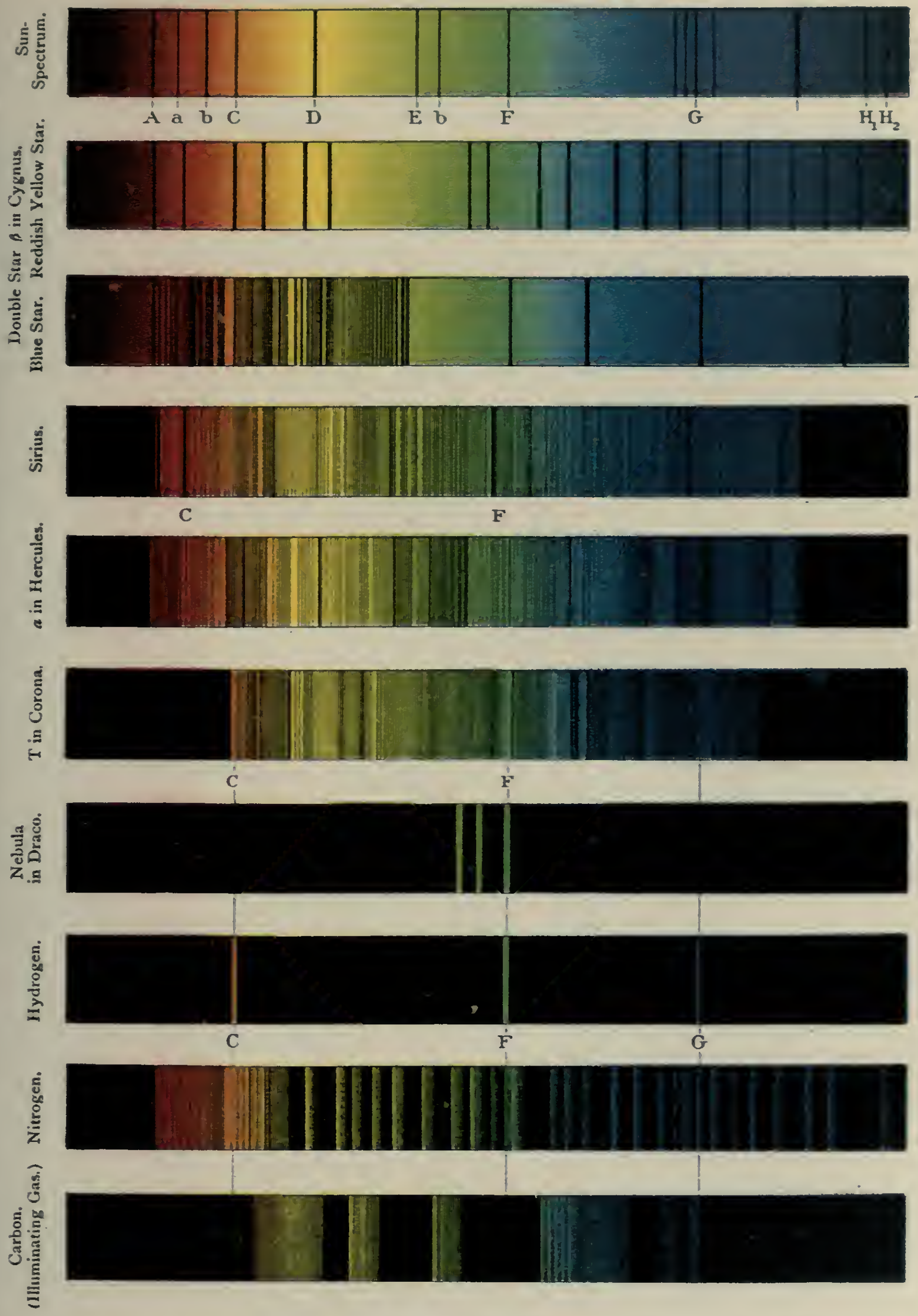
SPECTROSCOPY. The science which deals with the methods of production of the spectra by various sources of light (or of waves in the ether) and with their study and interpretation. Newton, in 1672, was the first to observe that if sunlight entering a darkened room through a small opening were allowed to fall upon a prism a spectrum was produced, owing to the fact that waves characteristic of different colors suffer different deviations by the prism, and that, therefore, the components of white light were separated. (See DISPERSION.) Newton made no observations except upon the visible portions of the spectrum; but in the year 1800 F. W. Herschel observed that the spectrum continued beyond the red, as was shown by holding a thermometer in that position; and in 1801 J. W. Ritter proved the existence of the ultra-violet light by showing that silver chloride was affected not alone by the violet portion of the spectrum, but beyond. In 1802 Wollaston made the discovery that the solar spectrum was not continuous, but was interrupted by certain dark lines, using in his experiments a slit and a prism with its edge parallel to the slit. It is remarkable that Newton did not make this same discovery in his investigation on the spectrum of the sun, because he also at times used a slit in the same manner as did Wollaston. The most important investigation, however, on the solar spectrum, one which in fact serves as the foundation of the science of spectroscopy, was that of Fraunhofer beginning in the year 1814. Fraunhofer (q.v.) was the inventor of the diffraction grating (q.v.), and was the first to measure accurately the wave-lengths of light waves. By using both grating and prism spectroscopes he showed that there were numerous dark lines in the solar spectrum, to the strongest of which he gave certain names in the form of letters, A, B, C, etc. He studied, further, the radiations from certain of the stars and from certain sources of light such as flames, etc. He made the important observation that the position occupied in the solar spectrum by the dark D lines is identical with that occupied by the bright yellow line observed in the spectra of all flames. His whole work was epoch-making.

Herschel was the first to investigate the absorption spectra produced by various bodies, that is, to study the effect of interposing between the source of light and the spectroscope a substance which absorbs certain radiations. The next great step was made by Kirchhoff, who showed from theoretical considerations that the emission spectrum and absorption spectrum of a substance should be the same at a definite temperature, and that as the temperature changed the intensity of the spectra would vary. In this way Kirchhoff was able to explain the dark lines in the solar spectrum as due to an absorbing layer of metallic vapors forming an atmosphere around the white-hot central portion of the sun, which was supposed to emit a continuous spectrum. In collaboration with Bunsen he then undertook a careful study of the spectra of various substances and founded the science of spectrum analysis. The explanation of the fact that absorption spectra and emission spectra are identical was first given by Stokes many years before Kirchhoff's statement, and Balfour Stewart had also arrived at the same idea. From the day of Kirchhoff up to the present time all branches of spectroscopy have been pursued most vigorously, the most important discovery being the principle of the concave grating, made by Rowland in the year 1882, which is discussed under SPECTROSCOPE, and under DIFFRACTION AND DIFFRACTION GRATINGS.

There are many methods of making vapors luminous, among which it may be sufficient to name the flame, the electric arc, the electric spark. The spectra produced in these various ways have received the names of flame spectra, arc spectra, etc. The standard method of producing flame spectra is to hold a portion of the substance to be investigated or a salt of the substance in the Bunsen flame until it is vaporized, and thus the vapor is raised to the temperature of the flame, and in general becomes luminous. Other flames than that of the Bunsen burner may be used. Extremely minute amounts of the substance may be recognized in this way, as has been shown by Kirchhoff and Bunsen. They state that one fourteen-millionth of a milligram of sodium can be recognized in the Bunsen flame; one sixty-thousandth of lithium; one fifty-thousandth of a milligram of calcium, etc. To produce arc spectra it is customary to bore out a small opening in a carbon rod, fill this with some salt of the substance to be investigated, and then use it as the positive pole in the ordinary electric arc. By this means a high temperature is produced, namely about 4000° Centigrade, and the vapor of the substance is made luminous. To produce the spark spectrum numberless methods are in use. Among these it may be sufficient to mention two. If the electric spark produced by an induction coil or transformer is made to pass between solid electrodes made up of the substance to be studied, they will be vaporized and the vapor will be luminous. If a gas, for instance nitrogen or hydrogen, be inclosed in a glass bulb into which enter two metal wires to serve as electrodes, and if the pressure be made sufficiently low, a spark can be made to pass through the remaining gas. Changes in the pressure, in the electrical constants of the circuit, etc., produce alterations in the spectra. The main distinction between the flame spectra and arc spectra is one of temperature, but so little is known in regard to the mechanism of a spark that no conclusions can be drawn with certainty. Beyond a doubt the spectra produced in the arc are due in the main to the high temperature of the arc, whereas the cause of the production of spectra in the spark is probably not a temperature effect at all, but something concerned with the transformation of electric energy.

The means of producing spectra are discussed under the head of SPECTROSCOPE (q.v.). Prisms or gratings are used for this purpose. The accepted method at present for measuring wave-lengths in the spectrum of any substance is to photograph on the same plate with these lines the spectrum of some substance whose lines are known and then to obtain the desired quantities by a method of interpolation. The spectrum of iron is as a rule used to give the comparison lines.

SPECTRUM



SPECTRA OF THE FIXED STARS AND NEBULAE COMPARED WITH THE SUN-SPECTRUM AND OTHER SPECTRA

It has been found as a result of careful observation that, with one or two doubtful exceptions, the spectrum of a solid or liquid is always continuous; and within recent years attempts have been made successfully to express in mathematical form the connection between the temperature of the solid and the distribution of energy in its spectrum as a function of its wave-length. These laws have been deduced theoretically and verified by experiment. It has been found further that the spectrum of a gas when rendered luminous is in all cases discontinuous, although occasionally there is a faint continuous background. This fact in regard to gaseous spectra is what would be expected from the kinetic theory. The exact origin of the spectrum is in general inside the atom; but the connection between the parts of the atom and the ether in which waves are produced is not known. The spectra of compounds when rendered luminous at a temperature not sufficient to decompose definitely the substance have been studied with care, and many interesting facts have been discovered. It has been shown that all gases will produce under varying conditions different spectra, but the reason for this is by no means clear. There are at least three different spectra of hydrogen, many of oxygen, many of argon, etc. The influence of pressure, of temperature, and of the electrical conditions is marked; and these subjects form at present one of the most important fields of research in spectroscopy.

The spectrum of a gas is modified if the source of light is either approaching or receding from the spectroscope, as, for instance, in the case of a star with a motion toward or away from the earth. It is owing to this fact that one is able, by a comparison of the spectra of certain stars with spectra produced here on the earth, to calculate the motion of the stars in the line of sight. See DOPPLER'S PRINCIPLE.

A careful comparison of the lines in the spectrum of any one gas or vapor, and of the spectra of different vapors, has led to the discovery of several simple mathematical laws connecting them. Thus the lines in the ordinary hydrogen spectrum have such wave-lengths that they can be expressed in a mathematical formula which is known as Balmer's law. This can be expressed as follows: $\lambda = h \frac{m^2}{m^2 - 4}$. where λ represents the wave-lengths, m has in succession the values 3, 4, 5, etc., and h is a constant whose value is approximately 3647.20.

A relation similar to this of Balmer's has been shown by Kayser and Runge to apply to most of the lines in the spectra of the alkalies and the alkaline earths. Another law has been found to express most accurately the distribution of the lines in the well-known bands which are produced by carbon, nitrogen, and other substances. Laws have been found also connecting the spectra produced by different substances, in those cases where these substances are related chemically.

In the year 1896 Zeeman discovered that a source of light if placed in a magnetic field and viewed either along the lines of force or at right angles to them had its spectrum changed by the resolution of its lines into several components. This fact has a most important bearing upon theories of matter and serves to prove that the vibrations in the ether are produced by the vibrations inside the atom of minute electrical charges which have been called electrons. A recent investigation of the Zeeman effect by Runge has shown that the components of these spectrum lines produced by the magnetic field also obey certain mathematical laws.

A most important branch of spectroscopy is the study of the solar spectrum as we observe it on the earth. A few of the absorption lines are due to the fact that the waves coming from the sun pass through the atmosphere of the earth, and, therefore, suffer absorption owing to the water vapor and oxygen in it. The 'rain band' is due to the presence of the former. The other lines are, as explained above, caused by the absorption in the atmosphere of the sun itself. The interior portion of the sun, which is at a high temperature, emits a continuous spectrum, but, owing to the presence in the atmosphere of the sun of metallic vapors at a temperature less than that of the interior, there is absorption, and thus the solar spectrum is a continuous one crossed by dark lines. There are radiations also coming to us from the outer portions of the sun, the so-called chromosphere and corona; but these are not easily observed, except at times of solar eclipses. Most of the solar lines can be identified with the spectra of known substances on the earth; for instance, sodium, iron, carbon, etc., are known to be in the sun. It may be stated in general that if the earth were raised to a temperature as high as that of the sun its spectrum as seen at a distance would be practically identical with that of the sun as we see it.

A careful study has been made of the spectra of the various stars, and attempts have been made with more or less success to group the stars in certain classes according to their spectra, the idea being that some knowledge might be obtained in regard to the evolution of the stars and their present stage in this progress. Consult Schuster, "The Evolution of Solar Stars," *Astrophysical Journal*, April, 1893.

The wave-lengths of a few of the important Fraunhofer lines in the solar spectrum, as measured by Professor Rowland, are as follows:

B	6870.186 $\times 10^{-8}$ Cm.	F	4861.527 $\times 10^{-8}$ Cm.
C	6563.054 "	G	4308.081 "
D_1	5896.357 "		4307.907 "
D_2	5890.186 "	H	3968.625 "
E_1	5270.495 "	K	3933.825 "
E_2	5269.723 "		

BIBLIOGRAPHY. There is a complete discussion of the methods, results, and theories of spectroscopy in Kayser, *Lehrbuch der Spektroskopie* (Leipzig, 1900). A briefer account is given in Landauer, *Spectrum Analysis* (New York, 1897). Fraunhofer's original papers are reprinted in *Prismatic and Diffraction Spectra, Scientific Memoir Series*, vol. ii. (New York, 1898); and those of Stewart and Kirchhoff in *Radiation and Absorption*, same series, vol. xv. (New York, 1901). Rowland papers *On Concave Gratings for Optical Purposes* (1883); *On the Relative Wave Lengths at the Lines of the Solar Spectrum* (1886); together with other papers contained in his collected physical papers (Baltimore, 1902), should be consulted by the student. More popular books dealing with spectroscopy are: Lockyer, *Contributions to Solar Physics* (London, 1874); id., *Chemistry of the Sun* (London, 1877); Roscoe, *Spectrum Analysis* (London, 1866); Schellen, *Spectrum Analysis* (New York, 1872). See LIGHT.

SPECTRUM. See LIGHT; DISPERSION; SPECTROSCOPE; SPECTROSCOPY.

SPECTRUM ANALYSIS. As is explained in the article on SPECTROSCOPY, the spectrum of a definite substance under definite conditions is always the same. The spectrum of the radiations emitted by iron vapor, for instance, when rendered luminous, is characterized by certain definite trains of waves, or, as ordinarily expressed, by certain 'lines.' If the conditions under which the spectra are produced are varied, for instance, if for one case the spark was used, and in another the arc, there are differences in the spectra, consisting mainly in variations in the intensity of the lines. Further, if other substances are mixed with the iron, or if the iron exists as an impurity in some other substance, or if the pressure of the surrounding atmosphere is varied, there are corresponding alterations in the iron spectrum. But under definite conditions there are definite lines which are characteristic of iron. Extremely small traces of a substance may be thus made evident by the presence of its spectrum; and in a mixture of many substances the presence of the various parts may often be ascertained by a study of the spectrum emitted. This constitutes the science of spectrum analysis and has proved useful to the chemist in many cases. In fact the discovery of several elements, viz. cæsium, rubidium, and gallium, was due to the detection in certain spectra of lines which could not be ascribed to any known substances. The application of spectrum analysis to the study of the spectra of the sun, stars, and other heavenly bodies has proved most important, and some of the results of various observations and investigations are given in the article on SPECTROSCOPY (q.v.).

SPECULAR IRON ORE. See HEMATITE.

SPECULATION (Lat. *speculatio*, exploration, contemplation, from *speculari*, to view, watch, spy out, from *specula*, watch-tower, from *specere*, to see). Buying and selling of property chiefly with a view to securing a profit through changes in the price of that property. There is a speculative element in a great variety of business transactions; but the term is usually confined to those in which the element of risk is relatively important. In former times speculative activity was largely engaged in seeking to take advantage of differences in price in distant markets. Foreign trade 100 years ago was highly speculative. Improvements in transportation and in means of communication have reduced such differences to a matter of exact calculation. Speculative business has, therefore, come to be confined almost exclusively to transactions involving the time element.

In its simplest form time speculation involved the buying of property outright, and the holding of it in anticipation of a rise in price. This practice is as old as civilization, and until late times has usually been regarded as socially injurious. Toward the end of the seventeenth century the practice developed in Holland of buying and selling the products of fishing voyages before the results of the voyage were actually known. In the early part of the eighteenth century speculation in grain, coffee, etc., was very active in Amsterdam, developing many of the practices of modern exchanges. In all of these early forms of speculation, however, what was bought and sold was the right to a particular lot of goods.

With the development of warrants and the grading of goods speculation received a new impetus. It thus became possible for a man to sell goods which he did not possess, since he could at any time secure identical goods upon the market if he could pay the price. It is largely to this principle that the phenomenal development of speculation in recent years is due. For the extent of speculative dealings and the practices of modern exchanges, see STOCK EXCHANGE.

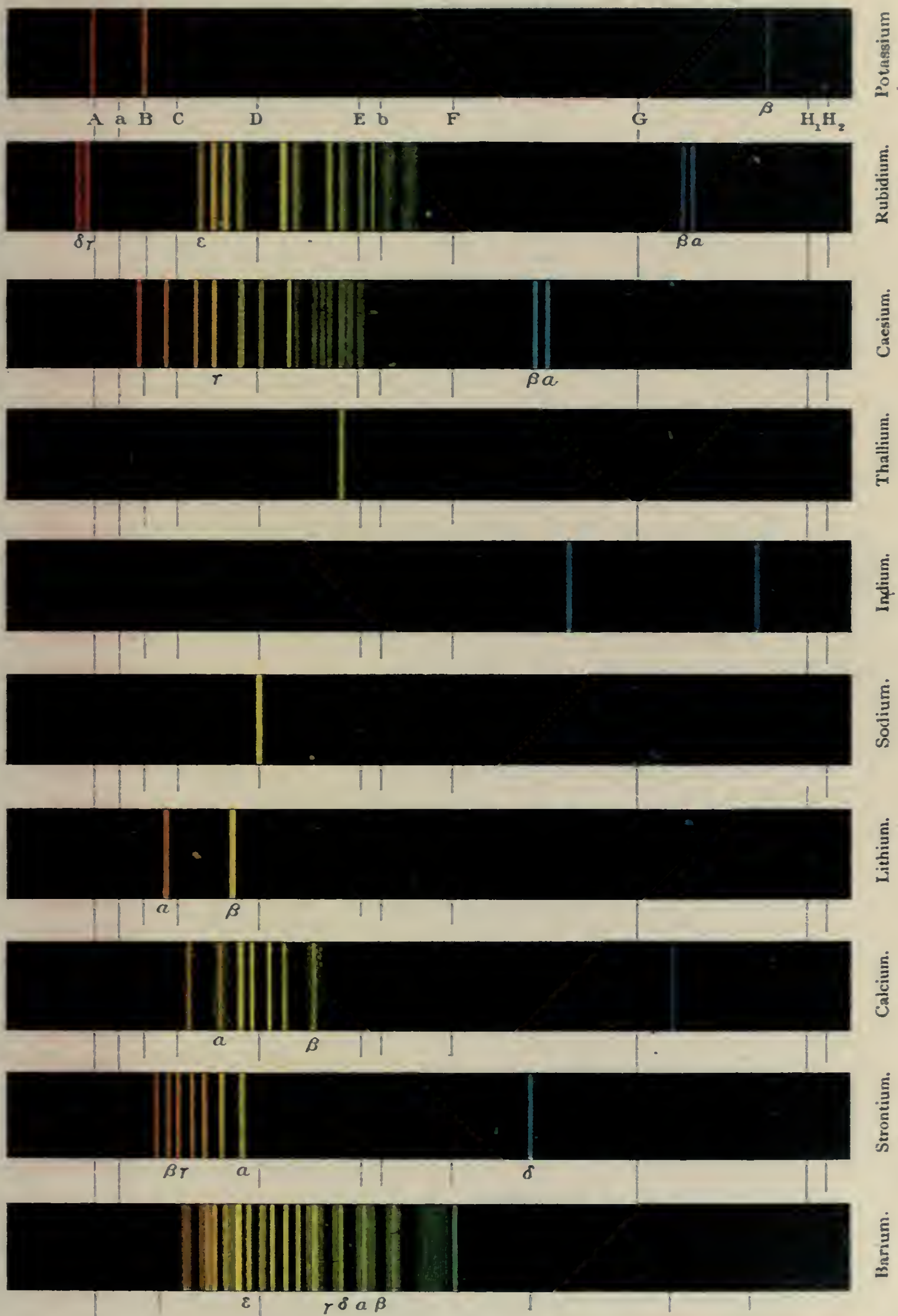
ECONOMIC FUNCTION OF SPECULATION. When the supply of any commodity is subject to great uncertainty, as, for example, the products of agriculture, it is manifestly to the advantage of society that it should be properly distributed through a period of considerable length. A class of individuals who study the conditions of demand and supply endeavoring to buy such commodities when they are abundant and cheap, in order to sell them when they are dear, serve to bring about such a distribution of consumption and thus render an important social service. Again, some commodities, such as iron, are subject to great fluctuations in demand, and hence in price, thus introducing a large element of uncertainty into all of those forms of industry which make extensive use of them. The speculator, by making contracts to deliver the article at a future date at a fixed price, frees the consumer from that uncertainty. Legitimate speculation thus serves as a means of insurance against certain classes of risks.

It may be, however, that the speculator is mistaken in his estimates of future supply and demand. In that case he exaggerates the evil which it is his function to minimize. Thus speculation may keep prices abnormally high for a period, only to render prices abnormally low for a succeeding period. Speculation may thus bring about a crisis (q.v.) with its attendant industrial stagnation.

A more serious evil results from the fact that speculation is carried on not only by those who are conversant with market conditions, but by a large class of individuals who engage in it without the proper equipment of technical knowledge. Unscrupulous operators, through false reports, or through their own apparent eagerness to buy or sell, often lead such unsophisticated speculators to their financial ruin. Such influences tend to increase business uncertainty, and hence diminish considerably the net social gain from speculation.

Popular sentiment in England and America has generally been hostile to speculation, and laws have frequently been passed to prevent it. An act of Parliament was passed in 1733, "To prevent the infamous practice of stock-jobbing." The act had no effect and was repealed in 1860. In America an act was passed in 1864 to prevent speculation in gold, but its operation was so unsatisfactory that it was repealed in two weeks. In several of the States laws have been enacted aiming to prohibit speculation in one form or another. These have proved quite ineffective. Bills were introduced in the Fifty-first, Fifty-second, and Fifty-third Congresses

SPECTRUM



SPECTRA OF THE METALS OF THE ALKALIES AND ALKALINE EARTHS.

which were designed to prevent certain forms of speculation in grain, but did not become law. Consult: Emery, *Speculation on the Stock and Produce Exchanges of the United States* (New York, 1896); Hadley, *Economics*, chapter "Speculation" (ib., 1898). See also general treatises on political economy (q.v. for references).

SPED′DING, James (1808-81). An editor of Bacon's works. He was born in Cumberland, England. From the grammar school at Bury Saint Edmunds he passed to Trinity College, Cambridge, where he graduated in 1831. Leaving Cambridge in 1835, he entered the Colonial Office. This position he gave up in 1841 that he might devote himself to the study of Bacon. For 30 years he continued his researches with slight interruptions. He died from an accident in London. Spedding's most delightful book is *Evenings with a Reviewer* (written in 1845, and privately printed; published 1881), in which with quiet humor Macaulay's essay on Bacon is torn into shreds. His *magnum opus* is an edition of Bacon's entire works with an exhaustive life (14 vols., 1857-74), in the preparation of which he was in some degree aided by Leslie Ellis and D. D. Heath. The biographical and historical parts of this work, much cut, were published under the title, *Account of the Life and Times of Bacon* (2 vols., 1878). Spedding also contributed articles to J. Gairdner's *Studies in English History* (1881) and wrote several other admirable historical papers. Consult the memoir of G. S. Venables prefixed to *Evenings with a Reviewer* (London, 1881); Edward Fitzgerald's *Letters* (ib., 1889); and Hallam Lord Tennyson's *Memoir of his father* (London and New York, 1897).

SPEECH (*AS. spæc, spēc, spræc, sprēc*, OHG. *sprāhha*, Ger. *Sprache*, speech, from AS. *specan, sprecan*, OHG, *sprehhan*, Ger. *sprechen*, to speak; possibly connected with Skt. *sphūrj*, to murmur). The act of producing vocal sound for the communication of ideas. Speech differs from voice in that the latter is rather the physiological potentiality and mechanical process, and from vocal language, which is the result produced by speech. Speech is, so far as known, like vocal language, peculiar to man, although attempts have been made to assign it also to monkeys and apes, while gesture language (q.v.) is shared by man with other animals. In a looser sense speech is synonymous with language. See Language; Voice.

SPEECH, Defects of. See Aphasia; Deaf Mute.

SPEED, James (1812-87). An American politician, born near Louisville, in Jefferson County, Ky. He graduated at Saint Joseph's College (Bardstown), was in the office of the clerk of the Circuit and County Courts, and after further legal study at Transylvania University began practice at Louisville in 1833. In 1847 he was elected to the State Legislature, where he served one term. He was the most effective opponent of the disunion cause in Kentucky, was elected to the State Senate in 1861, and in 1861-64 was in charge of the Kentucky recruiting stations. In 1864 he was appointed Attorney-General of the United States by President Lincoln, but he resigned from the post in 1866 because of his opposition to the reconstruction policy of President Johnson. In 1856-58 and 1875-79 he held a chair in the law department of the University of Louisville. His reputation as a jurist was considerable.

SPEED, John (c.1552-1629). An historical antiquary, the son of a London tailor. Through the generosity of Lord Brooke, he was able to give up manual labor and devote himself to study. Between 1600 and 1610 he published 54 maps of England and Wales, which were collected and described under the title of *Theatre of the Empire of Great Britaine* (1611). He next published the great work on which he had been engaged for many years: *The History of Great Britaine*, from the invasion of Julius Cæsar to King James I. (1611). This is regarded as the best history up to that time written by an Englishman. He also published *Genealogies Recorded in Sacred Scripture* (about 1611), of which 33 editions appeared in the course of 30 years, some of them being attached to issues of the Bible, and *A Cloud of Witnesses Confirming the Holie Word* (1616).

SPEEDWELL (*Veronica*). A genus of about 200 annual and perennial herbs and shrubs of the natural order Scrophulariaceæ, natives of temperate and cold climates. Some species grow in ditches and marshes, some only on the driest soils. They have generally very beautiful blue, white, or pink flowers, for which several species are cultivated. The bitter and astringent leaves of the common speedwell (*Veronica officinalis*), widely distributed in the Northern Hemisphere, are in some countries used medicinally and as a substitute for tea, as are those of the germander speedwell. *Veronica Virginica* is called Culver's physic in North America. Brooklime (q.v.) belongs to this genus.

SPEISS (Ger. *Speise*, amalgam, food, OHG. *spīsa*, food, from OIt., ML. *spesa*, expense, cost, from OIt. *spendere*, from Lat. *expendere*, to expend, from *ex*, out + *pendere*, to weigh). A mixture of the antimonides, arsenides, and sulphides of copper, iron, and nickel, that collects at the bottom of a crucible when ores of arsenic, antimony, cobalt, or lead, containing sulphur, are smelted with fluxes. The speiss containing nickel, which is obtained largely in the preparation of smalt, is an important source of that metal.

SPEKE, spēk, John Hanning (1827-64). An English African explorer. He was born at Jordans, Somersetshire, entered the Indian army in 1844, served in the Punjab campaigns, and distinguished himself as a soldier, naturalist, and sportsman. While in the Indian service he made several trips into the Himalayas and even entered Tibet, bringing back valuable collections. He began his brilliant though brief career as an African explorer in 1854, when he accompanied Captain Burton into Somaliland. He was also Burton's companion on the expedition of 1857-59 from Zanzibar into the interior of Africa. In 1858 they discovered Lake Tanganyika, and in the same year, while Burton was ill at Kaze, Speke reached the Victoria Nyanza. He believed that he had found one of the sources of the Nile, but Burton discredited the information he brought back and Speke could not verify his discovery until 1862, when he returned to the lake with Capt. J. A. Grant, and, proceeding northward, came to the Nile, which he found to be the outlet of the lake. Speke was killed by the accidental discharge of his gun. His books were *What Led to the Discovery of the Source of the Nile* (1864), and *Journal of the Discovery of the Source of the Nile* (2 vols., 1863). His companion, Grant, also described their journey in *A Walk Across Africa* (London, 1864).

SPELLING (from *spell*, ME. *spellen*, OF. *espeler*, to spell, OHG. *spellōn*, to declare, narrate, discourse, from OHG. *spel*, AS. *spel*, *spell*, Goth. *spill*, tale, narrative, history, tidings). The representation of words by combinations of alphabetic symbols; the practical application or use of an alphabet. In an alphabet that is accurately constructed and used there is one, and but one, symbol for each significant speech-sound, and but one speech-sound is represented by any given symbol. Under these conditions spelling is determined solely by the pronunciation ('sound') of the word to be spelled, that is, it is at once obvious when the pronunciation is known, and is accordingly marked by no irregularity or ambiguity. Such phonetically correct and simple orthography requires no special consideration apart from the alphabet employed. (See ALPHABET; PHONETICS; and SPELLING REFORM.) Outside of the writings of phoneticians, however, spelling of this degree of precision does not exist, though in certain languages there is a fairly close approximation to it. In customary spelling, in brief, each of the above-stated principles is, to a greater or less extent, violated, viz. there is alphabetic inadequacy, or the lack of symbols to represent certain important speech-sounds; redundancy, or the use of two or more symbols or combinations of symbols to represent the same sound; and the use of the same symbol or combination to represent two or more sounds. In other words, alphabetic writing as actually practiced is more or less ambiguous, irregular, and arbitrary. This divergence of customary spelling from the true alphabetic method has resulted, historically, in part, from defects inherent in the alphabets themselves (inadequacy and redundancy); but principally from continuous change in the sounds of the languages to which they have been applied. Since in every language pronunciation varies from age to age and from locality to locality, the phonetic character which every alphabet has originally possessed—or, more precisely, its phonetic use in spelling—could be maintained only by continuous adaptation to these alterations of the uttered words.

As a matter of fact changes of this sort in spelling have taken place in all alphabetically written languages, and in living European languages in particular (which alone are considered here) they have occurred abundantly, especially prior to the invention of printing; but except in some modern instances they have been effected under conditions unfavorable to phonetic precision, and so, in many cases, instead of producing greater accuracy, have often resulted in increased confusion. At best they have been inadequate to prevent spelling from becoming more and more faulty, from the phonetic point of view, as the alteration of pronunciation has advanced. Ambiguities and irregularities multiplied, new and complex associations between sounds and symbols were formed, and it became increasingly difficult to infer the pronunciation of a word from its written form. Moreover, this natural tendency toward phonetic corruption was intensified by a cause to which most of the defects of modern spelling may be attributed, namely, the establishment of a 'standard,' relatively unchangeable orthography, due principally to the introduction of the printing press. The beginnings of such an inflexible system existed earlier, wherever certain spellings were recognized as customary and then as 'correct' from the literary point of view (regardless of their phonetic value), and the feeling that the unity of the written and spoken words should be preserved was, accordingly, weakened; but its chief sources were the practical need of uniformity in spelling, which was quickly felt and (with much blundering) supplied in the printing office, and the influence of printed books. From this fixation of orthography it resulted not only that practically all the existing faults of the spelling found by the printer (together with those which he himself added) were rendered permanent, but also that even the imperfect earlier tendency to respond to phonetic change was almost wholly suppressed. Pronunciation has continued to change, often radically, but spelling has lagged behind. In certain languages notable divergence of the written from the spoken language has thus been effected, while others, like Italian, have been more fortunate in having had a relatively rational system of spelling to start with, or having undergone less extraneous disturbance, or having been able to adhere more closely or revert more frequently to the phonetic method.

These facts are well illustrated by English spelling, which in its existing standard form presents an extreme case of phonetic corruption or dealphabetization. The earliest English (Anglo-Saxon) spelling was almost purely phonetic, that is, the scribes sought to indicate the actual sounds of the words they wrote, using—with a high degree of precision—for this purpose the Roman alphabet (with certain modifications) and giving to its letters the values assigned to them in the pronunciation of Latin, with which they were familiar. But as the sounds gradually changed, confusion, due largely to imperfect adaptation (see above), slowly set in; certain symbols were not accurately distinguished, or were employed with different values in different combinations; the significance of some was irregularly altered and new ones were introduced; others were lost; and the accentual marks over the long vowels used in Anglo-Saxon disappeared, increasing the difficulty in distinguishing the long from the short vowels—a defect which has never been remedied except (in part) by non-alphabetic devices. But the most important irregularities were due to the influence of Norman, and later of literary (Parisian) French, under which, in the thirteenth and fourteenth centuries, English was practically re-spelled in accordance with Anglo-French methods. Notwithstanding this and other sources of confusion, however, English spelling remained for a considerable period in a notable degree phonetic. The change effected by the invention of printing has been indicated above; but it should be added that the printer's choice of spellings not only was not guided by any principles, but was often determined by ignorance, English having suffered, in this particular, more than any other language. Alteration in response to phonetic change was not, indeed, wholly stopped—for it has continued in some measure until the present day—but it was made more and more difficult, and from the sixteenth century the power of effecting any substantial phonetic improvement of English spelling has been lost. Notwithstanding many later modifications of details (there are still over 3000 words whose orthography is unsettled), the development of English orthography ends with that period, the subsequent life of the spoken language being practically unrepresented in it. In this direction—that of sound—the alteration has been great, but we still retain what is essentially the Elizabethan spelling, in total disregard of the fact that the pronunciation which it embodies has very largely disappeared.

Another important source of confusion in English spelling, closely associated with this process of fixation, must also be mentioned. Under the influence of the revival of learning, which brought words of classical origin into special prominence, the idea was developed that (regardless of their pronunciation) such words should be made to conform in spelling as exactly as possible to the Latin and Greek terms from which they were ultimately derived. This etymological theory of spelling gained strength, both from the weakness of the contemporary feeling for phonetic accuracy and from the practical difficulty found by the printer, in his quest of uniformity, in making a selection among existing forms, which offered a wide opportunity for the activity of pedants; and from the sixteenth century until the present time it has kept its hold upon our orthography. There was much tinkering, not only with words directly borrowed from the classical tongues, but also with words of Romance origin, while the native English and Scandinavian elements of the language were but little interfered with. A result was the introduction of many forms erroneous from both the phonetic and the true philological points of view; for apart from the indefensibility of this use of spelling as a means of rendering derivation obvious to the eye the method was dangerous in the hands of men whose knowledge of the history of the language was necessarily inadequate. A familiar example is the present English *debt* (from Early Modern English and Middle English *det*, *dette*, from Old French *dette*), in which the *b* was etymologically inserted both in French (though later abandoned) and in English to make the spelling more directly suggest the original Latin *debita*, though it has never been pronounced. On the other hand, this process in some cases actually corrupted pronunciation. For example, the *l* in *fault* (Middle English and Old French *faute*), which was inserted in the same way, to suggest the Latin *fallere*, has actually come to be pronounced, though the correct pronunciation (in this particular) survived as late as the time of Pope, who makes the word rhyme with *ought*, *thought*, and *taught*. Of pure etymological blunders, again, an instance is the *s* in *island*, which was inserted to indicate derivation from the Latin *insula* and connection with English *isle* (also corrupted from *ile*), to neither of which it is at all related. The corruptions of this kind form a long and instructive list.

The results of the above-indicated history, embodied in modern English orthography, are briefly as follows:

(1) While all of the other principal European alphabets have retained with comparatively small variations the Roman or 'Continental' values of the letters, that of English has to a very large extent abandoned them. This is especially true of the 'long' vowels—at least of their common or name-giving values: Thus, approximately, 'long *a*' (say) = Cont. *ê*; 'long *e*' (mete) = Cont. *î*; 'long *i*' (isle) = Cont. diphthong *ai*; 'long *o*' = Cont. *ô*; 'long *u*' (duty) = Cont. diphthong *iu*. Great confusion thus exists in the vowel-nomenclature, as well as an unfortunate divergence from the common usage of those languages which are most closely connected with English, both historically and practically. The quantity of vowels, also, as was noted above, is not (as in oldest English) distinguished by any alphabetic means, while the various orthographic devices employed for the purpose (doubling of consonants, etc.) are clumsy and are not used with uniformity.

(2) The letters of the alphabet are used with a great diversity of sound-values: Thus, of the vowels, accented and unaccented, *a* has 9 (as in n*a*me, b*a*re, m*a*n, f*a*ther, w*a*ter, w*a*nt, *a*sk, vill*a*ge, dat*a*), *e* 9 (b*e*, h*e*re, th*e*re, acm*e*, m*e*t, al*e*rt, *E*nglish, s*e*rgeant, prud*e*nt); *i*, 8; *o*, 10; *u*, 9; *y*, 3—48 in all; of the consonants, *b*, 2 (counting the silent ones); *c*, 6; *d*, 4; *f*, 3; *g*, 4; *h*, 3; *j*, 5; *k*, 2; *l*, 3; *m*, 3; *n*, 3; *p*, 2; *q*, 3; *r*, 2; *s*, 5; *t*, 5; *v*, 2; *w*, 2; *x*, 5; *y*, 2; *z*, 4—70 in all. To a certain extent this multiplication of values is due to the inadequacy of the alphabet, which has but 26 symbols to represent the 40 elementary sounds of cultivated English speech (44 with the diphthongs), but it is far in excess of what is necessary and results in manifold ambiguities.

(3) The various English speech-sounds are written with an even greater variety of symbols and combinations of symbols. These sounds, which comprise 16 volwels and 24 consonants (with 4 diphthongs), are represented in the standard phonetic alphabet, adopted by the American Philological Association, as follows (the sound being that of the corresponding letter in the word placed within the parenthesis): i (*i*t), e (m*e*t), a (*a*t), ɑ (*a*sk), ɵ (n*o*t), o (*o*bey), ʊ (b*u*t), u (f*u*ll), ī (p*i*que), ē (th*ey*), ā (*a*ir), ɑ̄ (*a*rm), ɵ̄ (n*o*r), ō (n*o*), ʊ̄ (b*u*rn), ū (r*u*le), p (*p*et), t (*t*ip), ch (*ch*est), c or k (*c*ome), f (*f*at), th (*th*in), s (*s*own), sh (*sh*e), h (*h*e), b (*b*et), d (*d*ip), j (*j*est), g (*g*um), v (*v*at), dh (*th*ee), z (*z*one), zh (a*z*ure), w (*w*it), l (*l*o, e*ll*), r (*r*at, a*r*e), y (*y*e, *y*ear), m (*m*e), n (*n*o), ng (si*ng*): diphthongs, ɑi (*ai*sle, *i*sle), ɑu (*ou*t, h*ou*r), ɵi (*oi*l, b*oy*), iu (f*eu*d, j*ew*). The ways in which these sounds are represented in the customary spelling are too numerous to be here given and illustrated in full, but the orthographic situation will be understood from the following examples: i (*i*t), accented or unaccented, is represented by i, y, e, o, u, ie, ee, ui, ai, hi, ive, eo, a, ia, ei, ey, ea, eig ('), ehea, ewi, ois, uy, oi, igh, ay, ieu, as in the following words: f*i*t, h*y*mn, pr*e*tty, w*o*men, b*u*sy, s*ie*ve, br*ee*ches, b*ui*ld, S*ai*nt John (sin′jun), ex*hi*bit, f*ive*pence (fip′ens), Th*eo*bald (tib′ald), carr*ia*ge, forf*ei*t, donk*ey*, guin*ea*, sover*eig*n, James's for*ehea*d, house*wi*fe (hus′if), cham*ois*, plag*uy*, Jerv*ois* (jer′vis), Denb*igh*, Rothes*ay* (roth′si), Beaul*ieu* (bew′li). E (m*e*t) = e, ea,

a, u, ai, ei, ie, eo, ue, ay, œ, ave, as in g*e*t, h*ea*d, m*a*ny, b*u*ry, s*ai*d, h*ei*fer, fr*ie*nd, l*eo*pard, g*ue*ss, s*ay*s, f*œ*tid, Aberg*ave*nny (abergen′i). O (no) = o, o-e, oa, ow, ou, owe, oe, oo, ew, ewe, ough, oh, eau, eo, au, os, aut, ock, as in holy, vot*e*, ro*a*d, bo*w*l, so*u*l, ro*we*d, w*oe*, brooch (brōch), *sew*, *sewe*d, tho*ugh*, *oh*, be*au*, yeoman, h*au*teur, apropos, h*aut*boy, Co*ck*burn (kō′bn). C (*c*ome) = c, k, q, ck, ch, cc, cq, qu, que, lk, gh, sc, x, ke, lke, quh, cch, as in *c*all, *k*ill, *qu*ell, ba*ck*, a*ch*e, account, a*cq*uaint, li*qu*or, bar*que*, wa*lk*, hou*gh*, viscount, e*x*cept, Bur*ke*, Fo*lke*stone, Ur*quh*art, Ba*cch*anal. T (*t*ip) = t, tt, ed, th, tw, bt, ct, pt, cht, phth, te, tte, as in *t*en, be*tt*er, stopp*ed*, *th*yme, *tw*o, de*bt*, indi*ct*, recei*pt*, ya*cht*, *phth*isis, cas*te*, gaze*tte*. In brief, the 44 (with the diphthongs) English sounds are represented by upward of 500 symbols and combinations. From this it results that an English word can, theoretically, be written in a great variety of forms.

The confusion of English spelling, however, while great, is not so complete as might be expected from its above-stated theoretical defects; it exhibits a certain amount of system and it is possible also to demonstrate in it a very considerable phonetic element. Apart from the inadequacy of the alphabet, its chief practical defects are the ambiguities in the use of *c* and *k* (*c*at, *k*ill), *c* and *s* (*c*inder, *s*eat), *f* and *ph* (*f*ool, *ph*ilosopher), *t* and *d* or *ed* (dropp*ed*, kep*t*), *ch* and *k* (*ch*olera, *k*eep), and the employment of silent letters, that is, letters which if omitted would leave the symbol (see above) a simpler and, generally, more common (though not necessarily more phonetically correct) one for the same sound (as in fe*a*ther, jeopardy, par*l*iament, pedagog*ue*, g*u*ard, ad*d*, fei*g*n, g*h*ost, tho*ugh*, thoro*ugh*, scythe, etc.).

SPELLING REFORM. The modification of customary spelling in such a way as to remove, or at least lessen, the divergence of orthography from pronunciation. (For the origin, character, and practical results of this divergence, particularly in English, see SPELLING.) Complete reform of this sort involves: (1) The elimination of superfluous letters (e.g. in English, of two of the equivalent letters *c* (hard), *k*, and *q*); (2) the enlargement of the alphabet by the addition of enough symbols (letters or digraphs) to represent all the significant speech-sounds of the language (in English there are 40 elementary sounds and but 26 letters); (3) the use of each letter or symbol to represent but one sound; and (4), in English the use of the letters of the alphabet with their Roman values. Among such (proposed) remodelings of the English alphabet the most practical is that adopted by the American Philological Association and given above in the article on SPELLING. If the above-stated conditions were fulfilled, orthography and pronunciation would be in harmony—that is, spelling would be essentially phonetic. While, however, such completeness is the aim of the modern spelling reformer, it has hitherto remained—and is likely long to remain—merely an ideal. The customary spelling is so firmly connected with the habits, the practical interests, and the æsthetic (literary) sentiments of its users that such thoroughgoing reform of it is impracticable, changes in the alphabet especially being very hard to introduce. The practical efforts of the reformers are accordingly now directed almost exclusively toward the simplification of spelling by the removal of irregularities which can be eliminated without radically changing the forms of words, and by the omission of silent letters which are phonetically useless (that is, do not determine the value of another letter, as does the silent *e* of English hate). Changes of this sort have occurred sporadically at every period in every European language; the spelling reformer attempts merely to make this familiar process more general and systematic. Rules for such simplification were adopted in 1883 by the American Philological Association and the British Philological Society, and in 1886 a list of amended spellings, based upon them, was adopted by the Philological Association and published in its *Transactions*. It has since been republished in (and approved by) the leading American dictionaries. While simplification of this sort would not, alone, produce phonetic accuracy, it would greatly enhance the phonetic character, uniformity, and simplicity of English spelling. Up to the present time, however, spelling reform, even in this restricted sense, though persistently urged by special associations and by persons of high scientific and literary authority, has made but little headway. Certain of the recommendations of the philological societies have been put into practice by a few individuals and journals, and by some scientific societies, but no general tendency to adopt them has been evident. Perhaps the most important step in this direction was the adoption by the American National Education Association in 1898 of the twelve simplified spellings: Program, tho, altho, thoro, thorofare, thru, thruout, catalog, prolog, decalog, demagog, pedagog.

In France, where the peculiarities of orthography give spelling reform a practical importance second only to that which it has in English-speaking countries, much interest in this subject has long existed, but little has been accomplished, the French being in matters of orthography almost as conservative as the English. The reform has also been active in Germany, and something has been done there, particularly in the omission of silent letters (*tat* for *that*, etc.). Spanish and Italian spelling are so simple and so largely phonetic that the practical reasons for reform have relatively little application to them.

SPEL′MAN, Sir HENRY (c.1564-1641). An English antiquary and philologist. He was born at Congham, Norfolk, and was educated at Cambridge and in law at Lincoln's Inn. He became High Sheriff of Norfolk, and was employed on various public missions by King James. In 1612 he removed to London, where he began to devote himself to the investigation of ancient law and custom with a view to establishing their relation to the English Constitution. In prosecuting this work he encountered so many strange and obsolete words that he turned aside to compile a glossary of law terms the first part of which, to the end of the letter L, he published in 1626, at his own expense. The second volume appeared in 1664 edited by Sir William Dugdale. He also compiled a collection of decrees of English Church councils from 1066 to 1531. He is best known in modern times by this and his curious *History and Fate of Sacrilege* (1693; new ed., London, 1846, 1853).

SPELT (AS. *spelt*, from Lat. *spelta*, spelt). A species of wheat (*Triticum Spelta*), characterized by grains held tightly within the chaff and not hulled out in threshing. It is grown chiefly where wheat fails on the poorer soils of the mountainous regions of Germany, Italy, Spain, and France, and is mainly employed as a stock food. It is little grown in America. The grain commonly called spelt in the United States and Russia is emmer (*Triticum dicoccum*), which has a much shorter and more compact head than spelt, and is much hardier as regards cold, drought, and rust resistance. Both spelt and emmer are grown and harvested like wheat.

SPENCE, Henry Donald Maurice (1836—). An English clergyman and theological writer, born in London. He was educated at Westminster School and Cambridge University; took orders in the Church of England; held various important charges; and in 1886 became Dean of Gloucester. Among his numerous published works are: *Cloister Life in the Days of Cœur de Lion* (1892); *The Church of England; a History for the People* (4 vols., 1897-99); *The White Robe of Churches of the XI. Century* (1900); and *Early Christianity and Paganism* (1902).

SPENCE, Joseph (1699-1768). An English anecdotist, born at Kingsclere, in Hampshire. He was sent to Eton and Winchester, whence he passed to Oxford. Elected fellow of New College in 1720, he took orders in 1724. *An Essay on Pope's Odyssey* (1726) led to an intimate friendship with the poet, and to Spence's appointment as professor of poetry at Oxford (1727). He afterwards held the professorship of modern history and several ecclesiastical appointments. In 1749 he was presented by a former pupil with a small estate at Byfleet, in Surrey, where he amused himself with gardening. He was found dead in a canal in his garden. While associated with Pope he noted down the conversations of the poet and his friends. These most valuable anecdotes, after circulating in manuscript for the benefit of Warburton, Joseph Warton, Dr. Johnson, Malone, and other critics, were published in 1820. Among Spence's other works is the pleasant *Polymetis* (1747), dialogues on the Roman poets and artists. Consult the *Anecdotes*, edited from Spence's own manuscript, by S. W. Singer (London, 1820; reprint, 1859); *Selections*, edited by Underhill (Camelot Series, London, 1890); Dobson's essay on Spence in *Eighteenth Century Vignettes* (first series, New York, 1892).

SPEN'CER. The county-seat of Clay County, Iowa, 152 miles northwest of Des Moines; on the Little Sioux River, and on the Chicago, Milwaukee and Saint Paul and the Minneapolis and Saint Louis railroads (Map: Iowa, B 1). It has a public library and a fine court house. Spencer is known for its large hay interests. There are also some manufactures. The water-works and the electric light plant are owned by the municipality. Population, in 1890, 1813; in 1900, 3095.

SPENCER. A town, including several villages, in Worcester County, Mass., 12 miles west by south of Worcester; on the Boston and Albany Railroad (Map: Massachusetts, D 3). It has the Richard Sugden Library, with more than 11,000 volumes, and Spencer Public Park. Boots and shoes, wire, and woolen goods are manufactured. The government is administered by town meetings. The water works are owned and operated by the town. Population, in 1890, 8747; in 1900, 7627. Settled in 1720, Spencer formed a part of Leicester until 1753, when it was separately incorporated. Consult: Draper, *History of Spencer* (Worcester, 1860); Tower, *Historical Sketches Relating to Spencer, Massachusetts* (Spencer, 1901-02).

SPENCER, Ambrose (1765-1848). An American jurist, born in Salisbury, Conn. He was educated at Yale and Harvard; was admitted to the bar in New York; in 1794 entered the State Assembly, and the next year became a member of the State Senate, to which he was reëlected in 1788. From 1802 to 1804 he was Attorney-General of the State, and in the latter year he became one of the judges of the Supreme Court, and was its Chief Justice from 1819 to 1823, when he resumed his private practice. From 1824 to 1826 he was Mayor of Albany, and from 1829 to 1831 a member of Congress. Eight years later he retired to a farm near Albany, but continued to take an interest in politics, and in 1844 he presided over the National Whig Convention at Baltimore. He secured the abolition in New York of the death sentence in all cases except those of murder and treason; took an important part in the State Constitutional Convention of 1821; and later opposed an amendment making the judiciary elective. Consult *Memorial of Ambrose Spencer* (Albany, 1849).

SPENCER, Charles, third Earl of Sunderland. An English statesman. See Sunderland, Charles Spencer, third Earl of.

SPENCER, Herbert (1820-1903). A distinguished English philosopher. He was born at Derby, April 27, 1820. His father was a teacher by profession, with views in advance of his time. He believed in training the student's mind in observation and in reflection on objective facts instead of mere ideas. Herbert's health was delicate in childhood, and he was largely educated at home with as much outdoor life as possible. A little later he was put in charge of his uncle, a clergyman of the Church of England. He early showed a fondness for studies in nature, and for a good many years his favorite occupation was the catching and preserving of insects and the rearing of moths and butterflies; he also studied botany with some passion, and in these ways laid the foundation for the scientific character and interest of his later work. His parents were both originally Methodists, but his father became a Quaker. The boy's mind, however, being an independent one, and having early been brought into contact with the intellectual influences centring about John Stuart Mill and with the scientific spirit, he imbibed the tendencies of the age toward extreme liberalism in theological matters.

An uncle planned to send him to Cambridge, but the boy 'perseveringly objected,' and continued to study privately. He had no aptitude for languages, and made little progress in the classics, but showed original constructive power in mathematics and mechanics. His father wanted him to take up teaching, but an accidental opportunity decided in favor of another vocation more suitable to his tastes. In the autumn of 1837 work was offered to him under the chief engineer of the London and Birmingham Railway, with whom he spent nearly a year. For some ten years he engaged in engineering pursuits. When the railawy mania finally subsided, Spencer, now twenty-six, was left, like many other young men, without occupation. But the time spent at home while he was looking for something to do was not wasted. He had leisure for a good deal of miscellaneous reading. He studied Lyell's *Principles of Geology,* in which the doctrine of evolution as defended by Lamarck was attacked, but came away from the reading with a favorable impression of Lamarck's doctrine as against creationism.

While he was in the railway service, still a mere boy, he wrote some articles for *The Nonconformist* on "the proper sphere of government," in which he outlined the principles of non-interference which regulated all his thinking in later life. When no more work offered as an engineer, he went to London and soon obtained employment on *The Economist,* becoming its sub-editor in 1848. This position, which he held till 1852, gave him time for his studies, and made him acquainted with that brilliant coterie which centred about George Henry Lewes, George Eliot, and John Stuart Mill. During his leisure hours he wrote his first considerable work, *Social Statics* (1851). It is of a decidedly *a priori* character, and not written in the inductive spirit of his later thinking. It shows, however, his tendency to reconcile opposing influences and to discover closeness of relations where others did not suspect them. Subsequently he became dissatisfied with both its views and its methods, and wished to recall it from circulation. This being found impossible, in later years he revised it by omitting what he had outgrown.

In the eight years after his leaving *The Economist,* he pursued his studies with eagerness, and published a work on *Psychology* (1855), which he afterwards revised and expanded into a part of his *Synthetic Philosophy.* Over-application brought on a serious attack of nervous prostration, which obliged him for the rest of his life to abridge his hours of study. He became a chronic sufferer from dyspepsia and insomnia, so that all his later work had to be done under these disadvantages. Meanwhile he had conceived a system of philosophy which should embrace the general principles of all existing knowledge. In 1850 he published a prospectus or outline of it, indicating his intention to give twenty years to its development. The first instalments of the system did not meet with the reception he expected, and he feared he would have to abandon his undertaking. But the timely aid of American friends, at the head of whom was Mr. Youmans, editor of the *Popular Science Monthly,* enabled him to continue his work. His health, however, was so precarious that at one time he feared he would not live to complete the system. With this view he suspended his labors on the main part of his work to write *The Data of Ethics,* which had been the object of the whole system, and in which it was intended to culminate. Fortunately, his life was prolonged sufficiently to enable him to complete the system, and to revise a part of it in order to bring it up to date. It consists of *First Principles* (1862) ; *Principles of Biology* (1864) ; *Principles of Psychology* (1871-72) ; *Principles of Sociology* (1876-80) ; *Principles of Ethics* (1879). He also wrote three volumes of *Essays Scientific, Political, and Speculative* (1858-63), and some fugitive articles including two essays on Weissmannism (1894, 1895). He died December 8, 1903.

It was his intention in the *Synthetic Philosophy* to develop a complete and articulated conception of all cosmic phenomena, including those of mental and social principles. His qualifications for attempting so comprehensive a task were wide powers of generalization, profound acquaintance with the facts of the various sciences, and a veritable genius for detecting the relations and connections of phenomena that escape the specialist. No philosopher has employed such a wealth of illustration and facts to explain his meaning or to prove his thesis. It is the clearness of his thought, the force of his illustrations, and the dependence of his views upon the facts and methods of the inductive sciences that have given him his power over all thinkers, except the technical and traditional philosophers. His attempt to systematize all knowledge in terms of modern science must always receive high credit among intelligent men.

The *First Principles* endeavors to define the fields of 'the unknowable and the knowable,' and the postulates with which the study of the knowable must be pursued. The whole weakness of Spencer's system is shown in his discussion of the unknowable. The Absolute, Space, Time, Matter, Force, and Motion were all taken as unknowable. After telling us that all these are unknowable, he asserts that the most certain things in our conviction are the 'Absolute' and all the other fundamental data for the knowable. Besides, after telling us that all explanation consists in reference to the known, he says that all phenomena are explained as manifestations of the unknowable. Then, in the discussion of the knowledge, Space, Time, Matter, Force, etc., appear as known. Both the strength and weakness of his system are due to this equivocal import of the term knowledge. If Spencer had omitted all reference to the dogma of the unknowable and confined himself to a discussion of the knowable, he would have avoided the controversy which has invited the distrust of his system. The postulates with which he conducted his speculations were, besides the existence of Space, Time, Matter, Motion, and Force, the assumption of the indestructibility of Matter, the continuity of Motion, and the persistence of Force, which he regarded as an *a priori* truth, though also determinable inductively.

The whole system is an application of the idea of evolution to the universe, and more particularly to organic life and its forms, and to political and social institutions. Spencer's conception of this process did not go beyond Darwin's in its details, but it was apparently quite as original and certainly more comprehensive, besides involving philosophic conceptions of which Darwin was incapable. Spencer applied the materialistic formula to the explanation of all things, but protested that he was not a materialist. Even if he had expressed his doctrine, as he said he could as well have done, in terms of consciousness, it would not have modified the accusation against his materialism, as the expression of philosophy in terms of mental states does not insure one against all that materialism stood for. In order to adapt the conception to all forms of phenomena, he variously expressed the process as the passage from the simple to the complex, from the homogeneous to the heterogeneous, from indefinite homogeneity to definite heterogeneity, and so on. This description of the process brought him into controversy with all those who like metaphysics, and gave him no credit with those who do not. It was at best a vague formula, which might be true or false according to the definition of the terms and the statement of the facts; the phrase at least meant nothing more than the facts, and was not explanatory. In his facts and illustrations, however, Spencer gives a clearer idea of his doctrine than in his abstract formulas intended to cover every type of phenomena in the organic and inorganic kingdoms. These facts, he thinks, show a continuous order of things with historical connections and relations which suggest a common origin from some ultimate indefinite form of force which he calls matter and motion. Darwin did not pretend to go beyond the extension of a few types in the organic world or to develop their genesis. He was content to demonstrate the origin of species in the organic world and left unsolved and undiscussed the general origin of things—a much larger task. Spencer sought to make intelligible the process of evolution throughout the whole field of nature, and hence the importance of his formula about the 'continuous redistribution of matter and motion,' as embodying the whole system of changes and growths in the cosmos.

It was Spencer's antagonism to the doctrine of creationism that caused a complete misunderstanding of what evolution really undertakes to accomplish. The theory of creation was equivocal. It assigned a cause for the origin of phenomena, and it was associated with the conception of the miraculous and supernatural. Spencer denied the creational theory and adopted the gradual development of all things in its stead. But what he failed to recognize sufficiently, though he sees it at times, is the fact that evolution is the history of origin, not the explanation of it. It determines the law, not the cause of genesis. All that Spencer and his coadjutors established is the fact that the origin of things was *gradual* instead of *catastrophal*. Creationism was so closely associated with the latter conception that the disproof of great breaks in nature carried with it the principle by which every change has to be explained. The transition from species to species may be gradual instead of catastrophal, but this fact does not eliminate the agency of causes, and it was cause that the creationistic theory sought and unfortunately made catastrophal. It was natural, therefore, when the evolutionists showed that the process was gradual, that creationism should suffer to the same extent, but after all the real conquest was in favor of law instead of caprice in the order of nature, so that if Spencer and the evolutionists had refused to conceive their problem in opposition to creationism, and had limited themselves to the conception of the history of genesis, they would have escaped controversy with the metaphysicians on the one hand and with the theologians on the other.

Conceiving evolution, however, as the history rather of events than of causes that originate change, we shall find that Spencer's services to human knowledge can hardly be overestimated. It was a stroke of genius to combine the ideas of the persistence of force, adjustment to environment, and natural selection for the purpose of explaining the relations of all phenomena. It offered a mode of unifying the cosmos which showed identities and relations throughout the whole not before observed. The persistence of force guaranteed the fundamental identity of all reality, in spite of the differences of form which it assumed, while the varieties of composition explained the differences. The conception supplies an initial presumption of the variation of a single species to account for the varieties; this once done, the whole problem of evolution is at least historically conceived as intelligible. In the inorganic world it is merely a question of the collocations of matter. In the organic world it is a question both of collocation and of the adjustment of structure and function. In the ethical world the growth is in the form of the substitution of altruism for egoism or selfishness. In the political and social worlds the process is but a repetition of that in the others, except that we deal with collective as distinct from organic wholes. One law prevails throughout the whole process—the redistribution of matter and motion according to the conditions of the persistence of force. Originally Spencer reduced life to a function of matter and motion. But in the last edition of his *Biology* he admitted that life was an 'unknown force,' a position which involves a complete revolution in his system as recognizing something more in the world as ultimate than matter and motion. The hypothesis of a universal ether and the modification of older views regarding the nature of electrical and magnetic phenomena, with the discovery of a number of forms of energy not suspected a generation ago, threaten to modify greatly the bases of Spencer's system. But they do not disturb the general conception which he formed of the process of evolution, since this is independent of the forces involved and is simply a process of composition and decomposition throughout the cosmos and in all specific forms of reality. It is Spencer's manner of tracing the relations and affinities between the various phenomena of existence that gives his work its interest and has so generally influenced the intelligent public. He knew little of Greek philosophy and less of the modern Kanto-Hegelian movement. The consequence was that he began his speculations with science, eschewed the transcendentalism of German epistemology, and wrote in terms that every intelligent man can understand. The public has not cared whether his abstract formulas were clear or not, or whether they really expressed an explanation. They were impressed with his power of illustration and reference to facts which they were willing to use as interpreting his formulas, and as his illustrations and analogies depicted such an interesting unity in the course of nature, they were ready to take him as a prophet of the new gospel and leave subtleties to the transcendentalists. Spencer will not be forgotten for a method that supplies a clear conception of the unity of all things in terms of facts instead of abstract conceptions, though he was at times too much of a philosopher to avoid the sins which his scientific temperament sought to correct in others.

Consult: Hudson, *Introduction to the Phi-*

losophy of Herbert Spencer (New York, 1894); Collier, *An Epitome of the Synthetic Philosophy* (ib., 1889); Guthrie, *On Spencer's Unification of Knowledge* (London, 1882); Painter, *Herbert Spencer's Evolutionstheorie* (Jena, 1896); Gaupp, *Herbert Spencer* (Stuttgart, 1897).

SPENCER, Jesse Adams (1816-98). A Protestant Episcopal scholar. He was born at Hyde Park, N. Y.; graduated at Columbia College (1837), and the General Theological Seminary; was ordained 1840, and became rector of Saint James's Church, Goshen, N. Y.; professor of Latin and Oriental languages at Burlington College, N. J., 1849-50; editor and secretary of the Episcopal Sunday School Union and Church Book Society (1851-57); rector of Saint Paul's, Flatbush, L. I. (1863-65); and professor of Greek in the College of the City of New York (1869-81). He edited the American reprint of T. K. Arnold's series of Greek and Latin text-books (1846-56) and other classics, including the Greek New Testament (1847). His independent works include a *History of the English Reformation* (1846), *Egypt and the Holy Land* (1850), *History of the United States* (1856-69), *Eschatology* (1887), *Memorabilia, 1820-86* (1890).

SPENCER, John Canfield (1788-1855). An American jurist and politician, born at Hudson, N. Y. He graduated at Union College in 1806, studied law, and was admitted to the bar at Canandaigua in 1809. In 1813 he was brigade judge-advocate-general in the army on the northern frontier. From 1817 to 1819 he was a Democratic member of the United States House of Representatives and wrote the report condemning the United States Bank, which was afterwards used by President Jackson at a time when the author's views had changed. In 1820-21 he was a member of the Lower House of the State Legislature, serving as Speaker the first year. He was in the State Senate from 1824 to 1828, and in 1827 was appointed by Governor Clinton one of the committee to revise the statutes of New York. This work was finished in 1830; a second edition was published in 1835-36, and a third in 1846-48. For a time he was affiliated with the Anti-Masonic Party, and he was appointed by Governor Van Buren to prosecute the alleged abductors of William Morgan (q.v.), but resigned in 1830. He again sat in the Legislature in 1832, and in 1834-40 was Secretary of State for New York and Superintendent of Schools. On October 12, 1841, he became Secretary of War in the Cabinet of President Tyler. He was transferred to the Treasury Department, March 3, 1843, but opposed measures looking to the annexation of Texas and resigned May 2, 1844. He then resumed the practice of law at Albany, and was influential in establishing the State Asylum for Idiots. He edited a translation of De Tocqueville's *Democracy in America* (2 vols., 1838). Consult Proctor, *Review of John C. Spencer's Legal and Political Career* (New York, 1886).

SPENCER, John Charles, Earl (1782-1845). An English statesman, best known as Lord Althorp. He was the son of the second Earl Spencer, and was born in London. After being educated at Harrow and Cambridge, he entered Parliament in 1804 and became a junior lord of the treasury in 1806. From that year till 1834 he continuously represented Northamptonshire in the Whig interest. In 1830 he became Chancellor of the Exchequer and leader in the House of Commons under the Grey Ministry, and was active in carrying the Reform Bill of 1832. He held office under the Melbourne Ministry which succeeded the Grey Ministry in July, 1834, but in November of the same year the death of his father gave him a seat in the House of Lords. He died October 1, 1845. He was a man without ambition or especial ability, fond only of agriculture and country sports; but honesty and industry raised him to positions of responsibility, all of which he filled with great credit. Consult Myers, *Lord Althorp* (London, 1890).

SPENCER, John Poyntz, fifth Earl Spencer (1835—). An English statesman. The only son of the fourth Earl, he was born at Spencer House, was educated at Harrow and at Cambridge, and in 1857, the year of his graduation, was elected member of Parliament, and by his father's death succeeded to the peerage. He was Lord Lieutenant of Ireland 1869-74, and again in 1882-85; and lord president of the council, with a seat in Mr. Gladstone's Cabinet, 1880-83 and 1886. He was First Lord of the Admiralty 1892-95.

SPENCER, Joseph (1714-89). An American soldier, born in East Haddam, Conn. He was a probate judge in 1753, and rose to the rank of colonel in the French and Indian War. He was one of the eight brigadier-generals appointed by Congress on June 22, 1775, served at Boston and New York, became a major-general in August, 1776, and commanded in Rhode Island in 1777. He resigned in January, 1778, and was a member of Congress in 1779.

SPENCER, Joseph William Winthrop (1851—). An American geologist, born at Dundas, in Ontario, Canada. He graduated at McGill University in 1874, and received the degree of Ph.D. from the University of Göttingen three years later. He was professor of geology in King's College, Nova Scotia, in 1880-82, and in Missouri State University, 1882-87; and was State geologist of Georgia, 1888-93. He is especially distinguished for researches in lacustrine geology. Among his published works are: *Niagara Fossils* (1884); *Glacial Erosion in Norway* (1887); *Geological Survey of Southwestern Georgia* (1891); *Geological Survey of the Paleozoic Belt of Georgia* (1893); and *Duration of Niagara Falls and History of the Great Lakes* (1895).

SPENCER, Platt Rogers (1800-64). The originator of the Spencerian system of penmanship. He was born at East Fishkill, New York, and at the age of ten years removed to Ashtabula County, Ohio. He gave many lectures upon penmanship in various parts of the country, and his work was influential in causing the establishment of business colleges. Spencer published *Spencer and Rice's System of Business and Ladies' Penmanship* (1848), later republished as *Spencerian or Semi-Angular Penmanship.*

SPENCER, Robert, second Earl of Sunderland. An English statesman. See Sunderland, Robert Spencer, second Earl of.

SPENCER, Sara Andrews (1837—). An American author and woman-suffragist, president and proprietor of the Spencerian Business College, Washington, D. C. She was born in

Savona, Steuben County, N. Y., and in 1864 married Henry C. Spencer, and afterwards removed to Washington, D. C. In 1871, with other women, she made an unsuccessful attempt to register and vote, and afterwards brought suit on which the Supreme Court of the United States decided (1874) that women have not the right to vote without local legislation. She represented the National Woman's Suffrage Association at the Republican National Convention in Cincinnati, in 1876; and engrossed, signed, and presented the *Woman's Declaration of Rights* at the Centennial Celebration at Philadelphia. Her publications include *Problems on the Woman Question* (1871).

SPENCER, William Robert (1769-1834). An English poet and wit. He was a grandson of the third Duke of Marlborough. He was educated at Harrow and at Christ Church, Oxford, but left the university without a degree. Among his friends were Pitt, Fox, Sheridan, and Sydney Smith. His last years were passed in Paris, where he died in poverty. In 1796 Spencer published a version of Bürger's *Leonore,* which was praised by Scott; and in 1802 burlesqued German romance in *Urania,* a play performed at Drury Lane. In 1811 he collected his poems in a volume, which contained his best known pieces, like "Beth Gélert" and "Too Late I Stayed." As a poet, Byron ranked him with Moore, Campbell, and Rogers. Consult the reprint of Spencer's *Poems* with biography (London, 1835).

SPENER, spā′nēr, Philipp Jakob (1635-1705). A German clergyman, the founder of the German Pietists. He was born at Rappoltsweiler. in Upper Alsace, and was educated at Strassburg, Basel, Tübingen, Geneva, and Lyons. At Geneva he was influenced by Labadie (q.v.), and his natural disposition led him strongly toward a religion of spiritual and untheological type. He preached at Strassburg, was transferred to Frankfort, and in 1666 became first pastor there. He strove to awaken a deeper faith and more active Christian life, emphasized the necessity of conversion and regeneration, and the study of the Scriptures, in opposition to the prevalent teaching which laid stress on orthodoxy and connection with the Church, and cared more for the symbolical books than for their source. His views were set forth in his *Pia Desideria, oder herzliches Verlangen nach gottgefälliger Besserung der wahren evangelischen Kirche* (1673). In 1670 he began meetings at his house for the cultivation of evangelical morality, the so-called *collegia pietatis,* with the aim, as he expressed it, of forming within the Church (*ecclesia*) a smaller church (*ecclesiola*) which should have a deeper spirituality. At the same time he reorganized the method of catechising and improved the religious instruction given to children. In 1679 a preface which he wrote for a new edition of the *Postille* of Arndt, in which he censured the morals of the upper classes, brought him into difficulties; and in 1686 he accepted an invitation to become Court preacher at Dresden and member of the upper consistory. In this capacity he effected changes in the theological teaching of the University of Leipzig and in the system of religious catechising practiced throughout Saxony; but because of attacks from the orthodox theologians, and having fallen into disgrace with the Elector Johann Georg III., in 1691 he went to Berlin as provost of the Church of Saint Nicholas and consistorial inspector, offices which he retained till his death. The Elector of Brandenburg encouraged his efforts for religious reform and intrusted theological instruction in the new University of Halle to Francke, Breithaupt, and others of his disciples. In 1695 the theological faculty of Wittenberg formally censured as heretical 264 propositions drawn from Spener's writings. There is no collected edition of his works; the full list (180 in number) is given in his biography by Von Canstein (Halle, 1740), and his chief works have been edited by Grünberg (Gotha, 1889). Consult also the lives by Hossbach (Berlin, 1828; 3d ed. by Schweder, 1861), by Wildenhahn (Leipzig, 1842; Eng. trans., Philadelphia, 1881), and by Grünberg (Göttingen, 1892-97). See Pietism; German Theology.

SPENGEL, spĕng′'l, Leonhard (1803-80). A German classical scholar, born at Munich. He became known through his edition (1826) of Varro's *De Lingua Latina,* and was appointed in 1826 lector, in 1830 professor in the present Wilhelmsgymnasium of Munich. In 1842 he accepted a chair at Heidelberg which he held until his return, as professor, to Munich in 1847. Among his publications were his edition of the *Ars Rhetorica ad Alexandrum,* which, following Petrus Victorinus, he attributed to Anaximenes of Lampsacus (*Anaximenes Ars Rhetorica quæ Vulgo Fertur Aristotelis ad Alexandrum,* 1844), his edition of the *Rhetoric* of Aristotle (*Aristotelis Ars Rhetorica cum Adnotatione,* 1867), and his text edition of the *Rhetores Græci* (3 vols., 1853). His address *Ueber das Studium der Rhetorik bei den Alten* (1842) is a valuable outline sketch of the art of eloquence in classical times.

SPEN′NYMOOR. A town in Durham, England, 4 miles northeast of Bishop Auckland (Map: England, E 2). It has coal-mining and iron industries. Population, in 1901, 16,660.

SPEN′SER, Edmund (c.1552-99). An English poet, born in London. He claimed relationship to the noble family of Spencers at Althorp, but he seems to have been more closely connected with the Spensers of Lancashire. His father, certainly in reduced circumstances, has been identified with John Spenser, a London clothmaker. The boy was apparently sent to the Merchant Taylors' School, London, whence he passed, as sizar or poor scholar, to Pembroke Hall, Cambridge. At the university he read widely and eagerly in Latin, Greek, Italian, and French literature. He was especially fond of Petrarch and Chaucer, of Marot and Du Bellay. He formed lifelong friendships with Gabriel Harvey and Edward Kirke. After graduating M. A. in 1576, he seems to have spent nearly two years with his kinsfolk in Lancashire, where he fell in love with a young woman whom he celebrated in verse under the name of Rosalind. In 1578 he went to London and found a place in the household of the Earl of Leicester. There he probably met Sir Philip Sidney, to whom he dedicated *The Shepheardes Calender* (1579). In 1580 he was appointed secretary to Lord Grey, the new Lord Deputy of Ireland. Thenceforth Spenser lived mostly in Ireland. There he completed *The Faerie Queene,* already begun at Leicester House.

By 1588 or 1589 he was living at Kilcolman Castle, in the County of Cork, which with its extensive lands was legally transferred to him in 1591. In the meantime he had written *Astrophel*, a noble pastoral elegy on Sidney, and had received a visit from Sir Walter Ralegh (1589), made memorable by *Colin Clouts Come Home Againe*. In 1590 he accompanied Ralegh to London, was welcomed by the Court, and published the first three books of *The Faerie Queene*, a moral and historical allegory. In 1591 followed a volume of miscellanies called *Complaints*, including "The Ruines of Time," "The Teares of the Muses," "Mother Hubberd's Tale," "The Tale of the Butterflie," and four other poems. Evidently disappointed of expected Court preferment, Spenser returned to Ireland, where he married a certain Elizabeth, probably Elizabeth Boyle, related to the first Earl of Cork. The courtship is described in the *Amoretti* (published in 1595), a series of mellifluous sonnets; and the marriage is celebrated in the *Epithalamion* (published in 1595), the richest nuptial hymn in the English language. In 1596 he brought to London for publication three more books of *The Faerie Queene.* Spenser intended to continue the work to twelve books, but he never got further than two cantos on *Mutabilitie* (printed 1609). While in England he seems to have completed a prose treatise on the *Present State of Ireland* (not published till 1633); he prepared for the press the beautiful *Foure Hymnes* (1596), in honor of love, beauty, heavenly love, and heavenly beauty; and wrote for a double marriage at Essex House the *Prothalamion* (1596), one of his choicest poems. Once more disappointed of preferment, he returned to Ireland. In October, 1598, his castle was sacked and burned by the Irish rebels. Spenser fled to England, where he died at a London inn, January 16, 1599. He was buried near Chaucer in Westminster Abbey.

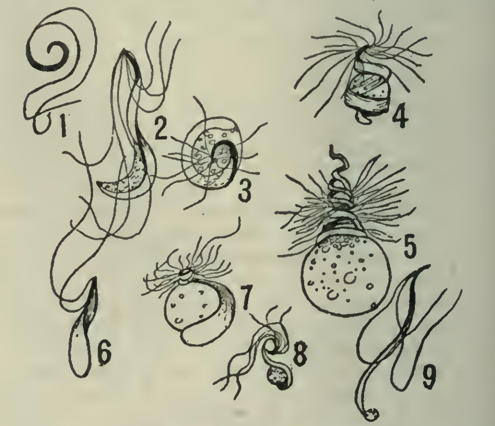
The Shepheardes Calender marks an epoch in English poetry. Conventional in theme, it yet shows a command over rhythm greater even than Chaucer's. It sounded the note of the Elizabethan outburst. As Spenser grew older he became more weighty in substance and discovered new melodies. In *The Faerie Queene* he invented a nine-line stanza known as 'Spenserian.' It is the Italian *ottava rima* with an added Alexandrine (twelve syllables). The rhymes run ababbcbcc. But there is more in Spenser than sweet verse. His imagination dwelt in a realm of beauty and the noblest ideals. His greatest fault is an insistence on the allegory until it becomes monotonous and obscure. With the poets themselves, for whom this weakness counts less than for the general public, Spenser has been a favorite. The generation following him were Spenserians, and to him Milton owed much. In the romantic revival at the end of the eighteenth century Spenser was potent, and Keats's *Eve of Saint Agnes* and Byron's *Childe Harold* were written in the Spenserian stanza.

Consult the *Life* by R. W. Church (English Men of Letters, London, 1879); *Works*, ed. H. J. Todd (8 vols., ib., 1805, new ed. 1877), by J. P. Collier (5 vols. new ed., ib., 1891), by R Morris, with memoir by J. W. Hales (Globe edition, ib., 1869, often reprinted), and by A. B. Grosart (Huth Library, 10 vols. ib., 1882-84). Consult also G. L. Craik, *Spenser and his Poetry* (ib., 1845), and the essays by Lowell, *Among My Books*, second series (Boston, 1876), and by Aubrey de Vere (London and New York, 1894). The Spenser Society, founded at Manchester in 1867, published a facsimile of the first edition of *The Shepheardes Calender.*

SPENSERIAN STANZA. See Spenser, Edmund; Versification.

SPERANSKI, spȧ-rän'skė, Mikhail, Count (1772-1839). A Russian statesman. Educated at the Saint Petersburg Ecclesiastical Academy, he was appointed professor of mathematics there in 1797, and State Secretary in 1801. He became Assistant Minister of Justice in 1808, and Privy Councilor in 1809. During his administration he remodeled the system of taxation and the system of national education, and instituted many other reforms. His influence brought him many enemies, and he was banished in 1812, but recalled in 1816 and made Governor of Pensa. As Governor-General of Siberia (1819-21) he displayed great energy in fighting official corruption and bettering the condition of the exiles. In 1821 he was made a member of the Imperial Council. Nicholas I. intrusted him with the codification of the Russian laws, which task he performed with singular success.

SPERM, in Plants (Lat. *sperma*, from Gk. *σπέρμα*, seed, from *σπείρειν*, *speirein*, to sow), Antherozoids, Spermatozoids. The male sexual cell, whose union with the egg is the process of fertilization, and results in the formation of an embryo. Sperms are produced by all plants except the lower algæ and many of the fungi, and are often characteristic of great groups of plants. An ordinary sperm is an actively moving, naked cell, consisting essentially of a relatively large nucleus with a thin sheath of cytoplasm, forming the body, and delicate, hair-like swimming appendages (cilia). The male organ which produces sperms is uniformly called an antheridium (q.v.). See Fertilization; Reproduction; Sex.



TYPES OF SPERMS.

1, Chara; 2-4, fern; 5, Marsilia; 6, club moss; 7, fern; 8, quillwort; 9, liverwort.

SPERMACETI (Neo-Lat., whale's seed, from Lat. *sperma*, from Gk. *σπέρμα*, seed + *ceti*, gen. sg. of *cetus*, from Gk. *κῆτος*, *kētos*, whale; so called because at first supposed to be the spawn of the whale). A waxy substance obtained from cavities in the head of the sperm whale (*Physeter* *macrocephalus*), which lives in the Pacific and Indian Oceans. In the living whale it is dissolved in an oil, but on cooling separates as a solid. As much as twelve barrels of crude spermaceti is obtained from an ordinary whale. It is purified by pressure, melting, and crystallization. It is white or translucent, crystallizable from alcohol and ether, not soluble in water, smooth to the touch, and without taste or odor. It becomes rancid and grows yellowish on exposure to light. It burns with a bright flame. Its specific gravity is .945, and its melting-point is about 38° C. (about 100° F.). It does not, like fats and oils, give glycerin after saponification, but cetyl alcohol. It consists chiefly of cetin, or cetyl palmitate, $\left.\begin{matrix}C_{16}H_{31}O\\C_{16}H_{33}\end{matrix}\right\}O$. Spermaceti is used as an ingredient of many ointments and cerates. It is made into sperm candles of definite weight for photometric purposes.

SPERMATISTS. A school of physiologists of the seventeenth century, who held that the whole of the material transmitted from the parents to the offspring as the foundation of the embryo was contained in the spermatozoön of the male, opposing those (the ovulists) who asserted that all the material was supplied by the mother in the egg. See Preformation.

SPERMATOPHYTES (from Gk. *σπέρμα, sperma*, seed + *φυτόν, phyton*, plant), Seed-Plants. The highest of the four primary divisions of the plant kingdom, distinguished from the other groups by the production of seeds. The much used name phanerogams, meaning evident sexual reproduction, is unfortunate because in this group sexual reproduction is least evident. The once used name anthophytes, meaning flowering plants, which last is probably the most commonly used popular name, is also inappropriate, since the production of flowers is not coextensive with the group. The most recently proposed name siphonogams, meaning sexual reproduction by means of a tube, referring to the passage of the male cells to the eggs through pollen-tubes, has not been extensively adopted. Since the seed-production seems to distinguish the group more than any other character, the name spermatophytes, which is in common use, seems likely to prevail.

This group, which includes practically all the conspicuous vegetation (herbs, shrubs, and trees), is by far the most useful group to man, so useful, indeed, that until the closing years of the nineteenth century elementary botanical training dealt with no other group and botanists were thought of chiefly as students of flowers. More than 100,000 species of seed-plants have been described, and grouped in two distinct but very unequal divisions, gymnosperms (q.v.) and angiosperms (q.v.). They are distinguished by the position of their seeds, which are naked or freely exposed in the former, but inclosed in a seed-case in the latter.

In all seed-plants the alternation of generations (q.v.) is very much obscured by the great reduction of the sexual plants, which are not popularly recognized, and are undiscoverable except by laboratory manipulation, the whole visible body of these plants, contrary to the popular notion, being the sexless phase or sporophyte. All the members of the group are also heterosporous. (See Heterospory.) The pollen-grain is a sexless microspore that in germination gives rise to a small plant consisting of only a few cells, among them two male cells, which are formed within the pollen-grain and are to function as sperms. The pollen-grain is transferred to the immediate neighborhood of the female plant, usually by the wind or by insects. See Pollination; Fertilization.

The megaspore, a large sexless spore, that produces the female plant, is developed within the ovule, which is, therefore, a sporangium. The fact that in this sporangium there is but a single megaspore, and that is not discharged, but retained, is what makes a seed possible; for the retained megaspore germinates within its sporangium

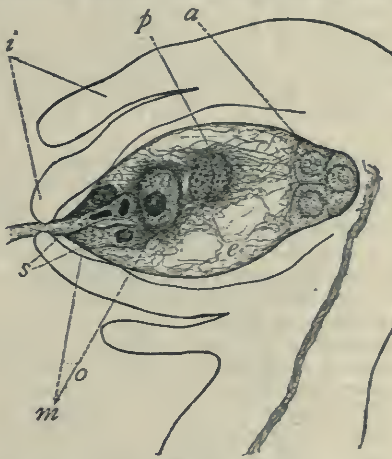


Fig. 1. Ovule.

Showing *i*, integument; *e*, embryo-sac; *a*, antipodal cells; *p*, polar nuclei fusing; *s*, synergids; *o*, eggs; and *m*, pollen tube containing male cells.

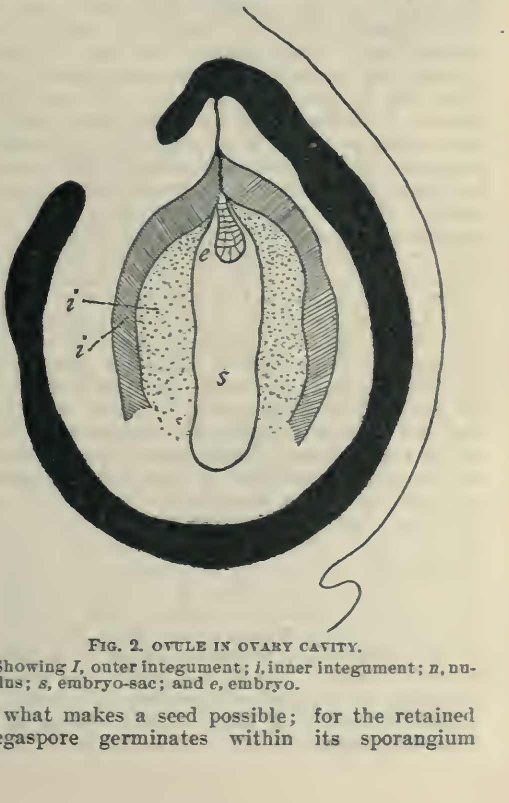


Fig. 2. Ovule in ovary cavity.

Showing *I*, outer integument; *i*, inner integument; *n*, nucellus; *s*, embryo-sac; and *e*, embryo.

(ovule) and produces the female plant there. This megaspore within the ovule was once thought to be merely a sac-like cavity, within which the embryo appeared, and hence was called the 'embryo-sac' (*e*, Fig. 1; *s*, Fig. 2). In germination the megaspore produces a female plant, with several or many cells, which has long been called 'endosperm,' and recognized as a prominent nutritive tissue within the seed. The female plant, therefore, is entirely inclosed within the ovule, and produces an egg (*o*, Fig. 1) which is reached by a pollen-tube (*m*, fig. 1) and fertilized. This act of fertilization is followed by two conspicuous results, namely (1) the development of the embryo (*e*, Fig. 2), and (2) the development of a hard superficial tissue (testa) in the outer part of the ovule, which hermetically seals the female plant and embryo within, the whole complex structure constituting the seed.

In the seed condition the plant passes into a resting period of greater or less duration, and then, under favorable conditions, the seed is said to germinate. This simply means the renewed growth of the young plantlet, whose embryo, which had begun to develop, was checked by the hard investment of the seed. A seed, therefore, is a complex of three generations: (1) the old sexless generation (sporophyte), represented at least by the seed coats; (2) the following female sexual generation (gametophyte), represented by the endosperm; and (3) the new sexless generation (sporophyte), represented by the embryo.

SPERMATOZOÖN (Neo-Lat., from Gk. *σπέρμα*, *sperma*, seed + *ζῷον*, *zōon*, animal). The male germ cell. The phenomenon of sexuality consists of the union of two cells. In the lowest forms these may be alike, but in the higher plants and animals there is a difference in size of the two uniting cells. The larger is called the female cell or 'egg,' the smaller the spermatozoön. This difference in size is advantageous, for it means a division of labor. The large cell is passive and accumulates a large amount of food-material by virtue of which the future embryo is better provided for. The spermatozoön, on the other hand, retains the capacity for locomotion; it seeks the passive egg. Consequently, the spermatozoön becomes as small as possible and is provided with a large locomotive organ—the tail, flagellum, or lash. The spermatozoön is thus a highly specialized, actively locomotor cell. A typical flagellate spermatozoön consists of three parts: head, middle piece, and tail. The head contains the nucleus, made up of an extremely dense mass of chromatin; also often an apical body or acrosome, lying in a spur of the head. The middle piece is larger than the tail and usually contains the centrosome. The tail is a cytoplasmic thread, containing a central delicate thread and having a lateral membrane or fin which makes the stroke of the tail more effective. Spermatozoa exhibit a great variety of forms. Thus, the head may be nearly globular or spear-shaped, or even of the shape of a corkscrew. The membrane may be absent or it may twist spirally around the axial thread. Finally the spermatozoön may, as in certain Crustacea, be not thread-like, but star-shaped or spindle-shaped, with the head at the centre. In plants, also, the spermatozoön (spermatozoid) exhibits a great diversity of form from a sphere to a screw-like thread.

The spermatozoa develop in a special organ of the body called *testis*, typically a mass of germ cells, young and old. In the young male this gland is made up of epithelial cells known as primordial germ cells; from these by cell-division arise 'spermatogonia,' still undifferentiated cells. The spermatogonia grow until they become very big, and are then called 'spermatocytes.' Each large spermatocyte divides and the daughter cells promptly divide again into 'spermatids,' four of which thus arise from each spermatocyte. But each spermatocyte has only half the number of chromosomes that the original spermatocyte had. Each spermatid now undergoes a change of form by which it becomes a spermatozoön, and not until then is it ready to fertilize the egg. See FERTILIZATION.

SPERMOPHILE (from Gk. *σπέρμα*, *sperma*, seed + *φιλεῖν*, *philein*, to love). A ground-squirrel of the genus Spermophilus, of which more than a dozen species occur in the United States, but only one or two in Europe. They are all terrestrial, live in burrows under ground, feed chiefly on herbage and seeds, are very prolific, and are commonly called 'gophers' (q.v.), thus confusing them with an entirely different group of mammals. Three of the species, at least, are sufficiently abundant to do much damage to lawns and cultivated fields. A very effective means of destroying them is by soaking some absorbent substance in carbon bisulphide and placing it in the burrows. In size, form, color, and length and shape of tail, the spermophiles show great variety. They are usually some shade of brown, mottled, spotted, or striped with other shades. With the tail, they will average about a foot in length. All are western, and denizens of open regions, only two species occurring as far east as Illinois. The flesh is edible. Consult Bailey, "Prairie Ground Squirrels," in *Bulletin 4* (Department of Agriculture, Division of Ornithology and Mammalogy, Washington, 1893). Compare CHIPMUNK.

SPERM WHALE. See WHALE.

SPES (Lat., hope). The Roman goddess of hope, represented as a youthful divinity clad in a long robe and bearing a bud in one hand. Spes personified particularly hope for good harvests and for children, and gradually came to be looked upon as a goddess of the future, to be invoked at births, marriages, and other important times.

SPEUSIP'PUS (Lat., from Gk. Σπεύσιππος) (c.395-c.339 B.C.). An Athenian philosopher, nephew and pupil of Plato, with whom he is supposed to have visited Syracuse. For the last eight years of his life. Speusippus was head of the Old Academy. He went even further than Plato in his mystical interest in the Pythagorean numbers, but in general agreed with his master, save that he denied the perfect goodness of the primordial unity, inasmuch as bad must be held to proceed from it as well as good. Consult Fischer, *De Speusippi Atheniensis Vita* (Rastatt, 1845).

SPEY, spā. A river of Scotland, rising in Inverness-shire, and, after a northeast course of about 110 miles, falling into the Moray Firth, 3 miles west of Portgordon (Map: Scotland, E 2). The Spey is the second longest river in Scotland. It has salmon fisheries.

SPEYER, spī'ĕr, or **SPEIER** (in Eng. often *Spire*). The capital of the Palatinate, Bavaria, situated at the confluence of the Speyerbach and the Rhine, 23 miles north of Karlsruhe (Map: Prussia, C 4). The chief feature is the magnificent cathedral, a vast Romanesque edifice. Its construction was begun in 1030 by Conrad II., the founder of the Franconian dynasty of German emperors, and in its original form it was completed in the reign of his grandson, Henry IV. It was long the burial place of the German emperors. It suffered in 1689 and 1794 from the vandalism of the French invaders, who spared nothing. The work of restoration was completed in 1858. The interior is embellished with magnificent frescoes, statues, and reliefs by Schraudolph and other masters. Among the other architectural monuments of the city is a splendid gate of the thirteenth century. Speyer has a fine museum of antiquities. The manufactures include woolens, machinery, shoes, tobacco, vinegar, and sugar. Speyer, the Roman Augusta Nemetum (later Noviomagus), was created an episcopal see in 348. It was a favorite residence of the German emperors, and became a free Imperial city in 1294. At the Diet of Speyer in 1529 the followers of Luther presented their protest, which gave them the appellation of Protestants. The city belonged to France from 1801 to 1814, when it passed to Bavaria. Population, in 1900, 20,911.

SPEZIA, spĕt'sē-ȧ. A city in the Province of Genoa, Italy, on the Gulf of Spezia, 56 miles by rail southeast of Genoa (Map: Italy, D 3). The beautiful scenery and mild climate have made it a favorite winter resort. The advantages of the Gulf as a naval station were pointed out by Napoleon I., and in 1861 the Italian Government made it the chief naval harbor of Italy. On the hills around the harbor there are strong fortifications. The ship-building yards are important, some of the largest Italian warships having been constructed here. The city has a technical institute, a school of navigation, and a marine hospital. Considerable trade is carried on, chiefly in olive oil, wine, fruits, and marble. There are manufactures of furniture, hemp-linen, and leather. Spezia is near the site of the anceint Luna, of which some remains exist. Population (commune), in 1881, 30,732; in 1901, 65,612.

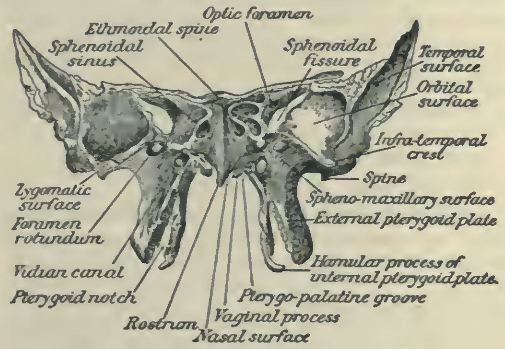
SPHACTE'RIA, or SPHAGIA. An island off the southwestern coast of Messenia, Greece, commanding the entrance to the Bay of Navarino.

SPHAGNUM (Neo-Lat., from Gk. *σφάγνος*, *sphagnos*, *σφάκος*, *sphakos*, *φάσκος*, *phaskos*, *φάσκον*, *phaskon*, sort of moss), or BOG MOSS. A genus of mosses intermediate between the liverworts and true mosses (see MUSCI) remarkable for their whitish or pale color. They often grow in considerable masses, absorbing water like sponge, but becoming friable when dry. They contribute much to the formation of peat, although peat from sphagnum alone is of poor quality. Gardeners employ them for covering and moistening the roots of plants because they readily absorb moisture from the air. The cells of the leaves are remarkable for their spiral structure, and for large pores in their sides. See Plate of BRYOPHYTES and Colored Plate under MUSCI.

SPHENE (from Gk. *σφην*, *sphēn*, wedge; so called from the shape of the crystals). One of the light-colored (yellow or green) varieties of titanite (q.v.).

SPHENISCI (Neo-Lat. nom. pl., from Gk. *σφηνίσκος*, *sphēniskos*, diminutive of *σφήν*, *sphēn*, wedge). A group of birds, the penguins (q.v.).

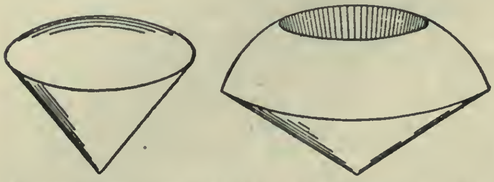
SPHENOID BONE (Gk. *σφηνοειδής*, *sphēnoeidēs*, wedge-shaped, from *σφήν*, *sphēn*, wedge + *εἶδος*, *eidos*, form). A bone situated at the anterior part of the base of the skull, and articulated with all the other cranial bones, which it wedges firmly together. It somewhat resembles a bat with its wings extended, and hence was termed the os *vespertilionis*. It is divisible into a body, the greater and lesser wings, and various processes. The greater wings present three surfaces: a superior or cerebral surface, forming part of the floor on which the brain rests; an anterior surface, which assists to form the outer part of the orbit of the eye; and an external surface with a rough ridge, giving attachment to the external pterygoid muscle, one of the most powerful muscles of mastication. The second, third, fourth, fifth, and sixth cranial nerves emerge from the cranial cavity through foramina in this bone.



SPHENOID BONE AS SEEN FROM THE FRONT.

SPHERE (Lat. *sphæra*, from Gk. *σφαῖρα*, *sphaira*, ball, globe; connected with Lith. *spirà*, ball of dung, and perhaps with Skt. *sphar*, to hasten, stretch out). A solid bounded by a surface every point of which is at a given distance from a fixed point. The given distance is called the *radius* and the fixed point the *centre* of the sphere. A spherical surface may be generated by revolving a semi-circumference about its diameter. Sections of a sphere made by planes are circles. If the plane passes through the centre of the sphere, the circle is a *great* circle, otherwise a *small* circle of the sphere. If the segments into which a plane divides a sphere are unequal, the smaller is called the *minor* and the larger the *major* segment. That portion of the spherical surface which is included between two parallel planes which cut or touch the surface is called a *zone*. The portion of a sphere generated by the revolution of a circular sector about any diameter of its circle as an axis is called a *spherical sector*.

The surface of a sphere is equal to four times the area of a great circle of the sphere, or $4\pi r^2$, r being the radius of the sphere. Its volume is $\frac{4}{3}\pi r^3$. The rectangular equation of a sphere, the origin being at the centre, is $x^2 + y^2 + z^2 = r^2$. (See COÖRDINATES.) (For the formulas for areas and volumes relating to zones, segments, and sectors, see Mensuration.) A remarkable property of the sphere is that its surface is equal to the curved surface of the circumscribed cylinder and its volume is two-thirds of that of the cylinder, a property said to have been discovered by Archimedes (q.v.). If a sphere and a double cone be inscribed in an equilateral cylinder, the sphere and the volume between the cone and the cylinder are Cavalieri bodies. See Cavalieri.



SPHERICAL SECTORS. THE LEFT ONE A SPHERICAL CONE.

SPHERICAL TRIGONOMETRY. See Trigonometry.

SPHEROGRAPH. See Sailings.

SPHEROID. See Ellipsoid.

SPHEROIDAL STATE (from *spheroid*, from Gk. σφαιροειδής, *sphairoeidēs*, like a ball or sphere, from σφαῖρα, *sphaira*, ball, globe + εἶδος, *eidos*, form). The phenomenon observed when a drop of water placed on a highly heated surface remains in its spherical shape and moves about over the surface, evaporating gradually, instead of vaporizing instantaneously. The experiment to show this condition of a liquid is generally performed by using a metallic disk heated by a lamp or Bunsen burner, on which one or more drops of water are carefully let fall. If the disk is sufficiently heated a layer of vapor will be formed between its surface and the drop, which is known as the 'Crookes's layer.' The liquid remains suspended on this vapor and the drop takes the form of an oblate spheroid, the temperature, however, never rising above the boiling point, being in the case of water about 206° F. or 96.6° C., while the disk itself must have a temperature of at least 340° F. or 171° C. The explanation of this fact is that the latent heat carried off in the course of vaporization is sufficient to keep the temperature below the boiling point. The drop does not actually touch the disk, but is supported on a cushion of vapor, which is evaporating toward the hot plate so rapidly as by its reaction to keep the water from falling. This may be seen by looking at a flame through the intervening space, or by attempting to pass an electric current from the drop of water to the metal disk, using a galvanometer to detect its passage, there being no deflection of the needle unless the two substances are in actual contact. The liquid takes a spherical shape owing to capillary action. Other liquids and bodies that are solid at ordinary temperatures also show this phenomenon, and instead of a metallic surface, that of a hot liquid can also be used. A striking illustration of this same principle is the immersion of a hand in molten metal, or in liquid air, the thin layer of aqueous vapor preventing the passage of the heat or cold to the hand. Consult: Stewart, *Elementary Treatise on Heat* (6th ed., Oxford, 1895); Barker, *Physics* (New York, 1893); Daniel, *Text-Book of the Principles of Physics* (3d ed., New York, 1894).

SPHINCTER MUSCLE (Lat. *sphincter*, from Gk. σφιγκτήρ, *sphinktēr*, that which binds tight, sphincter, from σφίγγειν, *sphingein*, to strangle; possibly connected with Arm. *pirk*, tight). A circular band of muscular fibres, whose function is to antagonize the expellent action of certain viscera, especially the bladder and the lower part of the intestinal canal. It is to the presence of these muscles that the higher animals owe the power of retaining for a considerable period the excrementitious matters collected in the bladder and rectum, and of discharging them at intervals, the sphincter muscles being, like those engaged in the process of respiration, mainly, but not entirely, under the control of the will.

SPHINX (Lat., from Gk. σφίγξ, *sphinx*, from σφίγγειν, *sphingein*, to strangle). A composite monster, famous in Greek mythology, having the head of a woman, the body of a lion, the wings of a bird, and the tail of a serpent. According to the legend, she proposed a riddle to the Thebans, slaying all who were unable to guess it, and when Œdipus finally solved her riddle, she threw herself over a cliff and perished. She is said to have been the daughter of Echidna and her son Orthrus, or of Chimæra and her brother Orthrus. The name sphinx was applied by the Greeks to a class of composite figures, familiar in Egyptian art, having the body of a lion and the head of a man or of some animal. A figure of this sort with a human head was called an androsphinx; one having a ram's head, a criosphinx; and one with a hawk's head, a hieracosphinx. Like the winged bulls and lions found in Assyria, the Egyptian sphinx was the guardian genius of the temple before which it stood. The avenues leading to many Egyptian temples were guarded by long rows of sphinxes placed at intervals on either side. Primarily the sphinx represented an imaginary human-headed animal, living in the desert, and believed to be a favorite incarnation assumed by the Sun-god Re. As a rule, the face was modeled after that of the reigning Pharaoh, the son of Re and his representative upon earth, and therefore Egyptian sphinxes were almost invariably male, though they might also present the features of a reigning queen. Where the sphinx has the head of an animal, the head is that of the animal sacred to the god before whose temple the figure is placed.

The most remarkable of all Egyptian sphinxes is the Great Sphinx of Ghizeh, lying about 300 feet east of the second pyramid. It is sculptured out of the native rock, to which masonry has been added in certain places to complete the form. The body is roughly hewn out, but the head was originally executed with great care. The entire height of the monument, from the crown of the head to the pavement on which the fore legs rest, is about 66 feet. In length the figure measures 172.5 feet; the fore legs are 50 feet long; and the head is 30 feet long by nearly 14 feet in breadth. The face was originally colored red, but the coloring has almost entirely disappeared. In 1816 the front of the Sphinx was cleared of sand by Caviglia, who found close to the breast a shrine, or small temple, containing an inscription of Thothmes IV. and one of Rameses II. Both monarchs had cleared away the sand that had accumulated about the monument. From the inscription of Thothmes IV. it is clear that the

Sphinx was considered to represent Harmachis (q.v.), a special form of the sun-god, and its office was to serve as a guardian of the necropolis near the pyramids. It has been supposed to be the work of King Chephren of the Fourth Dynasty, and some archæologists have even assigned it to an earlier period, but the existing evidence is insufficient to fix its date with any degree of accuracy. Consult: Vyse, *The Pyramids of Gizeh* (London, 1840); Lepsius, *Denkmäler* (Berlin, 1849-58); Perrot and Chipiez, *History of Art in Ancient Egypt* (London, 1883); Baedeker, *Aegypten* (4th ed., Berlin, 1897); Petrie, *A History of Egypt* (New York, 1899); Budge, *A History of Egypt* (ib., 1902). See Plate of PYRAMIDS.

SPHINX MOTHS. Moths of the family Sphingidæ, described under HAWK-MOTH. Prominent American examples are depicted on the Colored Plates of MOTHS, and of INSECTS.

SPHYGMOGRAPH (from Gk. σφυγμός, *sphygmos*, pulse + γράφειν, *graphein*, to write). An instrument invented by Vierordt and perfected by Marey by which are ascertained and permanently recorded the force and frequency of the pulse-beat and the changes which it undergoes. It consists of two essential parts: (1) Of two levers, one of which is so delicately adjusted, on the vessel the pulsation of which it is desired to examine, that on each expansion of the vessel the lever undergoes a corresponding slight elevation; this lever communicates by a perpendicular arm with a second, to which it transmits the impulse received from the vessel; the extremity of this second lever is armed with a pen-point, which records the movement thus indicated on a movable plate, controlled by the second part of the instrument. (2) The second portion consists of a plate, moved by clockwork, and bearing a strip of paper on which the sphygmogram is written. The instrument may be combined with a microphone, constituting a sphygmophone. The pulsations may be seen by an appliance termed a sphygmoscope.

SPICCATO, spê-kä′tô (It., separated). A term in music indicating a distinct and detached mode of performance. Its usual application is to music for bowed instruments, where it implies that each note is to be played with a springing bow. The bow is allowed to fall by its own weight upon the string; it rebounds and falls again, thus producing the next tone.

SPICE BUSH. See FEVER BUSH.

SPICE ISLANDS. A group of islands in the Dutch East Indies. See MOLUCCAS.

SPICES. See FLAVORING PLANTS.

SPIDER (ME. *spither*, from AS., Goth., OHG. *spinnan*, Ger. *spinnen*, to spin; cf. OHG. *spinna*, Ger. *Spinne*, spinner, spider). Any member of the Araneida, an order in the class Arachnida. The arachnids are distinguished from insects by the possession of four pairs of legs; while spiders are separated from other Arachnida by the presence of spinning-organs near the tip of the body. The body of a spider is divided into two portions connected by a small slender pedicel. The anterior part is called 'cephalothorax.' and is supposed to represent the combined head and thorax of insects. The posterior part is the 'abdomen.' On the anterior part of the cephalothorax are the eyes, commonly eight in number, and frequently arranged in two transverse rows of four each. In the lower front margin of the cephalothorax are the mouth-parts. These consist of a pair of jaws, sometimes called mandibles or 'falces;' a pair of palpi, whose basal joints are enlarged into maxillæ; and a median unpaired lower lip. The mandibles are two-jointed; the basal joint is very large and stout, the apical one is small, claw-like, and called the 'fang.' The palpi are filiform, and six-jointed. In the female they are simple and often terminate in a claw; in the male, however, the apical joint is curiously modified into a complicated accessory sexual organ, suited to carry and apply the seminal fluid. The four pairs of legs are similar in structure, but variable in length. Each consists of seven joints, and ends in two or three toothed claws. The spiders that live on webs usually have three claws, the median more curved than the others; while other spiders commonly have but two. In place of the median claw is sometimes a dense fascicle of hairs. The abdomen of spiders is generally soft, tumid, and has no apparent joints. The genital organ opens near the base of the abdomen beneath. The male aperture is inconspicuous, but the female vulva or epigynum is often very prominent, and sometimes quite complicated. At the apex of the abdomen are four to six short, often two-jointed pieces, the spinnerets or spinning-organs. Each spinneret has on its surface many minute orifices, from each of which may issue a thread, and the many threads joined together make the spider's line. The substance which exudes from the spinnerets is glutinous, but dries on contact with the air. Some spiders possess an accessory spinning-organ, a transverse surface in front of the base of the spinnerets known as the 'cribellum.' Correlated with this is a row of curved hairs on the hind metatarsus, called the 'calamistrum.' The spider draws the row of hairs over the cribellum and combs out a curled or tangled thread of silk.

The mouth of the spider opens into a short œsophagus, which leads to a sucking-stomach which draws up the liquid food. From the posterior part of this organ arise two branches which extend upward and forward and meet over the mouth; each branch gives off on the outer side four smaller branches, one in front of each leg, and these unite below the sucking-stomach. From the stomach arises the intestine, which passes into the abdomen and opens just behind the spinnerets. In the abdomen just above the intestine is a long tubular heart or pulsating vessel, with openings in front, behind, and along the sides. The nervous system is represented by a large, long ganglionic mass lying on the floor of the cephalothorax. In front is a smaller mass which gives rise to nerves to the eyes and jaws. At the base of the abdomen below there is a cavity on each side, nearly filled by a series of thin plates through which the air reaches the blood. These are the 'lungs.' Spiders also have a pair of branching tracheæ, which open just in front of the spinnerets. The silk-glands lie above the spinnerets and along the floor of the abdomen. They are of two kinds, most of them short, but two are larger and very long. Each silk-gland has a separate opening or duct in the spinnerets.

The eggs are deposited (10 to 2000 in number) within silken cases or cocoons made by the mother spider for this purpose. The young spider on hatching is in general appearance much like the parent, but with larger hairs, and less distinctly marked. As the young spider grows, it is obliged to molt the skin. The number of molts varies from six to nine. The spider's silk is not used solely in the construction of webs, but serves a variety of purposes. With many spiders the web is a loose, irregular maze of crossed threads, which are the true 'cobwebs.' In other cases it is a flat sheet of threads with a tubular retreat at one corner. The geometric or orb webs consist of a varying number of radiating lines, crossed by many parallel or spiral threads. The whole is supported by several guy-lines or stouter threads. At one corner or in the near vicinity is a silken nest or retreat, where the spider remains concealed during the day or when not using the web. This retreat is connected by a line to the centre of the web. When waiting for prey the spider rests upon the centre of the web, head downward and legs extended. See ORB-WEAVER.

The male spider is usually smaller than the female, with longer legs, and often is more highly colored; sometimes he has additional spines on the legs, or spurs on the coxæ. In many of the minute species the male has the front of the cephalothorax greatly swollen and elevated, often molded into grotesque shapes. The courtship of spiders is frequently attended with grave peril to the male. The female, if not in the suitable temper, may attack and devour her devoted admirer. In some cases, however, the male is larger than his mate.

As a rule spiders can see clearly only for a few inches. They have an acute sense of hearing, as well as of touch. A number of spiders are so shaped or colored as to deceptively resemble ants, an appearance heightened by their erratic movements. Others resemble the surfaces upon which they usually occur, as the bark of trees, dead leaves or twigs, and the petals of flowers. A few are able to produce sounds; some by rubbing the base of the abdomen over the base of the cephalothorax, others by rubbing the palpi against the sides of the mandibles. A considerable number, known as trap-door spiders, dig holes in the ground, line them with silk, and cover the entrance by a close-fitting door, the upper surface of which is made to resemble its surrounding. Some species make similar nests in trees. A few spiders are social and produce webs in common, or closely connected to each other. Some of the large spiders are very powerful and can kill small birds, rats, fish, and other animals. All spiders have poison-glands and use them in capturing prey, but with most spiders the mandibles are so small and weak as to be incapable of piercing the human skin, and if they did so the small amount of poison injected could have no deleterious effect. With the large tarantulas it is different, although cases of death from their bites are few and doubtful. There is one group of spiders, however (genus Latrodectus), which appear to merit the name of 'poisonous spiders.' The New Zealand species, locally known as 'katipo' (q.v.), certainly appears to be dangerous. A species of Latrodectus occurs in the Southern United States, where it is called 'malmignatte,' but its bite (as far as known) has not proved fatal.

The classification of spiders, formerly quite simple and based on their habits and webs, has undergone a complete revolution. Thirty-five or forty families are now known; several, however, contain but few species. The more prominent families may be grouped in two classes for convenience. Of the non-web-building kinds are the Theraphosidæ, or tarantulas, and trap-door spiders. They have vertically moving fangs, four lung-slits, and are of large size. The Dysderidæ possess but six eyes and live in dark places. The Drassidæ are flat, with prominent spinnerets, and live on the ground or under stones. The Clubionidæ are convex and occur on bushes or among dead leaves. The Sparassidæ are very flat and broad and are abundant in the tropics. The Thomisidæ, or crab-spiders, are flat, broad, can walk sidewise, and catch prey by the fore legs. The Lycosidæ, or wolf-spiders, have the eyes in three rows, those of the lowest very small; they wander in woods and fields. The Attidæ, or jumping spiders, have eyes in three rows, those of the lowest row the largest; they jump, and stalk their prey.

Among web-building forms are the Agalenidæ, which make flat sheets of web with a tubular retreat at one side; the Dictynidæ, which possess a cribellum, and make irregular webs, with curled threads; the Theridiidæ, which make the familiar cobweb; and the Epeiridæ, which make geometric or orb webs.

Consult: Emerton, *The Common Spiders of the United States* (Boston, 1902); McCook, *American Spiders and Their Spinning Work* (Philadelphia, 1889); Cambridge, *The Spiders of Dorset* (Sherbourne, 1879-81).

SPIDER-CRAB. Any crab in which the legs are of unusual length in comparison with the body. The famous giant crab of Japan (*Macrochira Kempferi*) is the largest known spider-crab, and has legs from four to six feet in length. On the eastern coast of the United States the name is usually given to species of Libinia, especially *Libinia canaliculata*, which is very common on muddy shores or flats.

SPIDER-MONKEY. One of the small American monkeys of the genus Ateles, with very long, slender, inelegant limbs. The tail is very long, prehensile, and sensitive. Spider-monkeys are very active, agile creatures, easily recognized by the absence of a thumb. The largest species is the coaita (*Ateles paniscus*) of the Amazon Valley, which is two feet long exclusive of the tail. Another species (*Ateles vellerosus*) is notable because it is found farther north than any other American monkey. The hooded spider-monkey (*Ateles cucullatus*) figured on the Plate of AMERICAN MONKEYS is black, and inhabits the eastern slopes of the Andes. Consult authorities cited under MONKEY.

SPIEGEL, spē'gel, FRIEDRICH VON (1820—). A German Orientalist, one of the pioneers in the field of Iranian philology. He was born in Kitzingen, studied at Erlangen, Leipzig, and Bonn, then spent five years in the libraries of Copenhagen, Paris, London, and Oxford, and from 1849 to 1890 was professor of Oriental languages in the University of Erlangen. His early studies on Pali and the publication of the *Kammavâkya*

(1841) and the *Ancedota Palica* (1845) did much for the knowledge of southern Buddhism. They were quickly followed by his researches on Zoroastrianism and the Avesta. The edition of the greater part of the extant Avesta, together with the Pahlavi translation (1853-58), was followed by a German version (1852-63), and supplemented by a commentary (1865-69). Then came the valuable linguistic and archæological works *Die altpersischen Keilinschriften* (1862, 2d ed. 1881), *Eran* (1863), *Eranische Alterumskunde* (1871-78), *Vergleichende Grammatik der alteranischen Sprachen* (1882), and *Die arische Periode und ihre Zustände* (1887). Mention should be made of a *Chrestomathia Persica* (1845), of the *Grammatik der Parsisprache* (1851), and of the *Einleitung in die traditionellen Schriften der Parsen* (1856-60).

SPIEGELEISEN, spē′gel-ī′zen. See Iron and Steel.

SPIELHAGEN, spēl′hä-gen, Friedrich (1829—). A German novelist, born at Magdeburg, and educated at Berlin, Bonn, and Greifswald. He taught for a while at Leipzig, and in 1859 became editor of the *Zeitung für Norddeutschland*, in Hanover. Thence he moved in 1862 to Berlin, and edited (1878-84) Westermann's *Illustrirte Monatschefte*. Spielhagen began novel-writing with *Problematische Naturen* (1860), and then for a while dealt with social problems, arising from the irrepressible conflict between the stolid landed nobility and the intelligence of the nation. In several books (*Durch Nacht zum Licht*, 1861; *Die von Hohenstein*, 1863; *In Reih und Glied*, 1866; *Hammer und Amboss*, 1869) he treated the subject with an aggressive optimism that won him a popularity which he afterwards maintained by sensational novels of a lower type. Of these *Sturmflut* (1877), *Der neue Pharao* (1899), and *Freigeboren* (1900) are sufficient exemplars. Excellent are his critical *Beiträge zur Theorie und Technik des Romans* (1883). His own ideal for the novel is to present an artistically composed picture of the times, and for this he makes constant hardly veiled allusions to persons of contemporary prominence, so that his novels lose with time something of their significance and actuality. As a translator Spielhagen rendered into German Curtis's *Howadji*, Emerson's *English Traits*, a selection of American poems (1859; 2d ed. 1865), and Roscoe's *Lorenzo de' Medici*. He also translated from the French minor works of Michelet, *L'amour*, *La femme*, *La mer*. His collected novels appeared in 22 vols. in 1895. Consult his autobiographical *Finder und Erfinder* (1890), and Karpeles, *Friedrich Spielhagen* (Leipzig, 1889).

SPIELMANN, spēl′man, Marion H. (1858—). An English art critic and author. He was born in London and studied at University College, London, with a view to becoming an engineer. He soon turned to literature, beginning with articles on art for the *Pall Mall Gazette* (1883). Afterwards he became art critic of the *Daily Graphic*, art editor of *Black and White*, and (1887) editor of the *Magazine of Art*. Among his publications are the *History of Punch* (1895), exceedingly well done; *Millais and His Works* (1898); *The Unidentified Contributions of Thackeray to Punch* (1899); *John Ruskin* (1900); *Notes on the Wallace Collection in Hertford House* (1900); and *British Sculpture and Sculptors of To-Day* (1902).

SPIGELIA (Neo-Lat., named in honor of Adrian van der *Spiegel*, a Belgian physician and professor of anatomy at Padua in the seventeenth century). A genus of plants of the natural order Loganiaceæ. *Spigelia marilandica*, often called worm grass and Carolina pinkroot, a native of the Southern United States, occurring from New Jersey to Wisconsin, and west to Texas, is a perennial plant with a simple quadrangular stem. The root has been employed in the United States as a vermifuge, as has also *Spigelia anthelmia*, a tropical American annual with spike-like racemes of purplish flowers.

SPIKE. A kind of inflorescence (q.v.).

SPIKENARD (OF. *spiquenard*, from Lat. *spica nardi*, spike of nard, from *spica*, spike, point, head or tuft of a plant, and *nardi*, gen. sg. of *nardus*, Gk. *νάρδος*, nard, from Pers. *nard*, from Skt. *nalada*, Indian spikenard), or Nard. A costly perfume of India highly prized by the ancients and used both in baths and at feasts. The 'ointment of spikenard' (John xii. 3) was probably an oil or fat impregnated with the perfume. The plant which produces it has been ascertained to be the Nardostachys jatamansi, a native of the mountains of Northern India. The root, which is from three to twelve inches long, sends up many stems, with little spikes of purple flowers, which have four stamens. Andropogon nardus yields an oil which is sometimes called oil of spikenard; and in the United States Aralia racemosa, a tall herb with large perennial spicy aromatic roots, is known as spikenard. See Aralia.

SPINA BIFIDA (Lat., cleft spine). A congenital hernia of the membranes of the spinal cord through a fissure in the wall of the bony canal. A tumor is thus formed, which is nearly round, varying in size from that of an egg to that of an adult head, lying in the middle line of the back, fluctuating, and adhering to the adjacent vertebræ either directly or by a pedicle. The sac may contain only the spinal membranes (meningocele) or a part of the cord with the membranes (meningo-myelocele), or lastly the spinal cord so distended by the expansion of the central canal as to form a neural lining to the sac. The usual termination of the condition is death. As the size of the tumor increases, fatal convulsions ensue; or the skin investing the tumor may ulcerate, and suffocation follow. Occasional cases are, however, recorded in which patients with this affection have survived till middle life. Active surgical treatment usually hastens death, and should only be used in the most urgent circumstances. Moderate support by means of a hollow truss, or a well-padded concave shield, may tend to keep the disease stationary; and any interference beyond this is, in the great majority of cases, unadvisable.

SPINACH, or **SPINAGE** (OF. *spinache*, *espinache*, *espinage*, *espinace*, from ML. *spinacia*, *spinacium*, spinach, from Lat. *spina*, thorn, spine, so called because of the prickly fruit), *Spinacia*. A genus of herbs of the natural order Chenopodiaceæ; probably natives of Asia. Common spinach, or garden spinach (*Spinacia oleracea*), is an annual widely cultivated for its young leaves, which are used as greens. Two very distinct botanical varieties are cultivated: prickly spinach, with somewhat triangular and arrow-headed leaves and rough knobby fruit; smooth spinach, or round spinach (*Spinacia glabra* of some botanists), with round and blunt leaves and smooth fruit. Upon poor soil and after the appearance of the stem, which reaches a height of two feet, the leaves become bitter, hence the more luxuriantly spinach grows, the better it is. It may be sown in spring in rows about one foot apart, but it is generally sown in autumn for early spring use. The smooth spinach is very generally preferred for the former purpose, and the prickly kind for the latter. Several unrelated plants are also called spinach, of which the best known is New Zealand spinach (*Tetragonia expansa*), a plant of the natural order Mesembryaceæ, a trailing, succulent annual that withstands the heat of summer and is a valuable successor to true spinach. See Plate of YAM, SWEET POTATOES, etc.

SPINAL CARIES. See SPINE, CURVATURE OF THE.

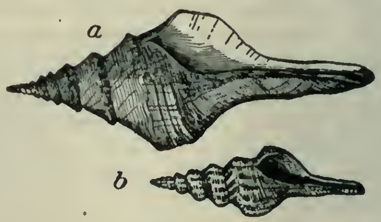
SPINAL COLUMN (Lat. *spinalis*, relating to a thorn or to the spine, from *spina*, thorn, spine), or SPINE. The most important and characteristic part of the skeleton of the highest animal sub-kingdom, which includes mammals, birds, reptiles, amphibians, and fishes. In each of these classes it is composed of a series of bones placed one above or in front of another, and called the vertebræ; and hence, these animals, having this distinguishing characteristic in common, are all included in the term *vertebrates*. The vertebræ vary greatly in number in different animals, and in shape they differ extremely, even in different parts of the same spine, in accordance with their special functions. In man the number of vertebræ which collectively form the spinal column is 7 in the neck (cervical vertebræ), 12 in the back (dorsal vertebræ), 5 in the loins (lumbar vertebræ), 5 ossified together, forming the sacrum, and 4 similarly united forming the termination of the column or coccyx. However long or short the neck may be, every mammal has 7 cervical vertebræ, excepting the three-toed sloth, which has 9, and the sea-cow, which has 6. In the other regions of the spine no such law exists. Each vertebra is attached to the two between which it lies by numerous strong and more or less elastic ligaments, and between each pair of vertebræ there is interposed a lenticular disk of fibro-cartilage, which acts as a buffer. By these arrangements the spinal column is rendered highly elastic, the communication of jars or shocks is prevented, and a very considerable general range of movement permitted, although the motion between any two adjacent vertebræ is slight. The elasticity of the column is further increased by the component vertebræ being arranged in curves, instead of being placed perpendicularly. These curves enable the spine to bear a greater vertical weight than it could otherwise maintain; they facilitate the movements of the body, especially in the act of running; and they are so disposed as to protect the cord in movements of the spine.

The vertebral canal formed by the apposition of the spinal foramina, or neural arches, and containing and protecting the spinal cord, varies in its size at different parts of the column. The intervertebral foramina through which the nerves emerge vary in shape and position in different parts, but are always of sufficient size to prevent injurious pressure on the nerves during movements of the spine; and in the dorsal region, which is the ordinary seat of angular curvature, the nerves are so protected by bony arches that they may escape injury, even when the bodies of several dorsal vertebræ have been destroyed by ulceration.

SPINAL CORD. See NERVOUS SYSTEM AND BRAIN.

SPIND'LER, KARL (1796-1855). A German novelist, born at Breslau. He studied law at Strassburg, fled thence to escape being drafted into the military service of France, and became an actor. In 1825 he turned to literature, and became one of the group, including Hauff and Häring ('Wilibald Alexis'), which imitated in historical fiction the *Waverley* methods of Scott. Most of his work, which fills 101 volumes in the Stuttgart collective edition of 1854-56, while fascinating as to plot, is careless in execution. In a few cases, however, as *Der Jesuit* (1820), *Der Jude* (1827), *Der Invalide* (1831), and *Der Vogelhändler von Imst* (1842), he skillfully depicted the historical background, and merited, though he did not gain, a more than temporary success.

SPINDLESHELL. A genus (Fusus) of gastropodous mollusks nearly allied to Murex (q.v.), having a spindle-shaped shell, with a very elevated spire, the first whorl often much dilated, and with a straight elongated canal. About 100 existing species have been described, and more than three times that number of fossil ones.



SPINDLE-SHELLS

a, A living species (*Fusus proboscidalis*); *b*, A fossil (Miocene) species (*Fusus longirostris*).

SPINDLE TREE (*Euonymus*). A genus of about 60 species of shrubs or small trees of the natural order Celastraceæ. The common spindle tree (*Euonymus Europœus*), a European shrub with an orange-colored aril, is often planted for ornament. The hard, fine-grained wood is used for fine turnery and for skewers. It was formerly used for making musical instruments and for spindles, whence the name. Charcoal made of it is much valued for crayons. In the United States wahoo, or burning bush (*Euonymus atropurpureus*), is a small crimson-fruited tree or shrub, which occurs from New York to Nebraska and southward. Strawberry bush (*Euonymus Americanus*) is a low shrub often found along wooded river banks from Illinois southward. See BLADDERNUT.

SPINDLE TREE (*Euonymus Europæus*).

SPINE, Curvature of the. There are two distinct forms of curvature, *lateral curvature*, arising from weakness of the bones, ligaments, and muscles, and *angular curvature*, which results from carious disease of the vertebræ.

Lateral curvature of the spine, or scoliosis, is not simply a bending of the spine laterally. In addition there is also considerable rotation or twisting of the vertebral bodies which normally are held in their proper relation and position by the ligaments and muscles. Muscular action is necessary for the maintenance of the erect pose; and if, through fatigue and exhaustion or through muscular weakness, from disease, such as rickets (q.v.), the muscles fail to act, a temporary deformity is brought about. If this is not remedied the ligaments become relaxed, the bones which are not yet fully developed adopt their growth to conform to the new relations, and the deformity persists. Postural habits, such as standing on one leg or sitting incorrectly at a desk, tend to distort the spine and to stretch certain ligaments, and often result in permanent deformity.

Lateral curvature is more frequent among girls than among boys, for their muscles are less developed by physical exercise and their general strength is often unequal to the strain put upon them in their school life. In lateral curvature the bodies of the vertebræ rotate toward the convexity and the spines toward the concavity of the curve. In the dorsal region the ribs are carried with the vertebræ in their rotation, and therefore the chest becomes deformed and the functions of heart and lungs are seriously interfered with. In order to maintain the erect position a compensatory curve develops. In the dorsal region the tendency is to the right, while in the lumbar region it is to the left.

The subjects of this affection do not usually complain of pain and often nothing wrong is noticed except an awkwardness in gait or a tendency to carry one shoulder higher than the other. An examination will show the prominent spinal processes and the abnormal curve of the spine. Spinal supports and plaster jackets are not to be used. The whole treatment should be directed to strengthening the muscles by exercise and massage. Exercise, however, must not be carried to excess, for this will only aggravate the existing conditions.

Angular curvature of the spine, commonly known as *Pott's disease*, is the result of caries of the vertebræ, a disease essentially tubercular in character. It occurs most frequently in children between the ages of three and twelve years, but is also met with in babes and in adults. An injury such as a blow or a fall often acts as an important factor, but at times we can trace no existing cause whatever. The most common seat of disease is in the dorsal vertebræ. The inflammation begins in the bodies of the vertebræ, and as they become softened or destroyed the spinal column above settles down upon the healthy portion below and the spines of the diseased vertebræ are pushed backward, producing a deformity more or less marked.

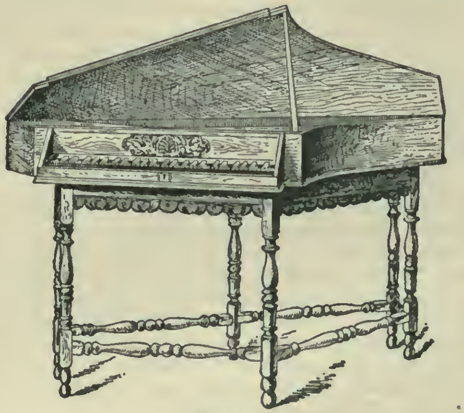
The symptoms are rigidity of the spine with tenderness and a deformity of varying degree. Sometimes abscesses form and pus and bony debris are evacuated (especially lumbar and psoas abscesses). The pain is frequently marked and in some cases pressure upon the spinal cord or nerves gives symptoms of an aggravated type. The disease is slow, with a poor prognosis, although the chances are vastly improved if treatment is begun early. The best we can hope for is an arrest of the disease and an ankylosis at the site of the trouble. Rest of the spine is the essential factor in treatment, and is obtained by a plaster-of-Paris jacket or some one of the surgical appliances especially adapted to special regions. General treatment and hygiene are of course necessary.

SPINEL (OF. *spinelle*, *espinelle*, Fr. *spinelle*, spinel, from Lat. *spina*, thorn, spine). A mineral magnesium aluminate crystallized in the orthorhombic system. It has a vitreous lustre and is found in various shades of red, passing into blue, green, yellow, brown, black, and occasionally nearly white. It is highly prized as a gem, and the transparent red colored crystals are called *spinel rubies;* while the violet and purple ones are known as *almandine;* the rose-red to pink colored varieties as *balas rubies;* the black varieties as *pleonaste;* the yellow or orange spinels are called *rubicelle*, and the pale to sapphire-blue kinds are known as *sapphirine.* The gem varieties are found for the most part in Ceylon, Siam, and other Eastern countries, and near Franklin, N. J., crystals occur that occasionally afford small gems.

SPINELLO ARETINO, spê-nĕl'lō ä'rȧ-tē'no, properly Luca Spinelle (c.1333-1410). A Florentine painter, a prominent representative of the declining school of Giotto. He was born in Florence, of a family of Aretine goldsmiths settled there, and probably was a pupil of Jacopo di Casentino. He was employed upon the chief decorative tasks of Middle Italy, in the churches of Florence, in the Campo Santo of Pisa, where he painted scenes from the lives of Saints Ephesus and Hippolytus, and in the Palazzo Pubblico of Siena, decorating the Sala di Badia with subjects from the life of

Pope Alexander III. His best preserved works are the frescoes of the "Life of Saint Benedict," in San Miniato, Florence. He also executed extensive frescoes at Casentino and Arezzo, where, in Santa Maria degli Angeli, was his celebrated "Fall of Lucifer," which gave rise to Vasari's well-known fable that the painter died of fright in consequence of an apparition of Lucifer calling him to account for the painting. Spinello's work is facile in composition and vivacious in presentation, but superficial in form and execution.

SPINET (OF. *espinette*, Fr. *épinette*, from It. *spinetta*, spinet, point, diminutive of *spina*, from Lat. *spina*, thorn, spine). A stringed musical instrument with a keyboard, smaller and weaker than the harpsichord, and, like it, one of the precursors of the pianoforte. The general outline of the instrument nearly resembled that of a harp laid in a horizontal position, with the keys occupying the position of the soundingboard. The oldest extant specimen is dated 1490.



SPINET.

SPINNAKER. A triangular racing sail carried by yachts. It hoists to the foremast or foretopmast head and is spread by a boom which is, at other times, carried up and down the foremast. The spinnaker is only set when the wind is free or behind the yacht. See YACHT.

SPIN'NER, FRANCIS ELIAS (1802-90). An American political leader, born at German Flats, now Mohawk, N. Y. From 1845 to 1849 he was auditor of the naval office in New York City. In 1854 he was elected to Congress as a Free-Soil Democrat, but soon identified himself with the newly organized Republican Party, and was twice reëlected to Congress, serving from 1855 until 1861, when he was appointed Treasurer of the United States. This position he filled with great credit until 1875, when he resigned on account of failing health and went to Florida, where he passed the remainder of his life. During his administration women were first employed as clerks in the Treasury Department to take the places of the men who enlisted in the Federal armies.

SPINNING (from *spin*, from AS., Goth., OHG. *spinnan*, Ger. *spinnen*, to spin; probably connected with AS., OHG. *spannan*, Ger. *spannen*, Eng. *span*, to stretch out, extend, and ultimately with Lat. *spatium*, extent, Gk. *σπᾶν*, *span*, to draw out). The art of drawing, twisting, and combining either animal or vegetable fibres, so that they are formed into continuous threads ready for the further operations of weaving, knitting, or sewing. The principal textile fibres are silk, wool, flax, jute, and cotton (qq.v.), and the method of spinning each of these substances differs slightly from the rest.

The most ancient instruments for spinning were the *spindle* and *distaff*, representations of which are to be seen on the earliest Egyptian monuments. The distaff was a stick or staff upon which a bundle of the prepared material was loosely bound, and which was held in the left hand or stuck in the belt; the spindle was a smaller tapering piece to which the thread was attached. By a dexterous twirl of the hand the spindle was made to spin round and at the same time recede from the spinster, who drew out between the forefinger and thumb of the right hand a regular stream of fibres so long as the twisting of the spindle lasted. It was then drawn in, the new length of thread wound upon it, and the operation renewed. An obvious improvement in this device was to set the spindle in a frame and make it revolve by a band passing over a wheel, driven by occasional impetus from the hand.

The *Saxon wheel* is said to have been invented in Nuremburg in 1530. This wheel, used only for flax-spinning, contained the germ of Arkwright's invention, described later on. A bobbin or 'pirn' with a separate motion was placed on the spindle, which had a bent arm—a flyer or flight—for winding the yarn on the bobbin. The spindle and bobbin revolved at different speeds, the revolutions of the spindle giving the twist, and the difference of the speed causing the winding on. The two-handed wheel had two spindles and pirns a little apart, with the distaff stuck into the frame between them, and the spinster produced a thread with each hand.

During the last half of the eighteenth century three inventions were made which completely revolutionized the art of spinning. These three inventions were Hargreaves's *spinning jenny*, Arkwright's *throstle machine* or *roll-drawing spinning machine*, and Crompton's *mule spinner*.

In the spinning jenny a number of large reels of fibre formed into a thickish coil, called a *roving*, were set on upright fixed spindles, and the ends of the rovings were passed between two small movable bars of wood placed horizontally and under the control of the spinner, who could thus make them press more or less on the roving, and consequently increase or decrease the draw upon it from the spinning spindles, which were set in a row at the other end of the frame, and all capable of being set in motion simultaneously by the wheel. The spinner drew out the rovings by moving the bars back and forth and at the same time turned the crank with his right hand to rotate the spindles.

The *throstle machine*, patented by Arkwright in 1769, had for its object the drawing of the rovings through a succession of pairs of rollers, each pair in advance of the others, and moving at different rates of speed. The first pair receive the sliver, compress it, and pass it on to the second pair, which revolve at a greater speed, and thus pull it out to exactly the number of times greater length that their revolutions exceed those of the other pair, and as the first roving is passed though a second, third, and sometimes fourth machine, the finished roving is 32 times longer than the sliver. As the roving issues through the last rollers of each machine it is received on *spools* or *reels,* calculated to hold a given quantity; and these are transferred to the *spinning frames,* which resemble the *roving frames.* Here the roving takes the place of the sliver, and, as it unwinds from the spool, is drawn through successive pairs of rollers, moving as before at different rates, each succeeding pair faster than the backward ones, so that the roving gets thinner and thinner, until the tenuity is carried as far as desirable. It is then carried on to a spindle which revolves with great rapidity, and, by means of a simple arrangement, is made both to twist the thread and wind it on the spindle ready for the weaver.

It was found that the process of spinning by rollers produced too great a strain upon the thread in its progress to admit of its being drawn so fine as is wanted for many purposes, and this led to the invention of the mule jenny by Crompton in 1779, which has a traveling frame upon which the spindles are set, and which in its modern form is described below.

During the nineteenth century many important improvements were made in the details of the construction of spinning machinery, but the general principles are those worked out a hundred years ago. The greatest improvements have been changes in the construction of spindles, allowing them to revolve more rapidly and freely. In the modern factory spinning is the final process in a series of operations necessary to convert the raw fibre into thread. Each of these processes has for its object the removal of smaller and smaller impurities and the production of a finer and stronger thread. These are: (1) opening and picking; (2) carding and combing; (3) drawing; (4) roving; (5) spinning. Other intermediate operations may be introduced.

The *opener* or *breaker lapper* is a similar machine to the *intermediate* or *finisher lappers,* as shown in Fig. 1, and described below. In the breaker lapper the cotton as taken from the bale is fed to it in a hopper or by some kind of automatic feed, and delivered in laps which are then placed on the intermediate lapper, either 3 or 4 laps being 'doubled' on the same and the cotton after being loosened and further cleaned is delivered in laps to be placed on the finisher lapper, 3 or 4 laps from the intermediate being again 'doubled' and delivered in a single lap ready for the card. The function of the lappers is to thoroughly loosen the lumps of cotton as taken from the bale, to remove dirt and dust and as much leaf, trash, and motes as possible. There are usually three of these, the breaker, intermediate, and finisher lapper. Fig. 1 is a section of an *intermediate* or *finisher lapper.* The cotton enters these machines in a sheet made up from the laps, A, delivered onto the slowly moving apron, from which it is taken by the feed-rolls and delivered to the rapidly revolving *beater,* which forces it against the *grid-bars,* loosening the dirt and motes which fall through the *grids* into the *mote-box.* The cotton is left in a light and feathery mass which is drawn between the *squeeze-rolls* by the suction of the fan, which also draws the dust and fine dirt from the beaten mass and discharges them through the *dust-flue.* The sheet of cotton from the squeeze-rolls is taken by the *calender-rolls,* and compressed and finally rolled into the lap B. The lap is about one inch in thickness, 40 inches to 48 inches wide, and usually from 48 to 52 yards long.

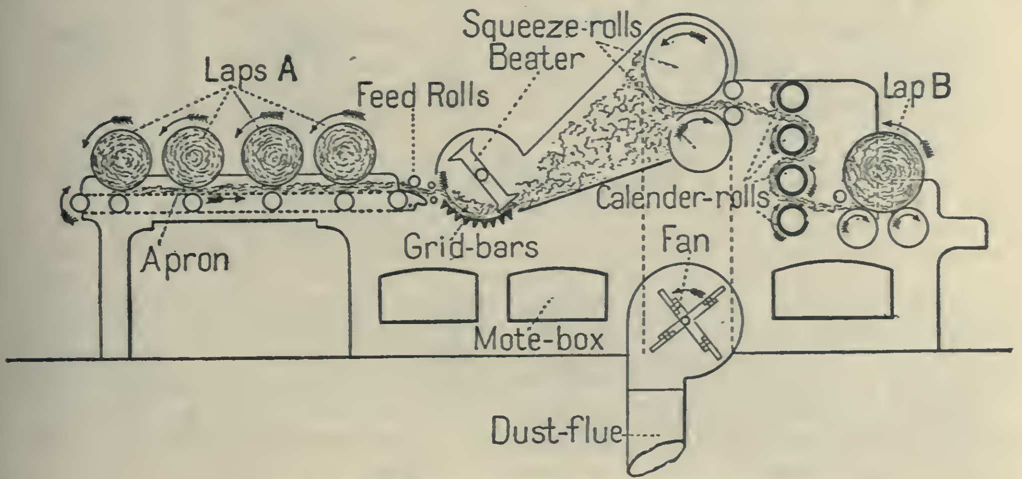


FIG. 1. SECTION OF INTERMEDIATE OR FINISHER LAPPER.

After the cotton has passed through the series of lappers the laps from the finisher lapper go to the *card* (Fig. 2). (See CARDING.) The cotton in the lap A is delivered to the *feed-roll* of the card and is grasped by the teeth of the *licker-in* or *taker-in,* from which it is taken in a thin sheet by the fine wire teeth of the *card-clothing* on the *cylinder* B, and carried upward to come in contact with the teeth on the clothing of the *top-flats,* and the fibres are combed into a degree of parallelism—the *cylinder* revolving rapidly, while the *flats,* which are in a chain, move slowly forward so that new *flats* are continually coming in contact with the cylinder—and much of the short and broken fibres are removed; the *comb,* C, removes the short fibres from the *flats* and they are rolled upon the *rod*, and the flats are further cleaned by the brush. The carded cotton is taken from the *cylinder* by the *doffer cylinder*, the latter having a surface velocity somewhat less than that of the main cylinder, and is removed from the *doffer* by the *comb*, D, in a thin evenly carded film; this film is drawn through the *trumpet* by the *calender-rolls*, in a round strand about one inch thick called a *sliver*, which is automatically coiled in the *sliver-can* by the *coiler*.

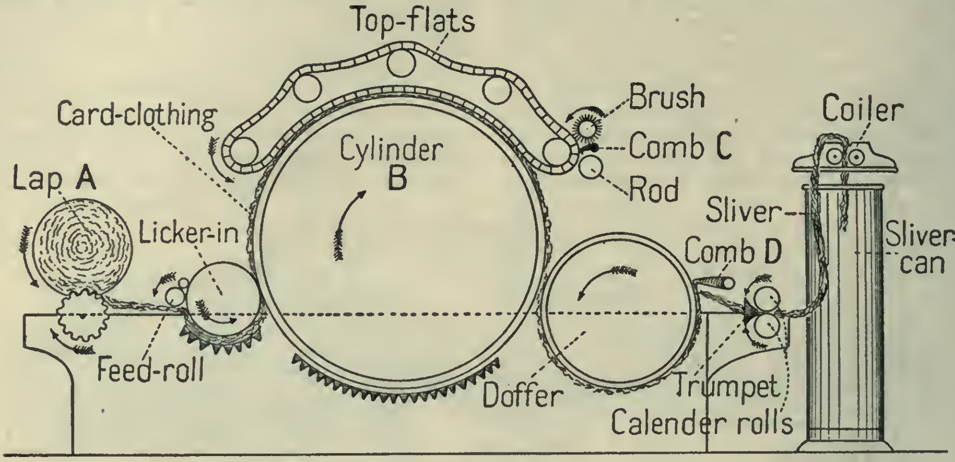


FIG. 2. SECTION OF REVOLVING TOP-FLAT CARD.

As all the processes are arranged to 'double' the mass of cotton and then to reduce the mass in size by 'drawing' it out to several times its original length until the yarn is finally produced, an examination of Fig. 3 will help the reader to understand how the 'drawing' acts on the fibres. On the left is shown the *sliver* from the card, the cotton being in a more or less tangled condition, but after passing between the successive pairs of *drawing-rolls*, 4.4′, the last or right hand pair, revolving faster than the others, 'draws' the fibres past each other and straightens them, bringing them into a nearly parallel position.

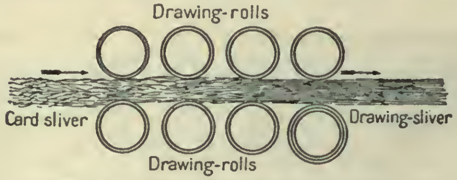


FIG. 3. DETAIL OF DRAWING PRINCIPLE.

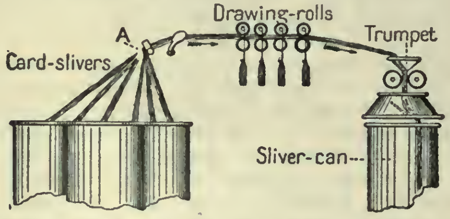


FIG 4. SECTION OF DRAWING FRAME.

The card-sliver goes first to the *drawing frame*, Fig. 4, and four or six slivers, A, are combined by passing them through the drawing rolls as above described. The *drawing sliver* is carried through the trumpet and deposited in the can by the coiler the same as from the card. This drawing process is repeated two or three times as the work may demand, always 'doubling' and 'drawing,' but without putting in any twist. After the drawing frames, the drawn sliver is placed in cans, behind the first of the *roving frames* which have rolls similar to the drawing frames, but have spindles by which the stock, then called *roving*, is twisted and wound on bobbins. The first of the roving frames is called the *slubber*, and is heavier than the *intermediates* and *fine frames*, as the other roving frames are designated. The full bobbins, A, from the slubber are placed in the creel of the *intermediate* frame, as shown in Fig. 5, and two strands combined are delivered to the rolls and drawn, the new strand of roving is carried to the top of the *flyer*, on the spindle B, is passed through one arm of the flyer, which is hollow, and

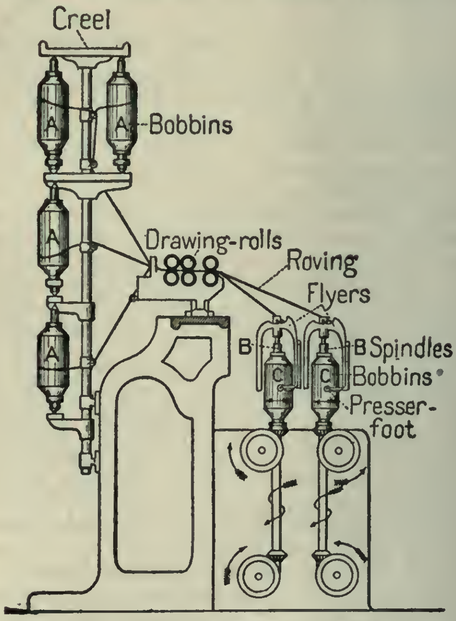


FIG. 5. SECTION OF ROVING FRAME.

delivered to the *bobbin*, C, by the *presser-foot*. The revolving of the flyer puts the twist into the strand of roving, while the difference in speed between the flyer and the surface of the bobbin winds the roving on the latter.

The *fine frame* is a similar frame to the above, and delivers the roving finer and more even than any of the preceding machines and ready for the *spinning frame* (Fig. 6). The roving may be doubled or run singly on the spinning frame, the rolls produce the drawing effect as on the preceding machines, and the revolution of bobbin and spindle puts in the twist. The *bobbin* A is fast on the *spindle* B, and draws the yarn through the *traveler*, a small wire loop attached to and movable on the *spinning ring*, which surrounds each spindle. The spindles are made to revolve by an endless cotton *band*, which passes around the *whorl* of the spindle and is driven by the *cylinder* D. The production of the spinning frame is technically 'frame-spun yarn,' either warp or filling. This is wound on the bobbins by the moving up and down of the *ring rail*, which holds the *spinning rings* with the *travelers*, the pull or drag of the travelers winding the yarn on the bobbin.

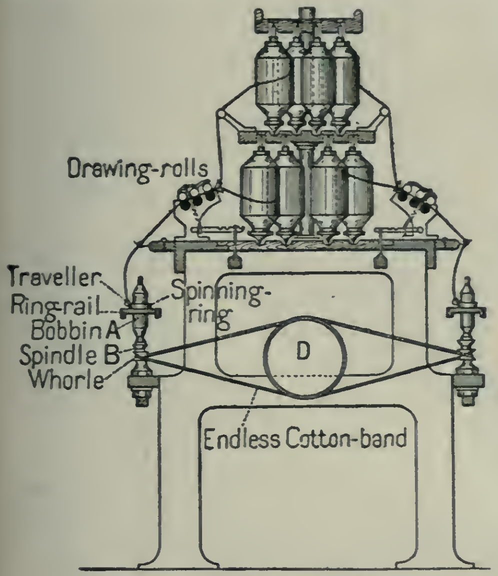


Fig. 6. SECTION OF SPINNING FRAME.

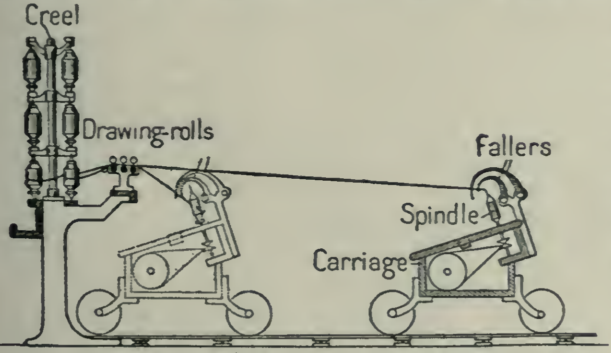


Fig. 7. SECTION OF SPINNING MULE.

Mule-spun yarn is produced by spinning the roving on a *mule* (Fig. 7), the roving coming from the fine frames as for frame-spun yarns, but the drawing and twisting being accomplished in a different manner. On the spinning frame the roving is drawn, twisted, and wound continuously, while on the mule it is drawn out while the twist is being put in and is spun intermittently, and then wound on *bobbins* or *cops* intermittently. The roving is placed in a *creel* and passed through the drawing rolls, as on the spinning frame, and carried to the *spindles*, which, instead of being in a stationary rail, are mounted in a carriage, which runs away from and back to the rolls alternately, traveling about 5 feet each way. As fast as the rolls deliver the roving the carriage and spindles recede from the roll stand and the spindles revolving twist the yarn over the top of the spindles, where it is held by the fallers. In some cases the carriage travels several inches more than the delivery of the front roll and causes additional drawing. The movement out of the carriage is called *stretch*, and at the end of each stretch the rolls are stopped automatically, the required twist being completed, the spindles are stopped and reversed in motion, while the *fallers* guide the spun yarn away from the top of the spindle and wind it on the cop or bobbin, the carriage approaching the rolls again, after which the same movements are repeated continuously. The spinning frames are arranged with an average of 104 spindles to a side of about 27 feet in length, but this number varies according to the *gauge* or distance between centres of spindles. The mules, not having spinning rings, admit of the spindles being nearly twice as near together, the average number per mule being 480, though some are built much larger.

In a general way the spinning of other textile fibres is the same as for cotton, the desire being to reduce the strands and to make them of uniform diameter throughout their entire length and to give them the requisite amount of twist. Woolen yarn is spun on a mule as described for spinning cotton, except that the carded roving comes to the mule in a different shape, being carded differently and without twist until spun on the mule. Worsted and some cotton yarns are produced by a *combing* operation which is a special *drawing* process, the cotton being afterwards worked on the roving frames, while worsted is spun on a frame not unlike the roving frame, the twist being put in by *flyers*, as the twist in the cotton roving. For the spinning of silk and other fibres, see special articles on those fibres.

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SPINNING-GLAND. One of a class of glands (q.v.) possessed by the larvæ of many kinds of insects and by the majority of spiders. See Spider.

SPINOLA, spē′nŏ-lȧ, Ambrosio, Marquis de (1569-1630). A Spanish general, born in Genoa, Italy. In 1602 he led a force of 9000 veterans to the Netherlands against Maurice of Nassau. Made chief commander of the Spanish army there, he forced Ostend to surrender in 1604, after a siege of more than two years. He continued his operations against Maurice till the twelve years' truce of 1609, when he took command of the Spanish troops in Germany. He took the field against the Elector Palatine Frederick V. and the Protestant Union in 1620, and forced the Union to disband in 1621. He captured Jülich in 1622, and Breda in 1625. Disease forced him to give up his command, but he afterwards commanded the Spanish army in Italy.

SPINOZA, spê-nō′zȧ, Baruch, or Benedict (1632-77). A famous Dutch-Jewish philosopher, born in Amsterdam, November 24, 1632. His father, a Portuguese merchant, had fled from Catholic persecution to the Netherlands. Spinoza was carefully educated in Jewish theology and speculation. He was, however, alienated from the orthodox belief by studies of physical science and of the writings of Descartes and probably those of Giordano Bruno. His heresies resulted in threats of severe punishment from his instructors in the Talmud and the Cabala, and the relation soon became so unpleasant that Spinoza withdrew from the synagogue. The rabbis, in 1656, excommunicated him and secured his banishment from Amsterdam. However, he remained in the neighborhood of the city for five years, supporting himself, as in later years, as a lens-maker.

Previous to his expulsion from the Jewish community Spinoza is said to have fallen in love with the daughter of Van den Ende, his master in Greek and Latin, and to have been rejected by her. Possibly even before his expulsion he composed his first work, *Tractatus de Deo et Homine ejusque Felicitate* (discovered in a Dutch translation in 1852, the Latin original not being extant), in which the form of his developed system is foreshadowed. And the *De Intellectus Emendatione* and *Tractatus Theologico-politicus* are also probably referable to the period of his Amsterdam residence, although the latter was not published until 1670 and the former until 1677.

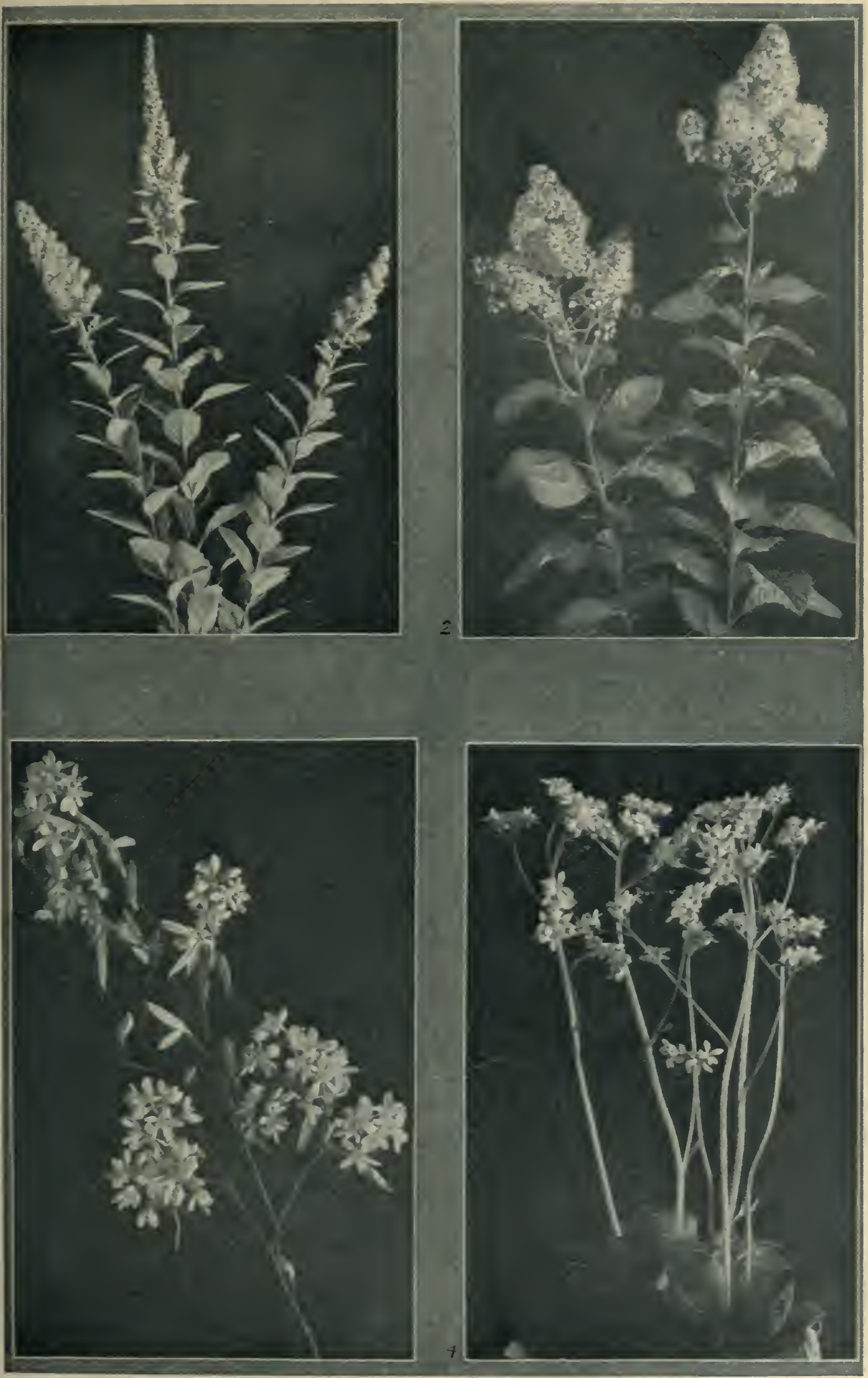
In 1661 Spinoza went to Rhynsburg, near Leyden, and two or three years later to Voorburg, near The Hague. Shortly after, yielding to the solicitations of friends, he removed to The Hague itself. The Elector Palatine, Charles Lewis, offered him a chair at the University of Heidelberg, but Spinoza declined the position in order to be free from any restrictions upon his thinking. An offer of a pension, on the condition of his dedicating a work to Louis XIV., he rejected with scorn. His domestic accounts, after his death, show that he preferred to live on a few pence a day rather than be indebted to another's bounty. He died February 21, 1677. His constitution was no less undermined by consumption and overwork than his sensitive mind was wrought upon by persecution and the violent severance of natural ties. But no word of complaint ever passed his lips; simplicity and heroic forbearance, coupled with an antique stoicism and a child-like, warm, sympathizing heart, were the salient features of his character. His life, in its nobility and suffering, is perhaps the most convincing plea for the vitality of the philosophy for which it served as the human context.

Spinoza's philosophy finds its most adequate expression in his great work, *Ethica Ordine Geometrico Demonstrata* (posthumously published in 1677). The basis from which it was developed was mainly Cartesianism. Certainly from Descartes he derived his empirical rationalism and his conception of exact demonstration. This latter, on the analogy of geometrical demonstrations, consisted of a series of axioms with corollaries, propositions, and elucidations, designed to render bias or extraneous inference impossible, and there can be no doubt that Spinoza was one of the most conscientious of thinkers in his effort to eliminate the personal equation. Nevertheless, there are few philosophers in whom the personal element is more distinctive. The very fact of Spinoza's severance from his own race and religion, together with his failure to adopt Christian thought, made the individuality of his system the more inevitable; he was bound by no tradition and so followed to the fullest the instincts of his reason. He was influenced by Descartes in method and probably by Bruno in his pantheism, but his system is still his own to a degree seldom true in the history of philosophy.

This system is a thorough-going and complicated pantheism. The universe is identical with God, who is the substance of all things. The conception of substance (which Spinoza inherited from the Scholastics) is not that of a material reality, but of a logical subject—the self-sufficient and comprehensive basis for all reality, capable of sustaining as its attributes all temporal existences. Spinoza recognized the possible existence of an infinite number of such attributes, but held that only two kinds are known to us—extension, or the world of material things, and thought. These two comprehend existence and they include all that exists in a real and palpable way, at least so far as human knowledge is concerned.

The idea of extension as the gist of physical reality, and of thought as a non-extended reality, Spinoza derived from Descartes. But Descartes made each of these independent substances and conceded to them the power of causal interaction —mind acting upon body and *vice versa.* Spinoza, as we have seen, makes both forms of reality dependent upon an ultimate substance—God—in which is their existence. Furthermore, he denies their power of causal interaction. Cause and effect in his conception are always similar; extension and thought are wholly dissimilar, therefore their causal interrelation is impossible. Causation may subsist between individual objects in the attribute extension, that is, between physical bodies, or between individual ideas in the attribute thought, but not between ideas and things. To explain the apparent causal interactions of the latter Spinoza resorted to an elaborate theory of parallelism. Every idea has a physical counterpart in the attribute extension; every physical object has its idea. This

SPIRÆA, ETC.



1. HARDHACK (Spiræa tomentosa).
2. WILLOW-LEAVED SPIRÆA (Spiræa salicifolia).
3. SHADBUSH (Amelanchier Canadensis).
4. SAXIFRAGE (Saxifraga Virginiensis).

is not only true for the individuals in each attribute, but necessarily for their relations also. Hence parallel with every physical causal series there is an ideational causal series reduplicating it; neither is dependent upon the other, but both depend upon the divine substance made manifest through them.

The individuality of things, whether ideas or physical objects, Spinoza explained as particular modes or 'affections' of substance. All particular things in space are the modes of God in the attribute extension; all particular thoughts and feelings are modes of God in the attribute thought. The modes are *natura naturata;* substance or God is *natura naturans.* The modes are ephemeral and their existence assumes temporal form; God is eternal, outlasting all attributive changes. Particular things, accordingly, whether of body or mind, are evanescent and finite. All existence is mortal.

Nevertheless there is an indestructible world. It is not to be found in the realm of existences, but in a realm of essences—something wholly different. The Spinozistic conception of essence is most nearly related to the Scholastic conception of Realism and to Plato's conception of a world of ideas. It is an hypostatization of the universal aspect of things, that is, of their essential nature in a logical or definitive sense, and in many respects is a striking forecast of Hegel's logic of the Absolute. The most distinctive difference between Spinoza's world of existences and his world of essences is that the former exists in time, while the latter has no temporal being. But mortality can pertain only to temporal being; therefore the world of essences, being timeless, must be immortal. Furthermore, the world of essences is a world of immanent being. Every existence has a universal or essential character, though to realize this character it must transcend its own intrinsic form, that is, free itself from whatever gives it particularity. The world of essences thus has a kind of being within the world of existences—as the immanent cause of the latter—though it does not share its temporal limitation. Now this is precisely true of the divine substance; and so it is that the world of essences represents the essential nature of God.

Immanent causation means self-causation, and that which is self-determined is free. From this reasoning Spinoza derived his doctrine of freedom to be won in the world of essences. Existence in the attribute is bondage, for each existent thing is determined by its own causal series; every particular object or idea is subject to other objects or ideas, and the form of its being is determined by them. Only in non-temporal, self-caused being, that is, in the universal and immanent, is freedom possible; only by identification with the eternal verities, with substance or God, is immortality—and with it peace—to be obtained.

From this conception springs Spinoza's ethical doctrine, developed in the third, fourth, and fifth parts of the *Ethica.* In its practical form his teaching assumes that everything, so far as in it lies, strives to remain in its own being. The effort by which this striving is manifest is nothing but the actual essence of the thing. This effort, when it is in the mind alone, is will; when in mind and body it is appetite. If desire is satisfied, we have pleasure; if not, we have sorrow. All affections and emotions resolve into desire, joy, and sorrow, accompanied by ideas. The good is that which we know to be useful, that is, that which we know to be a means for the nearer attainment of the standard of human nature which is our ideal. Knowledge of good and bad can be a cause in the moral world, counteracting passion and raising us from the world of appetite and mortality to the world of eternal truths.

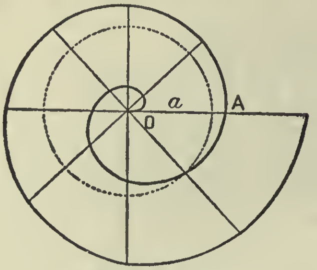
The passage from mortality to immortality, from bondage to freedom, is made plausible to Spinoza's mind by the fact that every reality has its immanent cause, its universal aspect, or what may be called its cosmological truth. By cultivating steadily this immanent and universal nature man is enabled to realize his immortal destiny. As to the nature of the initiative by which a soul in bondage is to alter its course, Spinoza has no clear teaching. The problem seems not to have presented itself to him, and indeed this is hardly to be wondered at, since his own mind turned so instinctively to what he conceived to be the divine and the good.

Spinoza's position in the development of philosophical thought is in many respects unique. He belonged to no school and he founded none. While in a measure his work was based upon that of his predecessors, it is too strikingly individual to be conceived a mere continuation, even of Cartesian thought. In the vigor and comprehensiveness of his conception, in synthetic daring, he must be ranked with the greatest philosophical thinkers; and though his system gave rise to no sequential development, he has had perhaps the most pervasive influence of any modern philosopher except Kant. Not only metaphysicians, but poets such as Goethe, Wordsworth, and Shelley, have gone to him for inspiration, and the essence of his thought has been in large part appropriated in the poetic pantheism of modern interpretations of nature.

Complete editions of Spinoza's works have been published by Paulus (1802-03), by Bonden (1843-46), and by Van Volten and Land (1882-82). English translations have been made for the Bohn Library (1883), by White and Stanlay, the *Ethics* (London, 1883), by Fullerton, *The Philosophy of Spinoza,* selections with introduction (New York, 2d ed. 1894). Of the extensive literature especially to be mentioned are: Caird, *Spinoza* (Edinburgh, 1888); Martineau, *A Study of Spinoza* (London, 1882); Pollock, *Spinoza* (2d ed., ib., 1899); Fullerton, *On Spinozistic Immortality* (Philadelphia, 1899); Camerer, *Die Lehre Spinozas* (Stuttgart, 1877); Baltzer, *Spinozas Entwickelungsgang* (Kiel, 1888); Berendt and Friedländer, *Spinozas Erkenntnislehre* (Berlin, 1891); Hoff, *Die Staatslehre Spinozas* (ib., 1895); Kuno Fischer, *Geschichte der neueren Philosophie,* I. (Heidelberg, 1897).

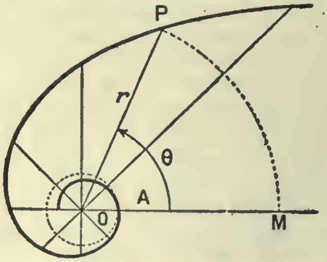
SPIRÆA (Lat., from Gk. *σπειραία, speiraia,* meadow-sweet, from *σπεῖρα, speira,* coil, twist, spire; so called from the shape of the follicles). A large genus of herbs and low deciduous shrubs of the natural order Rosaceæ, natives of the Northern Hemisphere. Dropwort (*Spiræa filipendula*) and meadow-sweet or queen of the meadow (*Spiræa ulmaria*) are European species. Two other species are shown on the accompanying plate. Many species are cultivated in shrubberies for their flowers.

SPIRAL (ML. *spiralis*, from Lat. *spira*, coil, spire, from Gk. *σπεῖρα*, *spêira*, coil, spire, twist). A curve which during its gradual regression from a point winds repeatedly around it. A *plane* spiral is generated by a point moving along a line according to a fixed law, while the line revolves uniformly about a fixed point in the plane. A spiral which is not plane is generated by a point moving on a given surface other than a plane, about a fixed point according to a given law, e.g. the loxodrome (q.v.). A great many spirals have been studied. Of these the most common are the spiral of *Archimedes*, the *hyperbolic*, *parabolic*, *Cotes's*, *logarithmic* or *equiangular* spirals, and the *lituus*.



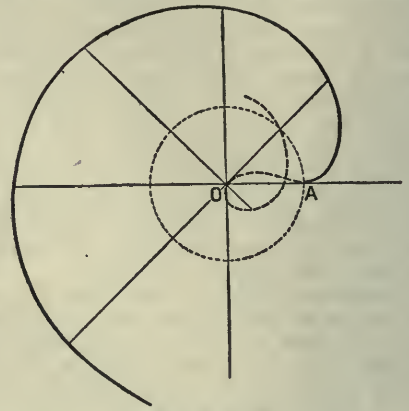
ARCHIMEDES SPIRAL.

The spiral of Archimedes, probably discovered by Conon, has the equation $r = a\theta$. In this curve the point moves with a constant velocity along the radius vector, and the length of the radius is proportional to the angle described. The curve may be constructed by points as follows: Draw a circle of radius a about O as a centre; draw radii dividing the circumference into n equal parts, and lay off from O on these radii the distances $\frac{a}{n}, \frac{2a}{n}, \frac{3a}{n}, \frac{4a}{n}$, etc. The circle used in this construction is called the measuring circle of the spiral. If the point so moves that the radius vector varies inversely as the angle described, the curve is called a *hyperbolic* or *reciprocal* spiral. Its equation is $r = \frac{k}{\theta}$, k being the circumference of the measuring circle. It follows from the equation that an infinite number of spires are necessary for the curve to reach the origin. The curve received its name from the fact that it can also be constructed by means of an auxiliary equilateral hyperbola. If r varies directly as the square root of θ the equation becomes $r^2 = a\theta$, and we have the *parabolic* spiral. The figure represents the curve for both positive and negative values of r.

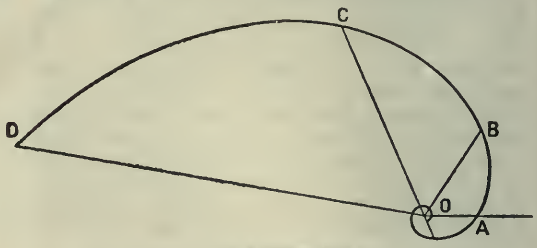


HYPERBOLIC SPIRAL.

If p denotes the perpendicular distance from the pole to the tangent at any point P of the curve, and if $p = \frac{br}{\sqrt{a^2 + r^2}}$, various spirals may be formed representing this equation. These are known as Cotes's spirals, and are of scientific interest, especially in their relation to trajectories (q.v.). If $b = a$ the equation is that of the *logarithmic* or *equiangular* spiral. The characteristic property of this spiral is that the angle between any radius vector and the corresponding tangent is constant. The equation of the logarithmic spiral is $\log r = a\theta$. It is evident from the equation that the curve has an infinite number of spires. The evolute (q.v.) of the logarithmic spiral is a similar logarithmic spiral.

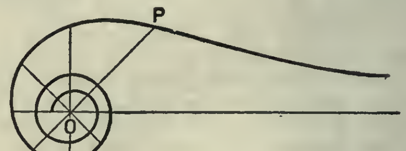


PARABOLIC SPIRAL.



LOGARITHMIC SPIRAL.

A spiral in which the square of the radius vector varies inversely as the angle described is called the *lituus* or *trumpet*, a curve described by Cotes (1682-1716). Its equation is $r^2 = \frac{a}{\theta}$. The curve begins at infinity and winds round the origin, but cannot reach it by a finite number of spires.



LITUUS.

One of the best, although not recent, monographs on the general subject is to be found in the *Mémoirs de l'Academie des Sciences* (1704, pp. 47, 69). For the general and special bibliographies and for a list of various spirals studied, consult Brocard, *Notes de bibliographie des courbes géométriques* (Bar-le-Duc, 1897, p. 252; partie complémentaire, 1899, p. 166). On the spiral of Archimedes, consult Pfaff, *Betrachtungen über die Spirale* (Munich, 1830). On the parabolic spiral and that of Cotes, consult Sacchi in the *Nouvelles Annales de Mathématiques* (1860). On the logarithmic spiral, Turquan in the same journal (1846) and Whitworth (1869). On the hyperbolic spiral, Fouret and Lebon in the same journal (1880).

SPIRE (AS. *spir*, stalk, Ger. *Spier*, needle, pointer). A very acute pyramidal roof in common use over the towers of churches or secular buildings. The history of spires is somewhat obscure, but there is no doubt that the earliest examples of anything of the kind are the pyramidal roofs of towers in the Romanesque buildings of the eleventh century. In the twelfth century, especially in France, these stone roofs were often made octagonal and pointed and took the form we call spire. They were less used in England and Italy, where square and flat tops remained common; they were most developed in France and Germany. The point where the square tower merged into the octagonal base of the spire was marked by angle turrets and pinnacles, to which tabernacles and windows often corresponded in the alternate faces of the spire. This masking afterwards was carried still farther up by galleries, flying buttresses, and pinnacles, enhanced by every variety of tracing and surface ornament, breaking up the outlines of the spire. At first the surface of the spire was of solid masonry merely varied by angle moldings and scaled surfaces, but before the close of the thirteenth century the masonry was often more or less pierced and the outlines infinitely varied, first with windows and galleries and then by a network of tracery which made of the entire spire a series of lacework patterns or grouped arcades and pinnacles.

SPIRE. A town of Germany. See SPEYER.

SPIRIFER (Neo-Lat., from Lat. *spira*, coil, spire + *ferre*, to bear). A genus of long hinged fossil brachiopods of Paleozoic age. The shells are biconvex with the greatest width on the hinge line, the hinge areas are well marked and usually large, the ventral beak prominent and overreaching that of the dorsal valve, the surface marked by strong radial folds or striations, and with a pair of calcified spirally coiled brachidia within the interior of the shell. These brachidia served as supports for the breathing organs and are coiled in the form of cones with the apices of the cones directed toward the outer angles of the shell. The genus has many species, ranging from the Silurian system upward into the Carboniferous and distributed all over the world. Consult Schuchert, "Synopsis of American Fossil Brachiopoda, etc.," *Bulletin of the United States Geological Survey, No.* 87 (Washington, 1897).

SPIRILLUS. See BACTERIUM.

SPIRIT (Fr. *esprit*, from Lat. *spiritus*, spirit, breath, air, from *spirare*, to breathe). A term sometimes used in connection with a variety of volatile substances, and more especially with solutions of volatile substances in alcohol. *Spirits of wine* is ordinary alcohol; *spirits of wood* or *pyroxylic spirit*, is wood alcohol, or methyl alcohol; *spirit of hartshorn* is aqueous ammonia; *spirit of copper* is acetic acid (when distilled from verdigris); *spirit of alum* is aqueous sulphurous acid, etc. Among the 'spirits,' i.e. alcoholic solutions, used in medicine may be mentioned those of lemon, peppermint, ether, chloroform, phosphorous, camphor, lavender, bitter almonds, etc. *Aromatic spirits of ammonia* is made up of 34 parts of ammonium carbonate, 90 parts of ammonia water, 1 part of nutmeg oil, 10 parts of oil of lemon, 700 parts of alcohol, and 1 part of oil of lavender flowers, enough water being added to make 1000 parts. In the British pharmacopœia alcoholic solutions of 20 per cent. strength are called 'essences.'

SPIRITUALISM (from *spiritual*, Lat. *spiritualis*, relating to spirit or breath, from *spiritus*, spirit, breath, air, from *spirare*, to breathe). A term which, as most commonly used, describes the belief of those who think that communications are occasionally established between the living and the dead who survive in some other mode of existence. This conception, in so far as any general acceptance of the doctrine is concerned, is probably not more than half a century old, although sporadic instances of the belief are possibly as old as human nature.

In modern times the first definite movement in the direction of a general interest in spiritualism took place in 1848 in America, and was associated with the Fox sisters, at Hydesville, New York. The 'phenomena' associated with these sisters were the traditional 'raps' and 'knockings,' the meaning of which required that the experimenter agree upon some certain number of 'raps' as an indication of an affirmative or negative answer to questions. In more complicated matters the answers were spelled out by pointing to letters, etc. The *modus operandi* of the 'communications' is not important, as it was only the familiar production of physical phenomena supposed to be evidence of some transcendental origin. The Fox sisters performed their wonders for all classes of men and women and numbered among their followers many intelligent people. But opinion was divided as to the value and significance of their 'phenomena.' The more intelligent investigators discovered fraud in them, and finally the sisters confessed to the manner in which they had consciously produced the 'raps' and 'knocks.' In the meantime the excitement and interest in spiritualism had spread to England and the Continent. It was probably much less the actual facts in the alleged phenomena that created the widespread interest in the subject than it was two facts in the mental condition of the age wholly independent of the inciting cause. The first was the immense strides which skepticism and criticism had made in discrediting the older theology; the second was the growing faith in scientific experiment and methods.

It was about the same time that hypnotism (q.v.) began to arouse a scientific interest and to contribute to the spiritualist's cause. It had arisen about 1770 or 1780 under Mesmer and was called mesmerism (q.v.) after him. But the quackery and incautiousness associated with it, encouraged by the inertia of scientific academies, brought it into neglect, and it was not heard of more until Dr. Braid, of Manchester, England, reopened the question by showing that there were genuine phenomena in it worthy of scientific attention. This was about 1840. He changed the name of mesmerism to hypnotism and employed 'suggestion' as the explanatory principle as against 'magnetic fluids' of Mesmer. But the peculiar methods of producing hypnosis and the strange psychological susceptibilities exhibited by hypnotic patients were well calculated to impress the popular mind with the belief in occult forces, and in spite of the scientific treatment to which it has been exposed, it still suggests to the public the possibility of supernormal phenomena. Its facts were more easily demonstrable, and could be put to more dignified uses, than the ordinary absurdities of the séance room.

Another type of phenomena occurred about the same time to encourage the spiritualist in his general theory. It was the production of Andrew Jackson Davis, who discovered in 1844 that he could go into a 'trance,' and that he had a strange power of performing intellectual feats in this condition, which were not natural to him in his normal state. He made a bargain with two friends to 'mesmerize' him and to take down in notes what he said during the 'trance.' A volume was published as a result representing the work of fifteen months. His utterances, which were very slow and deliberate, were taken down verbatim, and the volume was called *The Principles of Nature, Her Divine Revelations, and a Voice to Mankind.* The work dealt with the physical, chemical, and vital phenomena of the cosmos on a large scale, and treated of astronomical matters in a manner to excite curiosity, especially when the prediction of a new planet was verified soon afterwards by the discovery of Neptune by Leverrier and Adams. At the same time the man was practicing 'clairvoyance,' and the book asserted the existence of spirit 'communication.' But it was not the philosophic nature of the work that gave it its influence. It was the apparent illiteracy of the man who produced it, and its association with 'clairvoyance' and alleged spirit 'communications.' Davis himself said that, up to the time of his work, he had read but one book in his life and this was a romance called *Three Spaniards.* This claim, however, seems to be fairly well controverted, and it is probable that the man had read scientific matter in a casual way. But no amount of casual reading will easily explain in a normal way the systematic character of this work. There are indications in the man's history, and the fact that he was 'clairvoyant' or subject to the 'trance' state is evidence, that his was a remarkable case of secondary personality. See DOUBLE CONSCIOUSNESS.

In 1853 a work was published by Judge Edmonds and Dr. George Dexter that was second in interest only to that of Davis. Mr. Edmonds was a Judge of the Supreme Court of New York State and Dr. Dexter was an eminently respectable citizen of New York City. Their attention had been called to the subject of spiritualism by the excitement about the Fox sisters, and they set about investigation for themselves, and soon developed personal phenomena of a peculiar interest. They entered upon a system of experiments in coöperation upon themselves and various 'mediums,' with the result that they published a work which soon became classic, owing to the reputation of the authors. The phenomena recorded and described purported to represent more or less direct communications with discarnate spirits. At first they investigated with a view to ascertain whether the phenomena were genuine in any sense of the term, and having convinced themselves that they were dealing with spiritistic influences, they published, as the bulk of their work, the alleged messages from Swedenborg and Bacon, and the respectability of the men availed to carry their work through many editions. But the subject of secondary personality was not understood in their time, and was not worked out until a generation later, when the result was to discredit the spiritistic claims of Edmonds's and Dexter's work.

The most remarkable personality, however, in this movement was William Stainton Moses. He was born in 1839 and was educated at Oxford in England, becoming a clergyman in the Established Church. In 1872 he became interested in spiritualism through his friend, Mrs. Speer, and soon developed 'mediumistic' powers in himself. He fought against their influence on his mind for a long time, but his skepticism was finally overcome, and he became a spiritualist and abandoned the Church and at last became the editor of the chief spiritualist paper, *Light.* No one ever questioned his sincerity and honesty. The phenomena which he records were of a type and variety which tend to excite astonishment. They included the physical and the trance phenomena of the usual kind, such as the alleged movements of physical objects without contact, and even through other matters, and automatic writing evincing the personal identity of deceased persons and the spiritual and hortatory counsel of discarnate spirits long since deceased. His two works, *Spirit Identity* and *Spirit Teachings,* were widely read. But he resented scientific investigation because he thought it a reflection on his honesty, and hence, though there is some independent testimony to the nature of his phenomena, they depend mostly upon his own asseverations; and though there is no reason to impeach the probity of these, neither he nor his contemporaries reckoned sufficiently with the problems of abnormal psychology and secondary personality to assure the elimination of influence in the production of the phenomena that were quite compatible with honesty and yet were inconsistent with their supernormal character.

After the excitement produced by the Fox sisters, there appeared a perfect inundation of similar and more questionable performances in the person of all sorts of traveling 'mediums.' The popular conception of spiritualism was soon determined by the methods of this class of impostors. Their 'demonstrations' took the form of cabinet séances, 'materializations,' slate writing performances, and tricks that are easily imitable by the prestidigitator. To this day the general public has no other conception of spiritualism than that which is furnished by the most absurd and most trivial legerdemain. Finally the indifference of the public after discovering the futility of such methods and the influence of the Report by the Seybert Commission (see below) caused the interest in such phenomena to decline. The Society for Psychical Research (see PSYCHICAL RESEARCH, SOCIETY FOR) also had its share of the credit in this depreciation of the movement.

To this period, contemporaneous with Moses and apparently combining the phenomena described by him and the performances of the average trickster, belonged David D. Home, who created an enormous sensation throughout America and Europe. He received the attention of Sir William Crookes, and a system of experiments involving all sorts of physical 'miracles,' which still mystify students who have confidence in Crookes.

What the Society for Psychical Research has accomplished tends to show that the methods of physical science which had captivated the last generation are not adequate to cope with the problem. It has been shown to be a psychological problem that must comprehend the whole field of normal and abnormal psychology, including in the latter all the phenomena of automatism, sensory and motor, illusion, hallucination, secondary personality, hysteria, insanity of the functional sort, and the various hyperæsthesias. The consequence of all this has been to suggest that neither fraud nor spirits are always necessary to account for seemingly supernormal phenomena. We are being made acquainted with a vast fund of facts in connection with subliminal consciousness which are well calculated to strike the unwary as having a spiritistic significance, but which are only the strange productions of irresponsible secondary personalities. These personalities, like the dream life of normal people, are apparently quite as liable to deception as are the states of consciousness of every-day life. However, the range and capacity of the powers of subliminal states have not yet been exactly determined.

About the same time that the Society for Psychical Research was founded a Mr. Seybert gave a fund to the University of Pennsylvania for the investigation of spiritualism, and the Seybert Commission was appointed for the purpose. The commission exposed many of the ordinary frauds of professional mediums, and its conclusions were adverse to the usual spiritistic claims. After publishing a *Report*, the commission was allowed to lapse.

In Germany and France the movement has had a similar history and outcome. In Germany Reichenbach was the most important investigator, and in France Cahagnet and Du Potet are the principal men of interest. This was in the earlier period. Later we have Karl du Prel, A. N. Aksakoff, a Russian, and Schrenck-Notzing, who manifested interest in the subject and wrote freely upon it.

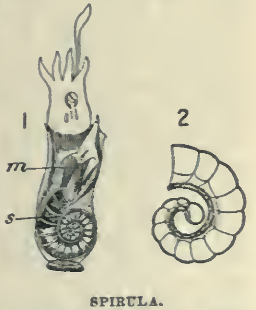
In recent years the *Proceedings* of the Society for Psychical Research have recorded data, especially in the phenomena of coincidental apparitions and experiments with a Mrs. Piper, a Boston 'medium,' which some of the members have thought favorably confirm the possibility of the spiritistic theory. She has been the subject of experiment for nearly eighteen years. This, with two recent volumes of Mr. F. W. H. Myers, has had the effect of reviving an interest in the general problem. But the subject must still run the gauntlet of scientific skepticism and investigation. The early history of the movement has been so infected with charlatanism, fraud, half-baked science, and various forms of radicalism in religious and social matters as to put it under abeyance by the intelligent part of the community.

It is not possible to determine with any accuracy the number of adherents to the spiritualistic belief. They are certainly very numerous, and have many thriving organizations. These take the form of the ordinary church. It is claimed that they have nearly 350 churches and over 200,000 members. It is probable that the number of believers far exceeds this figure. There is nothing in the belief to suggest the necessity of organization as in the orthodox Christian Church. Their periodicals are quite numerous. There are few, however, of first class character. *Light*, a weekly, published in London, England, is, perhaps, the best. The *Banner of Light* is published in Boston, Mass.

The literature on the subject is a very large one, but most of it is not of much importance. Even the best of it has to be read with more than the usual caution. The following, in addition to those mentioned in the body of the article, is a brief list of the most important works connected with the claims of spiritualism and dealing with various phases of it: Edmonds and Dexter, *Spiritualism* (New York, 1854-55); Allan Kardec, *Livre des esprits* (Paris, 1853); Mrs. De Morgan, *From Matter to Spirit* (London, 1863); Alfred Russel Wallace, *Miracles and Modern Spiritualism* (ib., 1876); Karl Du Prel, *Philosophy of Mysticism* (Eng. trans., ib., 1889); Frank Podmore, *Aspects of Psychical Research* (ib., 1897); id., *Modern Spiritualism* (ib., 1902); Frederick W. H. Myers, *Human Personality and Its Survival of Bodily Death* (ib., 1902); Flammarion, *L'inconnu* (Paris, 1899); Flournoy, *Des Indes à la planète Mars* (Geneva, 1900); Parish, *Hallucinations and Illusions* (London, 1897).

SPIROPHYTON (Neo-Lat., from Gk. *σπεῖρα*, *speira*, coil, twist, spire + *φυτόν*, *phyton*, plant). A fossil alga found in rocks of Devonian age. It presents a flabellate expansion with a central pit from which radiate curved ribs as from the centre of a vortex. The surfaces of the Esopus grit of Lower Devonian age in eastern New York and Pennsylvania are covered with these algal fronds. The genus is known also in the Carboniferous rocks, and it has been described from European localities under the name of Taonurus.

SPIRULA (Lat., diminutive of *spira*, coil, spire). A genus of small decapod, dibranchiate cephalopods, comprising two or three species, and constituting the family Spirulidæ, in which the internal skeleton is in the form of a nacreous, discoidal shell, the whorls of which are not in contact with one another, and which are divided into a series of chambers by partitions pierced by a ventral tube or siphuncle. The animal has minute lateral fins, and there are six rows of small suckers on the arms. The three species constituting the family dwell in the deep waters of the tropical seas. In internal anatomy Spirula is a true dibranchiate, having two branchiæ and an ink-bag. It has the peculiar feature that the hinder end of the body acts as a suctorial disk for fastening itself to foreign bodies.



SPIRULA.

1, Animal, showing position of shell; *s*, shell; *m*, siphon muscles; 2, shell enlarged.

The genus Spirula is not known in a fossil state, but it has ancestors, Spirulirostra and Spirulirostrina, in the Tertiary deposits of Italy. These latter have remnants of the 'guard' at the apical portion of the shell, which feature seems to indicate the descent of Spirula from some form of shell like Belemnites. See Cephalopoda.

SPIT′ALFIELDS. An eastern district of London, England, in Whitechapel, adjoining Bethnal Green. It is a manufacturing district inhabited chiefly by the poorer class of population, and by silk-weavers, descendants of French Huguenots. It is the seat of the Spitalfields market. Spitalfields derives its name from the Hospital of Saint Mary, founded in 1197. Population, in 1891, 26,594; in 1901, 27,965.

SPIT′HEAD. A roadstead off Portsmouth, England, between Portsea Island and the Isle of Wight (Map: England, E 6). It is 14 miles long by 4 miles in average breadth, and receives its name from the 'Spit,' a sand-bank stretching south from the English shore for three miles. Fortified by circular towers, and, except on the southeast, protected from all winds, it is a favorite anchorage of the British navy, styled by sailors 'the King's bedchamber,' on account of its security.

SPIT′TA, Karl Johann Philipp (1801-59). A German religious poet, born in Hanover. He was educated at Göttingen, and from 1824 to 1828 he was a tutor at Lüne, and there wrote the best of his hymns. Afterwards he was vicar or pastor in several churches, and in 1859, shortly before his death, was made superintendent at Burgdorf. His hymns, contained in *Psalter und Harfe* (1833; revised with biographical note by his son, Ludwig, 1890; 'Jubilee' ed., 1901), and in the *Nachgelassene geistliche Lieder* (1861 and often), rank high in the German spiritual song of the century, and attained great popularity by their freshness of thought, purity of style, and depth of sentiment.

SPITZ′BERGEN. A group of islands in the Arctic Ocean, situated about 430 miles north of the northern extremity of Norway, between 76° 30′ and 80° 48′ north latitude, and between 10° and 30° east longitude (Map: Arctic Regions, H 3). The group consists of three large islands, West Spitzbergen, North East Land, and Edge Island, whose areas are, respectively, about 15,000, 4000, and 2500 square miles, and a number of smaller islands. All of them are of a rocky and mountainous character and very irregularly indented. West Spitzbergen has an ice-covered plateau running along its eastern coast and eroded toward the west into deep and narrow valleys terminating in fiords, and carrying the overflow of ice in the form of glaciers to the sea. These valleys and fiords are separated by rugged and rocky mountain spurs, here and there forming a network of craggy peaks and ridges interspersed with glaciers. The highest point is the Horn Sund Tind with an altitude of 4560 feet. North East Land is almost wholly covered with an ice sheet, while the other islands are free from permanent ice, or carry only isolated glaciers on their eastern slopes. The mean monthly temperatures range from 10° below zero in February to 37° above in August. Snow falls at all seasons, but in summer a considerable herbaceous growth covers the lower western slopes. This consists largely of mosses, though there are 130 species of flowering plants and ferns, with sedges predominating along the shores. The fauna includes the reindeer, which, however, is fast disappearing, the polar bear, and the fox. The walrus is still found along the coast, but the birds are becoming fewer.

Spitzbergen has no permanent inhabitants, and no country claims possession of it. The islands were discovered by the Dutch in 1596. The interior was first explored in 1892 by Rabot, and in 1896 by Sir Martin Conway, who was the first to cross the large island. Spitzbergen has been an important base for polar expeditions, and in 1897 Andrée made it the starting point in his ill-fated attempt to reach the Pole by balloon. In recent years the west coast has been visited by a number of tourists, and in 1896 a weekly steamship service during summer was established from Norway, and a small hotel was built on the coast.

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SPITZ DOG, or Pomeranian Dog. See Sheep Dog.

SPITZ′KA, Edward Charles (1852—). An American psychiatrist, born in New York City. He was educated at New York University, in Germany, and in Vienna. He served as interne in the New York City Asylum for the Insane, was professor of medical jurisprudence and diseases of the nervous system in the New York Post Graduate Medical School and Hospital from 1881, consulting surgeon to the Northeastern Dispensary, physician to the department of nerve diseases in the New York Polyclinic, and physician to the Metropolitan Throat Hospital. His writings include *A Treatise on Insanity* (New York, 1883), besides many monographs.

SPITZWEG, spits′vȧk, Karl (1808-85). A German genre and landscape painter, one of the most original figures in the art world of Munich, the most genial exponent of the humorous genre. Born and educated in Munich, he dispensed drugs for several years, then studied at the university, and in 1833 was won to art by his accidental surroundings in a watering place. Under the introductory guidance of the historical painter Hansonn (1791-1863), he took to brush and palette, but, practically self-taught, developed his rare talent for the depiction of those inimitable types of German philistinism amusingly associated with his name. On the establishment of the *Fliegende Blätter* in 1844, he became one of its most diligent contributors, whose incomparable humorous drawings were for years the delight of the entire reading world. Among his finely colored pictures of old bachelors, bookworms, hermits, etc., and his poetic landscapes with fanciful accessories, may be mentioned: "The Poor Poet" (1837), "Two Hermits" and a "Scholar in the Attic" (1882), all in the Pinakothek, Munich; "Spanish Serenade," "The Hypochrondriac," "Herd-Girls on an Alp," and "Turkish Coffee-House," all in the Schack Gallery, Munich; "Going to Church Near Dachau" (1862), in Dresden; "His Reverence" and

"Village Street," both in the National Gallery, Berlin. Reproductions of his works appeared in the collections *Spitzweg Mappe* (Munich, 1887) and *Spitzweg Album* (ib., 1888). Consult: Regnet, in *Zeitschrift für bildende Kunst* (Leipzig, 1886), and Holland, in *Allgemeine deutsche Biographie*, xxxv. (ib., 1893).

SPLAY. The sloping or bevelled opening in window recesses and other such openings. Also the corner taken off the outer angle of such openings.

SPLEEN (Lat. *splen*, from Gk. *σπλήν*, spleen; connected with Lat. *lien*, Skt. *plihan*, spleen). The largest and most important of the so-called ductless glands. It is generally oval in form, somewhat concavo-convex, soft, of very brittle consistence, highly vascular, of a dark bluish-red color, and situated in the left hypochondriac region, with its interior slightly concave surface embracing the cardiac end of the stomach and the tail of the pancreas. In the adult it is usually about 5 inches in length, 3 or 4 in breadth, and an inch or an inch and a half in thickness, and weighs about 7 ounces. At birth its weight in proportion to that of the entire body is as 1 to 350, which is nearly the same ratio as in the adult; while in old age the organ decreases in weight, the ratio being as 1 to 700. The size of the spleen is increased after gastric digestion, and is large in highly fed and small in starved animals. In intermittent fevers and leucocythæmia it is much enlarged, weighing occasionally from 18 to 20 pounds, and constituting what is popularly known as the ague-cake.

The spleen is invested externally by the peritoneum and inside this by a fibrous capsule giving off from its inner surface numerous small fibrous bands termed *trabeculæ*, which unite at numerous points with one another, and run in all directions. The parenchyma or proper substance of the spleen occupies the interspaces of the above-described areolar framework, and is a soft pulpy mass of a dark reddish-brown color, consisting of colorless and colored elements. The *colorless elements* consist of granular matter, of nuclei about the size of the red blood-disks, and a few nucleated vesicles, and constitute one-half or two-thirds of the whole substance of the pulp in well-nourished animals, while they diminish in number, and sometimes altogether disappear, in starved animals. The *colored elements* consist of red blood-disks and of colored corpuscles either free or included in cells; sometimes enlarged blood-disks are seen included in a cell, but more frequently the inclosed disks are altered in form and color, as if undergoing retrograde metamorphoses. Besides these, numerous deep-red, or reddish-yellow, or black corpuscles and crystals, closely allied to the hæmatin of the blood, are seen diffused through the pulp substance.

The venous blood of the spleen is carried away by the splenic vein, which contributes to form the great portal venous system, distributed through the liver; while arterial blood is supplied by the splenic artery, the largest branch of the cœliac axis. The branches of this artery subdivide and ramify like the branches of a tree, with the *Malpighian* or *splenic corpuscles* attached to them like fruit. These splenic corpuscles, originally discovered by Malpighi, are whitish spherical bodies, which are either connected with the smaller arterial branches by short pedicles, or are sessile upon their sheaths. They vary considerably in size and number, their diameter usually ranging from 1-30 to 1-60 of an inch. Each consists of a membranous capsule, homogeneous in structure, and formed by a prolongation from the sheath of the artery. The blood capillaries form a delicate plexus within these corpuscles.

With regard to its uses the spleen may be regarded as a storehouse of nutritive material, which may be drawn upon according to the requirements of the system, and the constant presence in large amounts of certain nitrogenous substances seems to indicate that some special nitrogenous metabolism takes place in it. The formation of both white and red blood cells probably also occurs in the spleen as well as the disintegration of exhausted blood corpuscles.

SPLEENWORT. See ASPLENIUM, and Colored Plate of FERNS.

SPLICING. See KNOTTING AND SPLICING.

SPLINT (Swed. *splint*, spike, forelock, flat iron peg, Dan. *splint*, splinter; connected with Eng. *split*). In surgery, a certain mechanical contrivance for keeping a fractured limb in its proper position, and for preventing any motion of the fractured ends; it may also be employed for securing perfect immobility of the parts to which it is applied in other cases, as in diseased joints, after resection of joints, etc. Many different kinds of splints are used, but wood and plaster of Paris are most common. In using wooden splints we take light strips slightly wider than the limb and long enough to reach beyond the joints that lie to either side of the injury. The fractured ends are brought as nearly as possible into their normal relation, thoroughly padded with absorbent cotton to prevent pressure or friction, and then the splints are applied and firmly bandaged to the limb, so as to prevent all motion. Wire netting, gutta percha, leather, and other materials are also frequently employed, as they can be molded to the shape of the limb. In the same way plaster of Paris can be applied to one side of a limb, carefully molded to it, and held in place by bandages. All movable splints, however, have the disadvantage that they must be readjusted from time to time, and thus the fractured limb is subjected to handling.

The plaster of Paris splint is desirable, therefore, in many cases. The limb is carefully protected with a light layer of non-absorbent cotton, especial care being used to guard bony prominences and to avoid any unevenness. Coarse, wide-meshed bandages well rubbed with dry plaster of Paris are immersed for a moment in water and then applied like ordinary bandages, each layer being rubbed into the one beneath so as to make a firm cohesive splint. The plaster should include the joints to either side of the injury. This splint may be both strengthened and lightened by the introduction of wooden or metal strips between the layers of plaster. Drying takes place rapidly and gives a firm resisting splint. In compound fractures or in operative cases a fenestrum may be left over the wound proper and an opportunity thus given to attend to the required dressings without disturbing the splint.

SPLINT. A bony enlargement on the horse's leg between the knee and the fetlock, usually appearing on the inside of the fore leg, frequently situated between the large and small canon bones.

It is usually caused by concussion, and is most common in young horses that have been driven rapidly along hard roads before their bones have become firm.

SPLÜGEN, splụ′gen. An Alpine pass leading between the Tambohorn and the Surettahorn from the Swiss Canton of Grisons into Italy at an altitude of 6946 feet (Map: Italy, D 1). The southern or Italian descent has three great galleries built to protect the road from avalanches, and completed by the Austrian Government in 1834.

SPODUMENE (from Gk. σποδούμενος, *spodoumenos*, pres. part. mid. of σποδοῦν, *spodoun*, to burn to ashes, from σποδός, *spodos*, ashes). A mineral lithium and aluminum silicate crystallized in the monoclinic system. It has a vitreous lustre and is light green, gray, yellow, or purple in color. It occurs commonly in the coarse granitic veins, and is found in Sweden, the Tyrol, Scotland, Brazil, and in Massachusetts, Maine, Connecticut, North Carolina, and South Dakota. The yellow green to emerald green crystalline variety found in Alexander County, N. C., is highly valued as a gem, and is known as *hiddenite*, from its discoverer, W. E. Hidden, of New York.

SPOF′FORD, Ainsworth Rand (1825—). An American librarian, born at Gilmanton, N. H. He was privately educated, became a bookseller, then associate editor of the Cincinnati *Daily Commercial* (1859), and in 1861 assistant librarian of Congress. From 1864 to 1899 he was librarian in chief of the Congressional Library, and became widely known for exceptional knowledge of books. He wrote much for periodicals on literature, economics, and history, and edited with others a *Library of Choice Literature* (10 vols., 1881-88), a *Library of Wit and Humor* (5 vols., 1884), and a *Practical Manual of Parliamentary Rules* (1884). He published annually *The American Almanack and Treasury of Facts, Statistical, Financial, and Political* (1878-91), and *A Book for All Readers* (1900), on the collection and preservation of books and the founding of libraries.

SPOFFORD, Harriet Elizabeth (Prescott) (1835—). An American novelist, born at Calais, Me. Educated at Newburyport, Mass., and Derry, N. H., she adopted literature as a profession and first attracted attention in 1859 by a story of Parisian life, *In a Cellar*, printed in the *Atlantic Monthly.* In the same year she published *Sir Rohan's Ghost*, followed by *The Amber Gods and Other Stories* (1863), and *Azarian, an Episode* (1864). In 1865 she married Richard S. Spofford, a Boston lawyer. The more noteworthy of her later books were: *New England Legends* (1871), *The Thief in the Night* (1872), *Art Decoration Applied to Furniture* (1881), *Marquis of Carabas* (1882), *Poems* (1882), *Hester Stanley at Saint Marks* (1883), *The Servant Girl Question* (1884), *Ballads About Authors* (1888), *Scarlet Poppy and Other Stories* (1894), *A Master Spirit* (1896), and *In Titian's Garden and Other Poems* (1897).

SPOHR, spōr, Louis (1784-1859). A German composer and violinist, born at Brunswick. He studied there under Kunisch and Maucourt and in 1802 became a pupil of the celebrated Franz Eck. In 1805 he accepted the appointment of concertmeister at Gotha and in 1812 went to Vienna as leader at the Theater an der Wien, where he remained until 1815. From 1817 to 1819 he filled a similar position at Frankfort and in 1821 received a life appointment as Court conductor at Cassel. It was in connection with this last position that he won his greatest successes as a violinist, composer, and conductor; besides which he succeeded in bringing his orchestra to a pitch of perfection that earned it a world-wide reputation. In 1831 he completed his work, *The Violin School*, which has remained one of the standard works of instruction for that instrument. His oratorio *Calvary* received its first presentation on Good Friday, 1835. He was a prolific composer and wrote in all nearly 200 works. Most of his operas were little known outside of Germany, but his oratorios have been very popular in England and America, particularly *Die letzten Dinge* (The Last Judgment). As a composer of distinct individuality he ranks but little below the greatest representatives of German music. He died at Cassel. Consult: *Autobiography* (Cassel, 1860; Eng. trans., London, 1865); Schletterer, *Louis Spohr*, in Waldersee's *Sammlung* (Leipzig, 1881).

SPOILS SYSTEM. See Civil Service Reform.

SPOKAN, spô-kăn′. An Indian tribe of Salishan stock (q.v.) formerly occupying the whole basin of Spokane River in Washington and Idaho, and now chiefly gathered upon reservations in the same States. They were visited in 1806 by Lewis and Clark, who call them *Liartielo.* In language, customs, and alliance they were closely connected with the Sanpoil (q.v.). All are now civilized and Christianized, about equally divided between Catholic and Protestant. The majority are reported to be thrifty and industrious, promising soon to become self-supporting and good citizens. They numbered about 700 in 1903.

SPOKANE, spô-kăn′. The county-seat of Spokane County, Wash., 450 miles east of Puget Sound, on the Spokane River and on the Northern Pacific Railway, the Great Northern Railway, the Oregon Railroad and Navigation Company, and several local branch lines (Map: Washington, H 2). The city was formerly known as Spokane Falls. Elevation, 1900 feet above sea level. The Spokane River flows through the heart of the city from east to west in a series of waterfalls, having a total descent of 142 feet, from which, at the lowest stage of water, 30,000 horse-power is available. Electrical power generated here is transmitted to the famous Cœur d'Alêne silver and lead mines of Idaho, 100 miles away. Spokane has the Gonzaga College (Roman Catholic), opened in 1887, Brunot Hall, an Episcopal school for girls, and Saint Stephen's School for Boys. The city is well provided with hospitals and charitable institutions, and expends about $8000 annually for a public library (Carnegie). The notable buildings are the court house, city hall, post office, and Auditorium Theatre. Twenty-three bridges span the river within the city limits. Fort Wright, a large United States army post, is situated on the river just outside the city. Spokane is the mining centre of the Pacific Northwest, the tributary mines producing over $21,000,000 annually in gold, silver, copper, and lead. The city is surrounded on the north, east, and south by large pine timber forests. It is also the metropolis of a highly productive cereal belt. In the census year 1900 there was $2,678,823 capital invested in the various industries, whose output was valued at $15,427,540. Lumber, foundry and machine shop products, cars, flour, malt liquors, brick, brooms, furniture, pottery, marble and granite, and ornamental iron constitute the principal manufactures. The government is vested in a mayor, chosen every two years, and a unicameral council, and in administrative officials, the majority of whom are appointed by the mayor with the consent of the council. The city spends annually for maintenance and operation about $547,000, the principal items of expense being: Schools, $157,000; interest on debt, $145,000; the fire department, $67,000; police department, $36,000; and streets, $21,000. The water-works, which represent an expenditure of $1,326,761, are owned and operated by the municipality. Population, in 1890, 19,922; in 1900, 36,848. In the early part of the nineteenth century an Indian trading post was established at Spokane, but there was a population of only 350 in 1880. The growth of the present city dates from 1884, when the Northern Pacific Railway was completed to this point. The city soon became an important distributing centre, and by 1892 was entered by eight railways. In 1889 it was almost completely destroyed by fire, but was quickly rebuilt. Consult a chapter by Harold Bolce, in Powell, *Historic Towns of the Western States* (New York, 1901); Edwards, *An Illustrated History of Spokane County* (n. p., 1900).

SPOLETO, spô-lā′tô. A city in the Province of Perugia, Italy, situated on a hill, 61 miles north-northeast of Rome (Map: Italy, G 5). It is dominated by a citadel, now a prison, in which in 1499 Lucretia Borgia was incarcerated. The town is united with the neighboring height of Monte Luco by a Roman bridge and aqueduct. Beneath the Piazza Vittorio Emanuele are the ruins of a Roman theatre. Several of the churches occupy the sites of Roman temples. The eleventh-century cathedral has a fine Renaissance portico. The gathering of truffles, together with the preservation of meats, fruits, and vegetables, the manufacture of olive oil and silk, and the mining of lignite are the chief industries. Population (commune), in 1881, 21,507; in 1901, 24,642. The ancient Umbrian town of *Spoletium* was colonized by the Romans in B.C. 241. It was destroyed by the Goths, but rebuilt by Narses. In 574 it became the capital of the Lombard Duchy of Spoleto, which rose to great power in the ninth century, when two of the dukes, Guido (q.v.), and Lambert, his son, successively received the Imperial crown from the Pope. From 1220 to 1860 it was a Papal possession.

SPOLIATION (Fr. *spoliation*, from Lat. *spoliatio*, a plundering, from *spoliare*, to plunder, spoil). The destruction of a thing by a person not an owner or interested therein, particularly the erasure of a signature on or alteration of the body of an instrument in writing. The wrongdoer is liable in damages for his act. Such an alteration or destruction of an instrument will not destroy its legal effect if the original contents can be clearly proved. Spoliation differs from *alteration* in that the former is committed by a stranger and the latter by a person interested in the thing destroyed or altered.

In admiralty law, the hasty spoliation or destruction of ship's papers or other documents connected with the voyage by the officers of a vessel suspected of smuggling or blockade running is held to create a presumption of guilt, which, however, may be rebutted.

In ecclesiastical law the term denotes the destruction or waste of church property.

SPONGE (Lat. *spongia*, from Gk. *σπογγία*, sponge; connected with Lat. *fungus*, mushroom). A group of animals representing a distinct branch or phylum, Porifera. The sponges are many-celled animals, with three cell-layers, without a true digestive cavity, supported usually by calcareous or siliceous spicules, the body-mass permeated by ciliated passages or containing minute chambers lined by flagellate, collared, monad-like cells. There is no true mouth-opening, but usually an irregular system of inhalent pores opening into the cell-lined chambers or passages through which the food is introduced in currents of sea water, the waste particles passing out of the body by a single but more usually by many cloacal openings (oscula). Sponges are hermaphroditic, multiplying by fertilized eggs, the germ passing through a morula and a gastrula stage.

Sponges are divided, according to the nature of the skeleton or supporting fibres or spicules, into two orders: (1) *Calcispongiæ*, in which the spicules are calcareous, and (2) *Silicispongiæ*, or glass sponges, in which the spicules are siliceous, or horny and fibrous, as in the bath sponges, when spongin instead of silica forms the supporting framework. Examples of the siliceous sponges are the Venus's flower-basket (Euplectella) and allied deep-sea forms, such as Hyalonema, Holtenia, etc. To the second order also belongs the fresh-water sponge (Spongilla), which grows in lakes or sluggish streams. These differ from other sponges in producing statoblasts or winter buds, formed by the protoplasm dividing into round bodies as large as a pin's head and enveloped by a dense membrane, thus enabling the species to survive freezing cold or droughts.

Certain sponges bore into shells, causing them to disintegrate. For example, *Cliona sulphurea* has been found boring into various shells, such as the oyster, mussel, and scallop; it also spreads out on all sides, enveloping and dissolving the entire shell. It has even been found to penetrate one or two inches into hard statuary marble. Cliona also disintegrates coral.

A FOSSIL SPONGE.
One of the Brachiospongia (*Tholiasterella gracilis*).

Of the marketable sponges there are six species, with numerous varieties. They are available for our use from being simply fibrous, having no siliceous spicules. The Mediterranean sponges are the best, being the softest; those of the Red Sea are next in quality, while our West Indian species are coarser and less durable. Our glove-sponge (*Spongia tubulifera*) corresponds to *Spongia Adriatica*, which is the Turkey cup-sponge and Levant toilet sponge of the Mediterranean. *Spongia gossypina*, the wool sponge of Florida and the Bahamas, corresponds to *Spongia equina*, the horse or bath sponge of the Mediterranean. This wool sponge of Florida attains under favorable circumstances a weight of one-tenth pound, in six months, and reaches a size of commercial value in a year.

Fossil sponges are known in rocks of all ages. They appear first in the Cambrian as Protospongia and Archæoscyphia, representing the hexactinellids and lithistids. They are represented in the Ordovician by the curious Brachiospongia, and a number of irregular forms; in the Silurian by Astræospongia, Astylospongia; in the Devonian by Hindia and the Dictyospongidæ, which latter enjoyed such great expansion in the shallow seas of western New York during Chemung time. Receptaculites is a peculiar sponge that is common in the Ordovician. During the Mesozoic sponges attained a great development, became especially abundant during the Cretaceous period, and declined during the succeeding Tertiary. Noteworthy Cretaceous genera are Ventriculites and Cœloptychium.

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SPONGIOZOA (Neo-Lat. nom. pl., from Gk. *σπογγία*, *spongia*, sponge + *ζῷον*, *zōon*, animal). One of the branches or phyla of Invertebrates, intermediate between the Protozoan and the Cœlenterati, and represented by a single class, Parifera, which comprises the sponges.

SPONSORS (Lat. *sponsor*, surety, from *spondere*, to promise; connected with Gk. *σπένδειν*, *spendein*, to pour a libation). The persons, also called godfathers and godmothers, who present a candidate for baptism, and in the Roman Catholic Church for confirmation also, to the minister of those sacraments. In the case of infants they are representatives who make the vows the child is incapable of making; with adults they act rather as witnesses, and among their duties is a subsequent general oversight in spiritual matters, with a view to preserving religious life in their godchildren. The spiritual bond resulting from this relation is supposed by Roman Catholic theologians to constitute a species of affinity, and hence an impediment of marriage, extending to the parents of the baptized, and even at one time operating between the sponsors themselves.

SPONTANEOUS COMBUSTION (Lat. *spontaneus*, willing, of one's own accord, from *sponte*, abl. sg. of **spons*, will). The ignition of substances at a given moment apparently without the intervention of any causative agency. The spontaneous combustion of organic materials is a frequent cause of fires. When large quantities of soot, linen, paper, cotton or woolen stuffs, ship's cables, etc., are soaked with relatively small amounts of oils (especially drying oils) and exposed to a limited access of air, they may be expected to take fire sooner or later. Similarly, trimmings of lamp-wicks have been known to take fire if kept in open boxes. The presence of moisture frequently aids spontaneous combustion, and piles of damp hay, freshly mown grass, sometimes take fire spontaneously. The phenomenon is not, however, without a clearly defined cause. Fats and oils can be shown to undergo a slow process of combustion at but slightly elevated, if not at the ordinary, temperatures. This fact may be demonstrated by placing a little oil on a hot (but not red-hot) metallic surface, when the combustion of the oil will cause a peculiar odor and will render the oil faintly luminous in the dark. The combustion of a small amount of oil causes the evolution of a corresponding amount of heat; the consequent rise of temperature accelerates the combustion, and hence produces a further elevation of temperature, and so forth, until at a given moment the temperature may become so high as to cause the inflammation of the oil, and with it of the entire mass of organic material containing it. The more porous the material, the greater the surface of oil exposed to the air, provided the amount of oil is not large enough to fill the pores completely. Free access of air might prevent spontaneous combustion by effecting a lowering of the temperature; nor could combustion take place if too little or no air at all were admitted. As to the spontaneous combustion of human bodies, it is an impossibility, and all reports of such cases can be clearly shown either to be due to erroneous observation or to be intentionally fraudulent. See PYROPHORUS.

SPONTANEOUS GENERATION and PROTOGENESIS. The doctrine that different forms of life, especially the lower, have arisen by phy-

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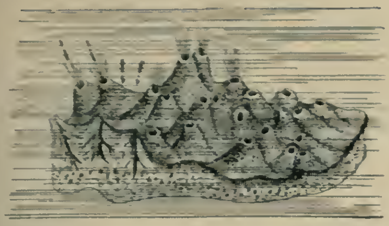
SPONGE STRUCTURE.

1. Exterior of a living bath-sponge: the arrows show how the water is sucked into the small pores and expelled from the elevated canal-mouths (oscules).
2. Diagram of canal system, represented by a young sponge with a single excurrent orifice; such a system is represented in a large sponge by each oscule: *a*, oscule; *b*, inhalent pores.
3. Vertical section of a part of a bath-sponge: *b*, inhalent pores; *c*, canals; *d*, *d*, flagellated chambers; *e*, *f*, skeleton fibres; *g*, maturing eggs.
4. Enlarged view of a part of the canal system: *a*, inhalent pores and passages by which water is drawn into the spherical flagellated chambers and their connecting passages (apopyles) conducting it into larger spaces (*b*) whence it flows out through an oscule (*c*). Cf. Fig. 2.
5. Enlarged view of flagellated cells lining the chambers and canals; and a single cell: *n*, nucleus; *c*, contractile vesicle; *m*, collar; *f*, flagellum.
6. Various forms of siliceous spicules.
7. One form of siliceous fibrous skeleton.
8. Fresh-water sponge; vertical section of Spongilla; the water enters through the dermal pores (*a*) into the sub-dermal cavities (*b*), then enters the incurrent pores and passages (*c*, colored black), and passes into flagellated chambers (*d*), thence out through the excurrent canals (*e*), into the main central canal or perigastric cavity (*f*), in which the openings (*g*) of these canals from all sides are indicated by the black dots; and the water is finally discharged through the apical oscule (*h*).
9. A bath-sponge (Spongia).
10. A branching sponge (*Chalinopsilla oculata*), a 'finger' sponge, common on the Atlantic coast of the United States.

SPONGE STRUCTURE



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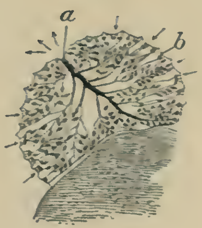

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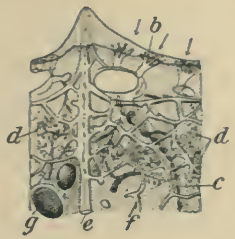

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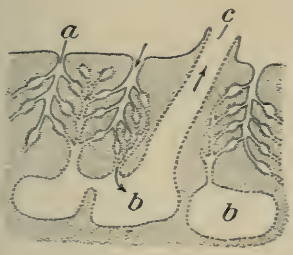

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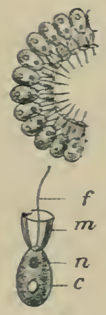

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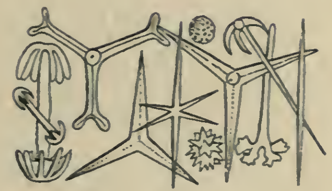

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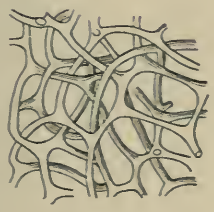

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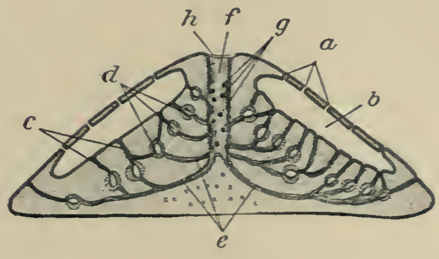

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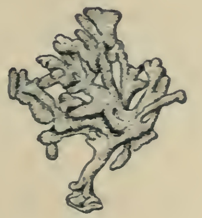

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For Names and Descriptions, see Text

sico-chemical agencies from inorganic substances. This view prevailed from ancient times until after the middle of the seventeenth century, and as late as 1842 Weeks maintained that mites (Acarus) were spontaneously generated in "several solutions under electrical influence." In 1859 Pouchet, in his *Hétérogénie*, revived the subject, and in 1871 Bastian maintained that bacteria and torulæ were developed at the present day in certain fluids containing organic matter by laws similar to those by which crystals arise, or by what he calls 'archebiosis.'

In 1660 Redi disproved the prevailing notion that the maggots of flies were generated in putrefying meat, by covering similar pieces of meat with fine gauze, and keeping away the blow-flies. He thus demonstrated that the maggots grew from eggs, and that there was "no life without antecedent life." About a century and a half ago Needham experimented by boiling and corking flasks of water containing infusoria, but in every case animalcules appeared after a longer or shorter period. This led Spallanzani (1768) to make more careful experiments. He boiled infusions longer, and instead of simply corking, fused the necks of his flasks. The result was that the infusions remained entirely free from living organisms. Schulze and Schwann in 1836 made further experiments. They carefully boiled their infusions, and then supplied air; but they made it first pass through red-hot tubes, so that any germs present in it would be burned. Under these conditions no infusoria appeared. Then the discovery was made by Cagniard de la Tour that fermentation, like putrefaction, is always accompanied by the presence of microscopic organisms. In 1854-59 Schroeder and Dusch invented the screen of cotton-wool now used for plugging the openings of tubes, which kept out the germs, and it was thus found that the cause of putrefaction and fermentation, and the origin of the living forms accompanying these processes, must be microscopic particles existing in the air. The next step was taken by Pasteur (*On the Organized Particles Existing in the Air*, 1862). On sowing these particles in suitable sterilized infusions he raised from them microscopic organisms. Germs like these were afterwards shown by Cohn to be low plants to which he gave the name 'bacterium.' Finally Tyndall, in 1869, by passing a beam of light through the air in a box, showed that whenever dust was present the putrefaction occurred sooner or later; when it was absent it did not. The result of these experiments and conclusions is that the view that spontaneous generation takes place at the present day has been entirely discarded.

SPONTANEOUS GENERATION (PROTOGENESIS) NECESSARY TO ACCOUNT FOR THE BEGINNINGS OF LIFE. Some of those who, like Wyman, made observations disproving its occurrence at the present day, yet supposed that in the beginning the first living organisms probably arose from inorganic matter, through the action of unknown physicochemical processes. In 1868 Herbert Spencer, while rejecting the ancient doctrine of spontaneous generation, stated his belief that the formation of organic matter and the evolution of life in its lowest forms "took place at a time when the heat of the earth's surface was falling through ranges of temperature at which the higher organic compounds are unstable." He conceived that the molding of such organic matter must have begun with portions of protoplasm, more minute, more indefinite, and more inconstant in their characters than the lowest rhizopods, or even the Protogenes of Haeckel. With this view biologists are now in agreement.

It is evident that the earliest living organism appeared when the temperature of the earth's crust and of the air and sea approached that which it is now; the earth's climate probably exceeded in temperature that of the present torrid zone; the sea may have been less saline; but we know that at present exceedingly few plants and animals can live in hot springs; that there is no life in our geysers, and, judging from analogy, the earth's surface must have been nearly as it is now when the first bit of animated protoplasm came into being.

When the earth had assumed its present shape, with its incipient continents, and the oceans lying in their basins, the period arrived when the conditions for the appearance of life became favorable, and at this critical moment the protoplasmic substance probably came into being. The chemical compounds giving origin to it were far more abundant, and the physical and chemical conditions more favorable.

The origin of protoplasm was probably the result of a combination of circumstances which certainly never occurred before in the history of our planet, and which has never happened since. The phenomenon of protogenesis, after taking place once for all, could never have again occurred. Such is the nature of cell-division, of sexual reproduction, of growth, and of heredity, that it would be contrary to the course of nature to suppose that it was ever afterwards necessary for it to again occur. After protoplasm appeared, the earth and ocean probably became too cool to supply a sufficiently high temperature, or chemical compounds of the right degree of stability to form protoplasm.

FIRST BEGINNINGS OF LIFE. To account for the beginnings of life we have been compelled to imagine the creation of a primordial microscopic bit of protoplasm. In shape it was drop-like, spherical or oval, its form being due to gravity, as the primary form of all living beings tends by the action of gravity to be round or ovate.

This primordial being had the power of absorbing and digesting food, or the protoplasmic materials round it, and hence of growing; it was contractile and could move automatically, and thus it was adapted for moving through the water, sending out from its body rootlike extensions or pseudopodia to aid in seizing its food and in locomotion. A single 'chance' germ (though in nature there is no such thing as chance) would have been sufficient. Such a primordial cell or sphere of protoplasm, by the simple process of self-division, even if not far enough advanced in organization to have a nucleus, may have multiplied itself, and in a few hours even become the parent of thousands of young, while the lapse of a few days would enable it to give birth to millions.

These primordial beings were plastic. Already the earth's surface varied, if not in relative distribution of land and sea, in depth, specific gravity, density, light, and shade, in the nature of the bottom of the primeval sea, and in chemical constitution and other physical features.

There would follow migrations and the foundation of new colonies in scattered areas. Adaptation to each new environment would take place, and in the course of time variation would set in and the evolution of higher organisms take place. See EVOLUTION. Consult: Chambers's *Encyclopædia,* art. "Spontaneous Generation;" Spencer, *Principles of Biology* (New York, 1898-1901); Haeckel, *The History of Creation* (ib., 1876); Verworn, *General Philosophy* (ib., 1899).

SPONTINI, spôn-tē′nē, GASPARO LUIGI PACIFICO (1774-1851). An Italian dramatic composer, born at Majolati, Ancona. In 1871 he became a pupil at the Conservatory della Pietà de' Turchini at Naples, where he studied under Sala and Tritto. As early as 1803 he had produced sixteen operas in the light Italian style used at that time. His opera *La finta filosofa* and two imitations of French opéra comique, *Julie* and *La petite maison,* met with little success. He then gave himself up to the study of Mozart and showed a marked change in the one-act opera *Milton* produced in 1804. The Empress Josephine, to whom he had dedicated the score of *Milton,* had him appointed chamber-composer, and she secured the production of *La Vestale* in 1807. It proved a great success. His grand opera *Ferdinand Cortez* (1809) was equally successful. In 1810, as director of the Italian Opera, he staged Mozart's *Don Giovanni* in the original form for the first time in Paris. In 1820 he was appointed general musical director at Berlin. He wrote for the Berlin festival play *Lalla Rukh* (1821), remodeled as the opera *Nurmahal, oder das Rosenfest von Kaschmir* (1822); *Alcidor* (1825); and *Agnes von Hohenstaufen* (1829). In 1842 he resigned his position and returned to Paris. He died in his birthplace.

SPOONBILL. An ibis-like bird of the family Plataleidæ, distinguished by the flat, dilated, spoon-like form of the bill. The species are five or six, in two genera widely distributed. The spoonbills of the Old World belong to the genus Platalea, and have the windpipe curiously convoluted. The spoonbills of the New World lack these convolutions, and are therefore placed in a distinct genus Ajaja. The roseate spoonbill (*Ajaja ajaja*), the only American species, is very abundant within the tropics. It is nearly three feet in length, and is a beautiful bird, with plumage of a fine rose color, of which the tint is deepest on the wings; the tail-coverts are carmine. It was formerly abundant in Florida, but is now rare there, and most commonly seen along the coast of Texas. It nests in colonies, and builds a coarse platform of sticks, in trees, on which it lays three eggs, white spotted with brown. The only European species is the white spoonbill (*Platalea leucorodia*), common in marshy districts throughout Northern Europe and Asia in summer, and in the salt marshes of the Mediterranean in winter. See Colored Plate of WADERS.

SPOON-BILLED SANDPIPER. A rare reddish, stint-like sandpiper (*Eurynorhynchus pygmæus*) of Eastern Asia, remarkable only for its spoon-shaped bill. (See Colored Plate of SHORE-BIRDS.) It breeds in Siberia, occasionally crossing to the Alaskan coast, and migrates southward in winter to China and India.

SPOON′ER, JOHN COIT (1843—). An American lawyer and legislator, born in Lawrenceburg, Ind. In 1859 he removed with his parents to Wisconsin. He graduated at the University of Wisconsin in 1864. He served during the Civil War first as a private in the Fortieth Wisconsin Volunteers and subsequently as a captain in the Fiftieth Wisconsin, and was brevetted major at the close of hostilities. In 1867 he was admitted to the bar, and from 1868 to 1870 he was Assistant Attorney-General of the State. He was a member of the State Assembly in 1872-74, and in 1885 he was elected to the United States Senate. In 1892 he was defeated for Governor by George W. Peck, and in 1893 resumed legal practice in Madison. In January, 1897, he was again elected to the United States Senate to succeed Senator Vilas. He took a prominent part in legislation and debates, and became recognized as the spokesman of the McKinley and Roosevelt administrations. He was reëlected for a third time in January, 1903, despite the opposition of Governor La Follette's faction in the Wisconsin Legislature.

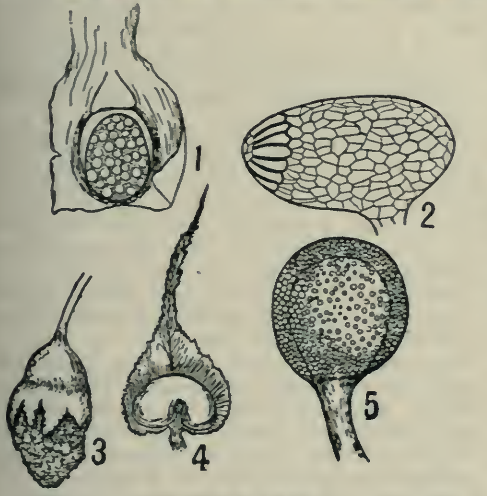
SPOONER, SHEARJASHUB (1809-59). An American dentist and author, born at Brandon, Vt. He graduated in 1830 at Middlebury (Vt.) College, at the College of Physicians and Surgeons, New York City, in 1835, and practiced dentistry in New York with much success until 1858. He contributed extensively to periodicals, professional and other, and published, in addition to dental works, two compilations once valuable: *Anecdotes of Painters, Engravers, Sculptors, and Architects, and Curiosities of Art* (1853), and a *Biographical and Critical Dictionary of Painters, Engravers, Sculptors, and Architects from Ancient to Modern Times* (1853; new ed. 1865). He also bought and restored the plates of Boydell's *Shakespeare Gallery,* which he republished.

SPORADES, spŏr′ȧ-dēz (Gk., scattered). The collective name for the islands lying in the southeastern portion of the Ægean Sea between Samos and Rhodes, and east of the Cyclades (q.v.) (Map: Greece, J 5). The ancients included under the Sporades a number of islands which lie south of the Cyclades proper and whose principal members are Melos, Ios, Santorin, and Amorgos; but these are now classed with the Cyclades, belonging to the Greek nomarchy of that name. The Sporades proper belong to Turkey. Their principal members are Astropalia, Leros, Patmos, Nicaria, Calimno, Cos, Nisyros, and Scarpanthos. Some also include Rhodes, Samos, Chios, and Lesbos with the neighboring islands. In a wider sense the name Sporades is applied to all the islands of the Ægean Sea except the Cyclades proper. The group lying in the western part of the sea, north and east of Eubœa or Negropont, the principal member of which is Scyros, are known as the Northern Sporades, and belong to the Greek Nomarchy of Eubœa. For details, see articles on the principal individual islands.

SPORAD′IC (Lat. *sporadious,* from Gk. σποραδικός, *sporadikos,* from σπείρειν, *speirein,* to sow). Isolated. In medicine, a disease is sporadic when but few cases, widely separated, appear. If many cases are found in the same region, the disease is called epidemic (q.v.). In botany, sporadic growths are those which are scattered or widely dispersed.

SPORANGIUM (Neo-Lat., from Gk. σπόρος, *sporos*, seed + ἀγγεῖον, *angeion*, vessel). The plant organ within which asexual spores are produced. Among algæ and fungi the sporangium is usually a single cell (mother-cell), which produces few to numerous spores. Among bryophytes there are no distinct sporangia, the spores being produced by a more or less complex capsule which is the essential feature of the characteristic leafless sporophyte (sporogonium) of the group. Among pteridophytes the sporangia are very prominent, and their origin is the basis of a fundamental distinction in the group. They are complex, many-celled organs, usually borne on leaves, and if they are developed from a single superficial (epidermal) cell the plant is *leptosporangiate*, if they involve several epidermal and deeper cells the plant is *eusporangiate*. The ancient ferns, represented by a few tropical forms to-day, were eusporangiate; while the great host of modern ferns, including the water ferns, are leptosporangiate. It is natural, therefore, to regard the eusporangiate condition as primitive, and the leptosporangiate as derived. The two other divisions of pteridophytes (horsetails and club mosses) and all the spermatophytes (seed-plants) are eusporangiate.

The structure of the ordinary fern sporangium indicates its highly specialized character. It consists of a long slender stalk that bears a spore-containing capsule. The walls of the capsule are thin, except for a single row of thick-walled cells (annulus) which girdles the capsule like a meridian, from the stalk nearly around to the stalk again. At maturity the annulus acts like a bent spring, and when the thin wall of the capsule begins to yield straightens violently, hurling out a spray of spores. In the eusporangiate plants such a contrivance is absent.



TYPES OF SPORANGIA.
1, Quillwort; 2, fern; 3, liverwort; 4, club moss; 5, fungus.

In most ordinary ferns the sporangia are developed in very great numbers upon the under surface of foliage leaves, usually occurring in definite groups (sori), popularly called 'fruit dots,' which are generally protected by a flap-like outgrowth (indusium, q.v.) from the epidermis. In some ferns (e.g. 'sensitive fern'), however, foliage-work and spore-production are separated, and distinct foliage leaves and sporophylls ('spore-leaves') occur. This distinction persists in the other groups of pteridophytes (horsetails and club mosses) and in the spermatophytes, the sporophyll being a constant organ in them. In the horsetails (Equisetales, q.v.) and most of the club mosses (Lycopodiales, q.v.) the small sporophylls are organized into a cone-like cluster (strobilus), which also appears as the so-called cones of pines, and as the equivalent in general of the flowers of angiosperms. In plants which exhibit heterospory (q.v.) the sporangia are differentiated, some producing megaspores (megasporangia) and others microspores (microsporangia). This differentiation begins among the pteridophytes, most notably in the club mosses (Selaginella, q.v.), and is found in all seed-plants. Since the two forms of sporangia in seed-plants, long called pollen sacs and ovules, are really microsporangia and megasporangia respectively, stamens and carpels are properly sporophylls, and not sex organs, as commonly supposed.

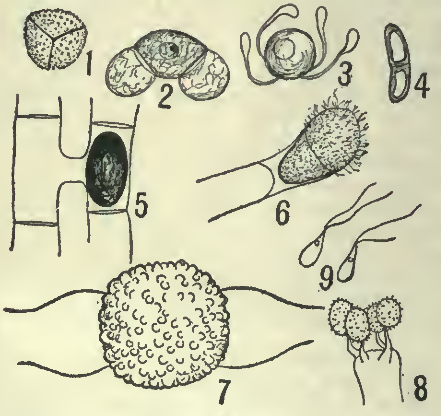
The structure of a complex sporangium, such as occurs among all the vascular plants (fern-plants and seed-plants), is constant in character though somewhat diverse in details. In the very early stages of a sporangium, when it consists of a mass of similar cells, there is no distinction of regions. Very early, however, a single cell or group of cells (archesporium) assumes the office of spore production, dividing more or less and producing in some cases a considerable mass of tissue. In any event, the cells of the last division are called the spore mother-cells, because within each one of them four spores are formed, the group of four being known as a tetrad. In a completely formed sporangium, just outside of the mass of mother-cells, there is a more or less distinct nourishing layer called the tapetum, outside of which is the sporangium wall, consisting usually of two to five layers of cells, and variously modified for protection, discharge, etc. This general account applies to all sporangia of the higher plants, excepting the megasporangia or ovules of seed-plants, where the ordinary sporangium structure is more or less modified, and the formation of the tetrad is obscured.

SPORE (from Gk. σπόρος, *sporos*, seed). In general, a single cell separated from the parent plant for reproduction. In the simplest plants spores are not produced, as in the blue-green algæ (Cyanophyceæ, q.v.), but in all other plants they are a prominent method of reproduction, and one or other of two great groups that differ in their mode of origin. Asexual spores are usually produced by mere division of the cells in a sporangium. Sexual spores are produced by the fusion of two sexual cells (gametes), which arise in a simple or complex organ called a gametangium (q.v.).

ASEXUAL SPORES. The diverse names given to asexual spores usually indicate some peculiar character of the spore or the group of plants which produce it. Among the green algæ (Chlorophyceæ, q.v.) the characteristic spore is a zoöspore or swarm spore, a minute, pear-shaped naked mass of protoplasm, swimming freely by means of one or two cilia at one end (fig. 9). Among the brown algæ (Phæophyceæ, q.v.) the zoöspores are bean-shaped, with two cilia on the concave side. Among the red algæ (Rhodophyceæ, q.v.) the spores have no cilia and hence cannot swim, and as each sporangium produces four such spores they are called tetraspores.

Among the fungi, asexual spores, which are produced in great profusion and variety, have received many names. Among the alga-like fungi (Phycomycetes, q.v.) they are developed in one-celled sporangia, and are mostly light, dry cells, easily scattered by wind. Such are called simply spores, with no designating prefix. Among the sac-fungi (Ascomycetes, q.v.), however, two conspicuous forms of asexual spores occur: the one, conidia, which are successively cut off from the tip of a filament, often forming chains; the other, ascospores (fig. 4), developed within a delicate sac (ascus). Among the rusts (Uredinales, q.v.) the greatest variety of asexual spores for one plant is reached; e.g. in wheat rust there are four. Among toadstools (Basidiomycetes, q.v.) the characteristic spores are basidiospores, borne two or four together on the tips of pointed branches from a swollen filament, the basidium (fig. 8). There are several other spores of minor significance among the fungi, each with its distinctive name. Among the bryophytes (liverworts and mosses) and most of the pteridophytes the asexual spores are called simply spores. In heterosporous plants (some pteridophytes and all spermatophytes), however, there are two kinds of asexual spores, megaspores or macrospores and microspores (qq.v.). Before their character in seed plants was appreciated these two kinds were called respectively embryo-sacs and pollen-grains. In all of these wind-dispersed asexual spores, the spore-wall consists of two layers, a delicate inner one (intine or endospore) and a tough outer one (exine or exospore), often variously sculptured, especially in the pollen-grains of flowering plants, and sometimes even winged, as in the pollen-grains of pines (fig. 2).

Sexual Spores. Only two names, zygospores and zygotes, are used to designate sexual spores which result from the union of similar gametes (fig. 5, 7). (See Isogamy.) Oöspores, produced by all but the lowest plants, are formed by the union of dissimilar gametes (see Heterogamy) known as sperms and eggs (oöspheres). See Sex in plants.



TYPES OF SPORES.

1, Megaspore of Selaginella; 2, microspore (pollen) of pine; 3, spore of Equisetum with elaters, 4, ascospore of lichen; 5, zogospore of Spirogyra; 6, zoöspore of Vaucheria; 7, zygospore of Mucor; 8, basidiospores; 9, zoöspores of green alga.

Under suitable conditions any spore begins to form a new plant, the process being called germination. In some cases the germination is immediate; in others it is delayed for a longer or shorter period by unfavorable conditions, as winter. Spores adapted to delayed germination are called resting spores, and may be recognized by their unusually heavy protecting wall. See Reproduction.

The methods of spore dispersal are as diverse as the various means of seed dispersal. In many of the lower forms, as in the algæ and some fungi, zoöspores may distribute the species over wide areas. Most aerial spores are light and usually small, and are thus readily scattered great distances by wind, a fact evidenced by the usually early appearance of ferns on new tropical islands. Mechanical expulsion and special devices for separating or entangling spores, as the elaters of Equisetum (fig. 3), are common.

SPÖRER, spē′rẽr, Gustav Friedrich Wilhelm (1822-95). A German astronomer, born in Berlin and educated there. He taught at Bromberg, at Prenzlau, and at Anklam (since 1849). Here he began in 1860 to observe sun spots with the view of determining the law of solar rotation. Through a Government endowment a solar observatory was erected by him at Anklam. Spörer arrived independently at a conclusion similar to that of Carrington concerning the equatorial quickening of the sun's movement on its axis. In 1868 he took part in an expedition to East India for observing a total eclipse of the sun. The structure of the chromosphere was also investigated by Spörer. This showed the chromosphere to be of the same nature as the vast protrusions from it. From 1874 to 1894 Spörer was observer at the astrophysical observatory at Potsdam.

SPOROPHYLL (from Gk. σπόρος, *sporos*, seed + φύλλον, *phyllon*, leaf). A leaf-like organ that occurs only in spermatophytes and in certain pteridophytes and bears sporangia (spore-cases). Though generally unlike ordinary foliage leaves in appearance, they are regarded as foliar organs. See Sporangium.

SPOROPHYTE (from Gk. σπόρος, *sporos*, seed + φυτόν, *phyton*, plant). The sexless phase in alternation of generations (q.v.).

SPOROZOA (Neo-Lat. nom. pl., from Gk. σπόρος, *sporos*, seed + ζῷον, *zōon*, animal). A class of parasitic protozoa comprising the malaria germs, Texas cattle-fever germs, etc. While the sporozoa differ much in structure, they are similar in parasitic habits and development. As a rule they are more or less oval or elongated, with no organs of locomotion except in the early stages. They are very minute, though *Gregarina gigantea*, which lives in the intestine of the European lobster, is of comparatively colossal size, being a little over half an inch in length. They are nourished by the absorption of the fluid in which they live. The young arise as 'sporoblasts,' which when enveloped with a membrane are called spores, the contents of which break up into several small bodies or 'sporozoites;' the latter to complete their development must leave the first host and enter a second one.

Some of the sporozoa are parasites in the interior of cells, such as those lining the intestine of higher animals. Malaria in man has been proved to be due to the presence of a sporozoan

(*Hæmamœba* or *Plasmodium Laverani*) which invades and destroys at a certain stage in its life history the red corpuscles of the blood. The sporozoites are developed in a mosquito (Anopheles) and are transferred from the salivary glands to man by the sting or proboscis. The bird-malaria germ is communicated by the ordinary mosquito (Culex). Another form (*Apiosoma bigeminum*) causes the Texas fever in cattle, the infection being carried by ticks (q.v.). A parasite of the tsetse fly (q.v.), which is a flagellate hæmatozoan, is the cause of the tsetse disease in Southern Africa. See *Insects and Disease*, in article INSECT.

The Myxosporida are generally rather large sporozoa, their hosts being fish and insects. The silkworm disease called pebrine is due to one of the Myxosporida (*Glugea bombycis*), which inhabits all the tissues of the caterpillar.

The Sarcosporida, also called Rainey's or Mieschers's corpuscles, take up their abode in the voluntary muscles of mammals. They form oval cysts, which when ripe inclose spores, each of which contains numerous kidney-shaped sporozoites. Thus *Sarcocystis Miescheriana* occurs in the muscles of the pig; *Sarcocystis muris* in the mouse; *Sarcocystic Lindemanni* rarely in human muscle.

SPORT (by aphæresis for *disport*, from OF. *desporter, deporter, depporter*, to support, banish, amuse, divert, from Lat. *deportare*, to carry away, from *de*, down, away + *portare*, to carry). In biology, the appearance at birth of an individual having one or more marked or extraordinary physical or mental characteristics; a sudden aberration from the type. See EVOLUTION; NATURAL SELECTION.

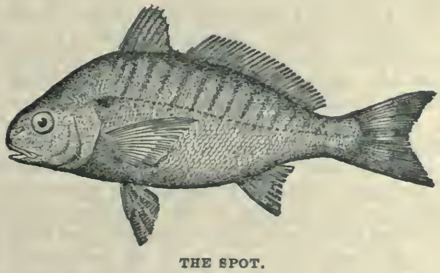
SPORTS, BOOK OF. A name popularly given to an edict issued by James I. of England in 1618 dictating the games which should or should not be played on Sundays after divine service. According to this declaration "no lawful recreation shall be barred to my good people which does not tend to the breech of the laws of my kingdom and the canons of the established Church." The sports allowed were dancing, archery, leaping, vaulting, May games, Whitsun ales, Morris dances, and the setting up of May poles. The occasion of this proclamation was the conduct of some Puritan authorities in the County of Lancashire, who, by their arbitrary repression of the customary recreations of the people, had created considerable discontent and (in the estimation of the King and his advisers) "had given much comfort to the Roman Catholics" by giving a repulsive aspect to the reformed religion. The unlawful sports were bear-baiting, bull-baiting, and bowling. In 1644 the Long Parliament ordered all copies of the Book of Sports to be called in and publicly burried.

SPOT, or LAFAYETTE. A small food-fish (*Leiostamus xanthurus*) of the South Atlantic and Gulf Coast, locally called 'Lafayette' (q.v.), 'goody,' and 'oldwife.' The color is bluish above and silvery below, with about fifteen dark, wavy bands slanting down the sides, and a black spot behind the eye. It appears numerously on the northern coast in September, when it is preparing to spawn in the inlets.

SPOTS'WOOD, or **SPOT'TISWOOD**, ALEXANDER (1676-1740). A British soldier and American colonial governor. He was born at Tangier, Africa; entered the British Army; served with Marlborough and was wounded at Blenheim. He was appointed Lieutenant-Governor of Virginia in 1710, became active in promoting the interests of William and Mary College, and was also interested in the improvement of the condition of the Indians. It is to his efforts that the improvement in the production of tobacco is attributable, and he favored the act for making tobacco-notes a circulating medium. He introduced the manufacture of iron into Virginia. Owing to a lack of support, disputes, and other difficulties, he was superseded in 1722, but he remained in America, and in 1730 was appointed Deputy Postmaster-General.

SPOTTED FEVER. See MENINGITIS.

SPOT'TISWOODE, SPOT'TISWOOD, SPOT'ISWOOD, or **SPOTS'WOOD**, JOHN (1565-1639). Archbishop of Saint Andrews. He was educated at the University of Glasgow, and on his father's death in 1583 succeeded him as parson of Calder. He was for many years an uncompromising Presbyterian, but he afterwards adopted English episcopal ideas. He became the chief instrument of James I. and Charles I. in their attempts to reconstruct the Scottish Church after the English model. He was made Archbishop of Glasgow in 1603 and member of the Scottish privy council in 1605. In 1610 he was moderator of the Assembly which gave its consent to the introduction of episcopacy into Scotland. In 1615 Spottiswoode was translated to the see of Saint Andrews, which held the primacy in Scotland. In 1618 he persuaded the General Assembly to accept the Five Articles of Perth, ordaining certain ceremonial innovations, and he subsequently inforced the articles as far as he could. He took part in the revision of the Scottish Prayer-Book, but was opposed to the introduction of the Laudian system into Scotland. In 1633 he crowned Charles I. at Holyrood, and in 1635 he was made Chancellor of Scotland, a dignity which no churchman had held since the Reformation. Finding that the King was determined to introduce the Prayer-Book, he, as usual, stifled his own scruples and acted energetically, according to the King's wishes, but in the resulting disorders he found it necessary to flee from Scotland. He was excommunicated and deposed by the General Assembly, December 4, 1638, and Charles asked him to resign the Chancellorship. Spottiswoode was the author of the *History of the Church and State of Scotland from the Year of Our Lord 203 to the End of the Reign of King James the VI., 1625*, an official compilation written at the request of King James, first printed in London in 1655.



THE SPOT.

SPOTTISWOODE, WILLIAM (1825-83). An English mathematician and physicist, born in

London. He was educated at Balliol College, Oxford. His memoirs on the contact of curves and surfaces in the *Philosophical Transactions* and various other scientific journals are important and original. Among his works are: *Meditationes Analyticæ* (1847); *Elementary Theorems Relating to Determinants* (1851; a second edition appeared in *Crelle's Journal,* 1856); *A Tarantasse Journey Through Eastern Russia* (1857); *Polarization of Light* (1874); *A Lecture on the Electrical Discharge, Its Form and Functions* (1881).

SPOTTSYLVANIA COURT HOUSE, Battles of. A series of battles during the Civil War, fought between May 7 and May 21, 1864, at and near Spottsylvania Court House in Virginia, 49 miles north by west of Richmond, between the Federal Army of the Potomac, under General Meade, and the Confederate Army of Northern Virginia, under General Lee. As in the battle of the Wilderness (q.v.), the movements of the Federal army were directed by General Grant. Both armies paused for breath after the battle of the Wilderness (May 5th, 6th), and prepared to renew the struggle. The Federal wagon trains were early in the afternoon of the 7th drawn to the eastward to clear the direct road to Spottsylvania Court House, upon which a night march had been ordered. This was, however, anticipated by General Lee, and Longstreet's corps (under R. H. Anderson) moved toward the same point, which (having a shorter line) they reached early on the morning of the 8th in time to oppose the advance of Warren's corps. Anderson had been ordered to begin his march at about the hour when (forced to move earlier by the burning forest in which he could not bivouac) he actually arrived at his destination. Notwithstanding the celerity with which Anderson moved, Watson's division of the Federal cavalry reached the Court House some hours earlier, and had not, as alleged, Sheridan's dispositions been countermanded by Meade, the result might have been different. Anderson immediately intrenched, and, although attacked by Warren with vigor, was enabled to maintain his position until heavily reinforced.

By noon of the 9th the relative positions of the opposing forces were as follows: The Confederate line formed a semicircle in front of the Court House, facing north, northwest, and northeast, with Anderson, Ewell, and Early from left to right. Confronting them were Warren, Sedgwick, and Burnside from right to left in order named; Hancock had not yet arrived, but had been ordered to threaten Lee's left. In the course of these movements the distinguished commander of the Sixth Corps—General Sedgwick—was killed by a sharpshooter, and was succeeded by General Wright. It was discovered that Hancock's movement had caused Lee to draw troops from his right, and Grant thereupon (on the 10th) delivered a severe blow upon that part of his enemy's line. Combining for the purpose the Fifth, Sixth, and part of the Second Corps, all under Hancock, while Burnside was to coöperate (a storming party of 12 regiments under Colonel Upton being a feature of the attacking column), he scaled the enemy's intrenchments and took several guns and some hundreds of prisoners. The general attack failed, and was repulsed with loss; it was renewed with success and Upton's men (their commander severely wounded) were finally withdrawn, bringing their prisoners with them, but leaving the guns behind. On the 11th there was no fighting.

A reconnaissance made on the 11th from Hancock's corps discovered a salient, at the right centre of the Confederate intrenchments. At 4 o'clock the next morning a combined attack of Hancock and Burnside was made, resulting in the capture of 4000 prisoners, 30 guns, several thousand stand of arms, and many colors. This success was only achieved after the most severe hand-to-hand fighting that occurred during the war. The captured artillery was turned upon the defenders of the position, who, heavily reinforced, resisted most strenuously. Five times Lee's men made desperate attempts to dislodge Hancock, each time losing heavily. It was 3 o'clock next morning before the fighting ceased, after the troops had been for nearly twenty hours under fire. Lee retired to a fresh position in rear of the one previously occupied and strongly intrenched. Until the 18th the two armies lay facing each other, engaging in several minor conflicts, and Grant then, on May 19th-21st, transferred his army to the North Anna River. On the 8th Sheridan had been detached with his command and sent on a raid in the direction of Richmond and against Lee's communications. He was promptly followed by the Confederate cavalry, but, notwithstanding their efforts, succeeded in passing entirely around Lee's army. He had four severe engagements with Stuart's cavalry, in one of which that distinguished leader was mortally wounded, recaptured 400 Federal prisoners, captured large quantities of supplies and war material, destroyed miles of railroad and telegraph, passed within the outer defenses of the enemy's capital, and after a fortnight's absence reached Grant's headquarters. The Federal losses at Spottsylvania are estimated at 6820; those of the Confederates at 9000, in killed, wounded, and missing. Consult: *Official Records;* Johnson and Buel (eds.), *Battles and Leaders of the Civil War* (New York, 1887); Humphreys, *The Virginia Campaign of 1864 and 1865* (New York, 1883); Grant, *Personal Memoirs* (last ed., New York, 1895); Badeau, *Military History of Ulysses S. Grant* (New York, 1868-81); and Swinton, *Campaigns of the Army of the Potomac* (new ed., New York, 1882).

S. P. Q. R. The abbreviation of *Senatus populusque Romanus* (the senate and the Roman people), the motto surmounting the Roman standards.

SPRAGUE, sprāg, Charles (1791-1875). An American poet, born in Boston, Mass. Leaving school at an early age, he became a merchant's clerk, and in 1820 teller in a bank. From 1825 to 1865 he was cashier in the Globe Bank of Boston. His literary skill was chiefly shown in occasional poems, which were first collected in 1841. In 1850, 1855, and 1876 editions of his *Poetical and Prose Writings* were published. Much of his verse is in the familiar rhymed couplet of the eighteenth century, to which period its literary feeling chiefly belongs.

SPRAGUE, William (1830—). An American manufacturer and politician, born at Cranston, R. I. After studying at the Irving Institute, Tarrytown, N. Y., he entered his father's calico factory, and afterwards became interested in linen weaving and locomotive building. He was elected Governor of Rhode Island, but at the outbreak of the Civil War he offered his services to the United States Government, and served with the Rhode Island troops, participating in the first battle of Bull Run and in the Peninsular campaign. From 1863, when his term as Governor expired, until 1875, he was a member of the United States Senate and served as chairman of the committees on public lands and on manufactures and as a member of the committees on commerce and on military affairs.

SPRAGUE, William Buell (1795-1876). An American clergyman and compiler of *Annals of the American Pulpit* (10 vols., 1857-1869), a comprehensive biographical dictionary of the leading American ministers of all denominations. He graduated at Yale (1815), studied theology at Princeton (1819), had pastoral charges at West Springfield, Mass. (1819-29), and Albany, N. Y. (1829-69), and afterwards devoted himself to literary work at Flushing, L. I. Besides the *Annals* mentioned above, he wrote numerous books, of which the chief are: *Life of Rev. Edward Dorr Griffin, D.D.* (1838); *Life of Rev. Jedidiah Morse* (1874); and *Women of the Bible* (1850).

SPRAIN (from OF. *espreindre*, from Lat. *exprimere*, to press out, from Lat. *ex*, out + *premere*, to press), or Strain. A term employed in surgery to designate a violent stretching of tendinous or ligamentous parts with or without rupture of some of their fibres. Sprains are very frequent in all the joints of the upper limbs, especially in the wrist and the articulations of the thumb. In the lower extremity the ankle is the joint by far the most frequently affected; and this is accounted for anatomically by the small size of the articular surfaces, the great weight the astragalus (the bone presenting the lower articular surface) has to support, and the unyielding nature of the lateral ligaments. In slight sprains of this joint the ligaments are only stretched or slightly lacerated, but in more severe cases they may be completely torn through. Sprains are sometimes mistaken for fractures, and *vice versa;* and the two injuries may coexist. The pain and swelling sometimes make an accurate diagnosis difficult, especially if the patient is not seen for some time after the accident; and if any doubt exists, the case should be treated as for the more severe injury. Sprains of the knee are not uncommon, and are characterized by great swelling from effusion of fluid within the joint. Sprains of the back are not unfrequent accidents, and are the most serious of any. The treatment of sprains generally must be regulated by their severity. In most cases, elevation of the joint, the application of cold, and complete rest in a splint will be sufficient, and as soon as the inflammation subsides massage and movement are necessary to prevent adhesions. Sometimes pain and impaired function persist for a long time, and frequently after a severe sprain a joint is permanently weaker.

Sprains, or strains, are very common among horses, owing to the severe exertions required of them, often while they are young and unprepared for such work. Various muscles, ligaments, and tendons are liable to strain, but none more frequently than the large tendons passing down the back of the fore limbs. In slight cases cold water continuously applied for several hours gives relief; but in all serious cases diligent fomentation with water about the temperature of 100° is preferable; or the injured part may be swathed in a thick woolen rag, kept constantly moist and warm by frequent wetting with the hot water. Perfect rest is essential, and in order to insure the relaxation of the large tendons of the horse's limbs, he may in bad cases be kept slung for several days. Blisters, hot oils, firing, and all such irritants are on no account to be used until the inflammation abates, and the part becomes cool and free from tenderness. Such remedies are then useful for causing the reabsorption of swelling, and perhaps also for invigorating the weakened part.

SPRAT (dialectic variant of *sprot*, from AS. *sprota*, OHG. *sprozo, sprozzo*, Ger. *Spross*, sprout, from AS. *sprēotan*, Ger. *spriessen*, to sprout). A small European herring (*Harengula sprattus*), very abundant in the northern Atlantic. It is six inches in length when fully grown. Sprats are cured in great quantities both dry-salted and in brine, and form a cheap and excellent food. Certain small and unimportant species have taken the name in America, where the true sprat is not found.

SPREADING ADDER. See Hognose; and the photographic Plate of Snakes.

SPRECK′ELS, Claus (1828—). An American business man, born at Lamstedt, in Hanover, Germany. He emigrated to Charleston in 1846; worked for a time in New York City; and went to San Francisco in 1856. In 1857 he started the Albany Brewery in San Francisco, and in 1863 organized the Bay Sugar Refining Company. Two years afterwards he sold his interests and went to Europe, where he studied the manufacture of sugar in all its aspects. Returning to California, he engaged more extensively than ever in business, having large interests in manufactures and shipping both in California and in the Hawaiian Islands. He acquired large sugar interests in Hawaii; built large refineries with improved processes; engaged in beet-sugar farming in California; and by the control he exercised over the sugar industry gained for himself the name of the 'sugar king.'

SPREE, sprā. A river of Prussia, which rises in the eastern part of the Kingdom of Saxony, on the borders of Bohemia (Map: Prussia, E 2), and after a winding northwest course of 226 miles, mainly through Brandenburg, falls into the Havel at Spandau. It flows through a low and marshy region, frequently expanding into lakes. It becomes navigable for small vessels at Liebsch, and has recently been deepened below Berlin so as to admit large ships to that city. It is connected with the Oder by two canals.

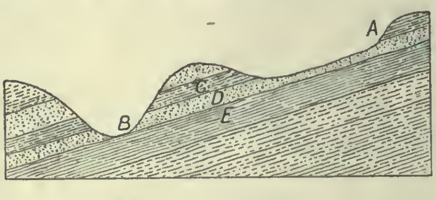
SPREMBERG, sprĕm′bĕrk. A town of Prussia, on the Spree, 77 miles southeast of Berlin (Map: Germany, F 3). Its chief industry is cloth manufacture. There are oil mills and mines of lignite. Population, in 1900, 10,925.

SPRENGEL, sprĕng′el, Kurt (1766-1833). A German physician and botanist, born at Boldekow, near Anklam, and educated at Halle. In 1789 he was made professor of medicine there, and in 1797 he was appointed professor of botany as well. He published: *Versuch einer pragmatischen Geschichte der Arzneikunde* (1792-

1803; 4th ed. 1846), *Handbuch der Pathologie* (1795-97; 4th ed. 1815), *Historia Rei Herbariæ* (1807-08), *Geschichte der Botanik* (1817-18), and *Neue Entdeckungen im ganzen Umfange der Pflanzenkunde* (1819-22).

SPRENGER, sprĕng′ẽr, Aloys (1813-93). A German-English Orientalist, born at Nassereit, Tyrol. He was educated at Innsbruck and at the University of Vienna. In 1836 he settled in London and became a naturalized British subject. In 1843 he proceeded to Calcutta under an appointment to the medical service of the East India Company. In 1844-48 he was principal of the Mohammedan College at Delhi. In December, 1847, he became an assistant resident at Lucknow, where he was employed for some time in cataloguing the manuscripts in the royal library of the King of Oudh. From 1851 to 1854 he was official Persian translator at Calcutta, and principal of the Mohammedan College at Hoogli. During these years he traveled extensively through the Orient, gathering materials for his projected *Life of Mohammed*, the first portion of which was published at Allahabad in 1851. In 1857 he returned to Europe, and settled at Heidelberg. In 1858-81 he was professor of Oriental languages at the University of Bern. The remainder of his life he spent in retirement at Heidelberg. His published works include: *Technical Terms of the Suffees* (1844); *An English-Hindustani Grammar* (1845); *Selections from Arabic Authors* (1845); *The History of Mahmud Ghaznih* (1847); *The Gulistan of Saadi* (1851), a translation from the Persian; *Leben und Lehre des Mohammed* (3 vols., 1861-63); and *Die alte Geographie Arabiens* (1875).

SPRING (AS. *spring, spryng*, OHG. *spring, sprung*, Ger. *Spring*, spring, from AS. *springan, sprincan*, OHG. *springan*, Ger. *springen*, to spring, leap; probably connected with Gk. *σπέρχεσθαι, sperchesthai*, Lith. *sprugti*, to spring away, escape). A subterranean stream which discharges at the earth's surface. Most springs are fed by meteoric waters in the form of rain and snow that percolate into the soil and accumulate at some depth in the strata. This accumulation is known as ground water, and its upper surface, which is called the water-level, coincides more or less closely with the surface of the ground, receding from it, however, under the hill crests and approaching it closely under the valleys. When the side of a valley is steep or its floor is much depressed the ground water may come to the surface and escape as a spring. Springs may also be formed by the percolating waters encountering an impervious layer of clay or cemented sand which retards their further descent, causing them to follow this dense stratum until they emerge on some hill slope. Springs of this character are more or less dependent on rainfall. All water in penetrating the soil and rocks, even if at no great depth, becomes more or less charged with dissolved mineral and organic matter, as by reason of its carbonic acid it possesses marked solvent powers. Spring waters therefore commonly contain various solid substances in solution, such as the carbonate, sulphate, or muriate of lime, salts of soda, potash, magnesia, and iron, or more rarely silica. When the quantity of dissolved solids is unusually large the spring is termed a mineral spring, and is often utilized for medicinal purposes. See Mineral Waters.



ARRANGEMENT OF STRATA CAUSING A SPRING.

The water collects in the depression A, and percolating through the porous stratum D, issues at B as a spring. C and E are impervious layers which prevent the escape of the water above or below D.

Underground waters may collect above an impervious stratum which does not appear at the surface, and they escape by slow percolation through the overlying strata, forming a marsh or swale. To such marshy tracts occurring in the arid regions of California, Arizona, and Mexico, the name cienega has been given.

Thermal springs, whose temperatures are notably higher than that of ordinary springs, usually have a deep-seated origin. In regions where the rocks have been greatly disturbed and fractured the surface waters penetrate to great depths, and thus become warmed by the interior heat of the earth, or they may be heated from contact with uncooled masses of lava. It is also known that igneous rocks of all kinds give off a great quantity of vapor during the process of cooling, and some springs thus may be fed by waters whose source lies deep within the earth, and which for the first time appear at the surface. Thermal springs are mostly limited to mountainous regions; in the United States they occur in great numbers along the Appalachians and the Rocky Mountains. In company with geysers they are found in the Yellowstone National Park, Iceland, and New Zealand. Consult Schlichter, *The Motion of Underground Water, Water Supply and Irrigation Papers*, No. 67, United States Geological Survey (Washington, 1902). See Artesian Wells; Geysers; Geology.

SPRING. A term used in mechanics to designate variously constructed devices of metal or other elastic material adapted to resist concussion, to supply motive power, or to register stress through their property of tending to return to their original form. A spiral spring is one which is wound around a fixed point or centre in constantly receding coils, like the mainspring of a watch or clock. Spiral springs are usually made of flat strips or ribbons of steel, but may be made of round or other shaped wire. A helical spring is one which is wound around a cylindrical arbor in advancing spirals like the thread of a screw. Helical springs are usually made from round bars or from square rods of steel, and are perhaps more extensively used than any other form. An elliptical or laminated spring is made of flat bars, plates, or 'leaves' of regularly varying lengths superposed one upon the other. For formulas for calculating the strength and energy of springs of various forms and sizes, consult Kent, *Mechanical Engineers' Pocket Book* (New York, 1900).

SPRING, Gardiner (1785-1873). An American Presbyterian clergyman, son of Samuel Spring (q.v.). He was born at Newburyport, Mass., and was graduated at Yale College in

1805. He began the study of law at New Haven, taught for two years in Bermuda, at the same time continuing his legal studies, and was admitted to the bar at New Haven in 1808. The next year he entered Andover Theological Seminary to study for the ministry. In 1810 he was ordained, and settled as pastor of the Brick Presbyterian Church, New York City, where he remained for over fifty years. He was one of the founders of the American Bible Society in 1816, the American Tract Society in 1825, and the American Home Missionary Society in 1826. He published many books of a religious character besides his *Personal Reminscences of the Life and Times of Gardiner Spring* (1866.)

SPRING, SAMUEL (1746-1819). An American Congregational clergyman. He was born at Northbridge, Mass., graduated at the College of New Jersey in 1771, and later studied theology. In 1775 he joined the Continental Army, and accompanied Benedict Arnold as chaplain of the invading army into Canada. In 1776 he left the army, and the next year was installed pastor of the church at Newburyport, Mass., where he continued until his death. He was one of the founders of Andover Theological Seminary, and also of the Massachusetts Missionary Society, and to him is attributed the idea of forming the American Board of Commissioners for Foreign Missions. Many of his occasional sermons have been printed, the most notable of them being *A Sermon on the Death of Washington* (1799), and *A Discourse in Consequence of the Late Duel* (1804)—that between Burr and Hamilton. Consult the *Life and Times of Gardiner Spring*, vol. i. (New York, 1866).

SPRING BALANCE. An instrument used to determine the weight of a body by the extension or compression of a spring. In the usual form of spring balance a spring of coiled wire is contained in a metal case and incloses a central rod to which is attached at one end a hook, and at the other a projection which extends through a slit in the case and moves over a graduated scale. The central rod can also be connected by means of a rack and toothed wheel with an axle on which is fastened a pointer moving over a circular scale or dial. The spring balance measures the amount of attraction of the earth at any particular place; consequently, readings at the equator would be different from those at the poles or other places on the earth's surface. The ordinary balance, on the other hand, would give the weight for a body irrespective of its position. The force of the spring varies with temperature, which alters the length and elasticity of the wire and renders impossible precise measurements.

SPRINGBOK (Dutch, springing goat). A South African gazelle (*Gazella euchore*). It is larger than the common deer, and its neck and limbs much longer and more delicate. The general color is fulvous brown on the upper parts, pure white beneath, the colors separated on the flanks by a broad band of deep vinous red. The whole head is white, except a broad brown band on each side from the eye to the mouth, and a brown spot in the centre of the face. The springbok derives its name from the prodigious leaps which it takes either when alarmed or in play, often to the height of seven feet, and sometimes of twelve or thirteen feet. It is one of the most sought-after game animals of South Africa, yet remains numerous. Consult authorities cited under ANTELOPE; and see Plate of GAZELLES.

SPRING EEL. A fish of the small order Opisthomi and family Mastacembelidæ, several species of which occur in the fresh waters of the East Indies; they are eel-like in form, with the dorsal fin very long, and the fore part of it composed of low free spines. Allied to this is a small, curious eel (*Derichthys serpentinus*) dredged from the depths of the North Pacific. See Plate of EELS.

SPRING′ER, ALFRED (1854—). An American chemist, born in Cincinnati, Ohio. He studied chemistry at the University of Heidelberg, and then settled in the practice of his profession in Cincinnati. He published studies on *Glycocholic Ether* (1879), *Pentachloramyl Formate* (1881), and *Reduction of Nitrates by Ferments* (1883), in which he announced his discovery of denitrifying ferments among the microörganisms of the soil, and forming a sort of link between the plants and their nitrogenous constituents; also, *A Latent Characteristic of Aluminum* (1891) and *Increase of Segmental Vibrations* (1897).

SPRINGER, ANTON (1825-91). A German art critic and historian. He was born at Prague, and studied at the university of his native city and at Tübingen. He taught successively at Prague, Bonn, Strassburg, and Leipzig. His historical works include: *Geschichte des Revolutionszeitalters* (1849); *Oesterreich, Preussen und Deutschland* (1851); and *Geschichte Oesterreichs seit dem Wiener Frieden* (1863-65). His principal works on art are: *Die Baukunst des christlichen Mittelalters* (1854); *Geschichte der bildenden Künste im 19. Jahrhundert* (1858); *Bilder aus der neueren Kunstgeschichte* (1867); *Raffael und Michelangelo* (1877); *Grundzüge der Kunstgeschichte* (1888; 4th ed., as *Handbuch der Kunstgeschichte*, 1895); and *Albrecht Dürer* (1892). Consult the posthumous *Aus meinem Leben* (Berlin, 1892).

SPRINGER, WILLIAM MCKENDREE (1836—). An American jurist and political leader, born at New Lebanon, Ind. He graduated at the Indiana State University in 1858, and for the next four years was a newspaper correspondent and editor. He was admitted to the bar in 1859, and in 1872 became a member of the Illinois Legislature. From 1875 to 1895 he was a member of Congress, where he introduced a resolution which was carried by a large majority, declaring that it would be "unwise, unpatriotic, and fraught with peril to our free institutions" for one man to serve more than two terms to the Presidency. From 1895 to 1899 he was United States Judge of the Northern District of Indian Territory and Chief Justice of the United States Court of Appeals there.

SPRING′FIELD. The capital of Illinois, and the county-seat of Sangamon County, 185 miles southwest of Chicago; on the Illinois Central, the Chicago and Alton, the Chicago, Peoria and Saint Louis, the Baltimore and Ohio Southwestern, the Saint Louis, Chicago and Saint Paul, the Cincinnati, Hamilton and Dayton, and the Wabash railroads (Map: Illinois, C 4). It is regularly laid out with wide streets. The most prominent edifice is the State Capitol, a handsome building begun in

1867, and completed twenty years later. It is 399 feet long and 286 feet wide, and has a massive dome 364 feet high. Other interesting structures are the old Capitol, now used as the county court-house, and the Lincoln residence, now under State supervision. The Lincoln Monument and Mausoleum of gray granite, the cost of which was borne by several States, is situated a little more than a mile from the heart of the city. There are the Bettie Stuart Institute (female), Concordia Seminary, Saint Agatha's School, and the Academy of Our Lady of the Sacred Heart. The State Library has 50,000 volumes, and the Public more than 42,000 volumes. There are also the State Historical Library, that of the Illinois State Museum of Natural History, and the Supreme Court Library. Other noteworthy features are the City Hall, Post-Office, Governor's Mansion, the High School, and the Odd Fellows' Buildings, the Orphanage of the Holy Child, the Springfield and Saint John's Hospitals, and the David Prince Sanitarium.

Springfield is the centre of a rich farming and coal-mining region, which also has important horse-breeding interests. Its industries in the census year 1900 had an invested capital of $5,030,438, and an output of $6,612,286. The Illinois Watch Company maintains a very large establishment here, and there are also engine works, boiler works, car shops, foundries and machine shops, lumber mills, woolen mills, breweries, and manufactories of soap, saddlery, flour, mattresses, brick, clothing, etc. The government is vested in a mayor, elected biennially, and a unicameral council. The subordinate officials, with the exception of the school board, which is chosen by the council, are appointed by the mayor. For maintenance and operation, the city spends annually about $375,000, the principal items being: Schools, $106,000; interest on debt, $52,000; fire department, $45,000; police department, $32,000; municipal lighting, $23,000; and streets, $21,000. The water-works are owned by the municipality. Population, in 1890, 24,963; in 1900, 34,159. First settled in 1819, and laid out in 1823, Springfield was incorporated as a town in 1832, and was chartered as a city in 1840. In 1837 it was chosen as the State capital, and the State Legislature assembled here for the first time in 1839. Consult Power, *History of Springfield* (Springfield, 1871).

SPRINGFIELD. The county-seat of Hampden County, Mass., 98 miles west-southwest of Boston; on the Connecticut River, and on the Boston and Albany, the Boston and Maine, and the New York, New Haven and Hartford railroads (Map: Massachusetts, B 3). Several bridges here span the river. There are 498 acres in the public park system. Forest Park, the largest of the pleasure grounds, contains 464 acres. In Court Square are the Soldiers' and Sailors' Monument and a statue of Miles Morgan. "The Puritan," by Saint Gaudens, near the library, is a work of great merit. Among the prominent buildings of Springfield are some designed by H. H. Richardson, the most notable of which, perhaps, are the County Court-House and the Church of the Unity. The United States Arsenal is conspicuously situated within the extensive armory grounds. Some 1200 men are employed here in making rifles for the United States Government. (See SMALL ARMS.) Other prominent structures are the railroad station, the Springfield Science Museum, Art Museum (containing the George Walter Vincent Smith collection, one of the best in the country), the City Hall, the Federal Government Building, the High School, and the Public Library. Springfield is the seat of the French-American College, opened in 1885, and of the International Y. M. C. A. Training School. The Public Library has more than 115,000 volumes. There are several other collections of books, among which is the Hampden County Law Library, dating from 1813. The most important charitable institutions include the State Almshouse, Springfield Hospital, Mercy Hospital, and the Hampden Homœpathic Hospital.

Springfield is a port of entry, its foreign trade in 1901 consisting of imports valued at $88,846. In the census year 1900 the various manufacturing industries had capital to the amount of $17,106,000, and an output valued at $21,207,000. The leading manufactures are foundry and machine-shop products, paper and envelopes, tobacco, cigars and cigarettes, brass castings, lumber and lumber products, buttons, electrical apparatus and supplies, confectionery, bicycles, automobiles, rubber and elastic goods, cotton and woolen goods, tools, etc. The government is vested in a mayor, annually elected, and a bicameral council. Springfield spends annually for maintenance and operation about $1,165,000, the principal items being: Schools, $360,000; interest on debt, $140,000; streets, $135,000; fire department, $97,000; police department, $68,000; municipal lighting, $67,000; and charitable institutions, $58,000. The water-works are owned and operated by the municipality. The system has cost $2,141,263. The net debt of the city in 1902 was $2,196,888; the assessed valuation of real and personal property, $74,338,927. The population in 1800 was 2312; in 1850, 11,766; in 1870, 26,703; in 1880, 33,340; in 1890, 44,179; in 1900, 62,059.

Springfield was first settled in 1636 by a party from Roxbury headed by William Pynchon. Until 1640, when it received its present name, it was known as Agawam. On October 4, 1675, during King Philip's War, it was attacked by Indians and burned. During Shays's Rebellion it was the scene (September, 1786) of a riot headed by Shays. Later (January 25, 1787) occurred a sharp skirmish between a small body of State militia and about 2000 insurgents led by Shays, the latter being easily defeated. In 1852 Springfield was chartered as a city. Consult: Green, *Springfield, 1636-1886* (Springfield, 1888); Burt, *The First Century of the History of Springfield, The Official Records from 1636-1736* (Springfield, 1898-99).

SPRINGFIELD. The county-seat of Greene County, Mo., 200 miles southeast of Kansas City; on the Saint Louis and San Francisco and the Kansas City and Memphis railroads (Map: Missouri, C 4). The city is in the vicinity of the Ozark Mountains, and is surrounded by beautiful forest and prairie scenery. It is the seat of Drury College (non-sectarian), opened in 1873, and of Loretto Academy. Other features include the United States Government building, the high school building, Saint John's Hospital, and the Zoölogical Gardens. The national cemetery here has 1703 graves, of which 737 are of unknown dead. Situated in the mineral belt of southwest

Missouri, Springfield has also important agricultural, lumbering, and stock-raising interests. In manufacturing, it ranked fourth in the State in the census year 1900, its industries having an invested capital of $2,111,048, and an output valued at $4,126,871. The leading establishments are carriage and wagon factories, lumber mills, flouring mills, foundries, and shops of the Saint Louis and San Francisco and the Kansas City and Memphis railroads. Springfield is also the centre of an extensive wholesale trade. The government is vested in a mayor, chosen biennially, and a unicameral council. The school board is elected by popular vote. Population, in 1890, 21,850; in 1900, 23,267. Springfield was settled as an Indian trading post about 1819, and in 1838 was incorporated, having been laid out three years earlier.

SPRINGFIELD. The county-seat of Clark County, O., 45 miles west of Columbus; at the confluence of Lagonda Creek and the Mad River, and on the Erie, the Cleveland, Cincinnati, Chicago and Saint Louis, the Pittsburg, Cincinnati, Chicago and Saint Louis, and the Ohio Southern railroads (Map: Ohio, C 6). It is the seat of Wittenberg College (Lutheran), opened in 1845, and has a female seminary, and the Warder Public Library, with more than 18,000 volumes. Noteworthy are the city hall, the United States Government building, the homes of the fraternal organizations, and Snyder Park. The Soldiers' Monument here was erected at a cost of $400,000. Springfield is surrounded by a highly productive farming section. Excellent water power has aided in making an important industrial centre. In the census year 1900 there was invested in the various industries capital to the amount of $14,091,175. Their output was valued at $12,777,173. More than five-sevenths of the capital, and nearly two-thirds of the output were represented by the manufactures of agricultural implements, and foundry and machine shop products. The government is vested in a mayor, elected biennially, and a unicameral council. For maintenance and operation the city spends annually about $395,000, the principal items being: Schools, $132,000; streets, $152,000; municipal lighting, $48,000; fire department, $40,000; interest on debt, $37,200; police department, $34,000. The water works, which represent an expenditure of $707,577, are owned by the municipality. Population, in 1890, 31,895; in 1900, 38,253.

SPRING HILL COLLEGE. A Roman Catholic institution near Mobile, Ala., founded in 1830, under the direction of the Society of Jesus. Its courses are preparatory (one year), commercial (four years), and classical (six years). The students in 1902 numbered 166, and the faculty 26. The buildings and ground were valued in that year at $250,000. The income was about $42,000 and the library contained 18,500 volumes.

SPRINGING USE. A use which is limited to take effect on the happening of a future event and not depending upon any preceding use or estate. This is a peculiar form of future estate and differs from a shifting use, which operates in derogation of some other estate, and from a remainder which must be limited upon some particular or preceding estate. It may be limited to rise either upon a certain or uncertain and contingent event. Consult Gilbert *On Uses*, Sudgen's edition.

SPRINGTAIL. Any one of the very minute insects of the families Poduridæ, Smynthuridæ, Entomobryidæ, and Papiriidæ, of the thysanuran suborder Collembola. These little insects leap by the tail-like organ arising from the under side of the penultimate or antepenultimate segment of the abdomen, reaching forward horizontally when at rest, nearly to the head. This organ when suddenly drawn toward the perpendicular throws the insect high into the air and sometimes to a distance of several feet. The springtails are found in great numbers on the surface of the ground or just beneath the surface in boreal and even arctic regions. They occur in the spring in the Northern United States on bright sunny days when the snow is melting, frequently in great numbers on the surface of the snow. One species (*Achoreutes nivicola*) is commonly known as the 'snow-flea.' Springtails are also found on the surface of stagnant water, and commonly in deep soil which contains more or less soil humus.

SPRING VALLEY. A city in Bureau County, Ill., 17 miles southeast of Princeton; on the Chicago, Rock Island and Pacific and the Chicago, Burlington and Quincy railroads (Map: Illinois, C 2). It is important as the shipping centre of a coal-mining and farming region. There is a public library. The water-works are owned by the municipality. Population, in 1890, 3837; in 1900, 6214.

SPRING WHEAT. See FLOUR and WHEAT.

SPRIT (AS. *sprēot*, pole, sprout, from *sprēotan*, Ger. *sprieseen*, to sprout). A light spar extending from the peak (see SAIL) to a sliding becket on the mast. In the early days of square-rigged ships, square sails set on yards under the head booms were called the sprit-sail, sprit-sail topsail, and sprit-sail topgallant sail. When the square sprit-sails of the head booms were replaced by fore-and-aft jibs and staysails, the various sprit-sail yards were no longer used, but as a spreader was needed for the jib guys, whisker booms (see SHIP) were devised, and these are occasionally called sprit-sail yards, though they are in two parts, one on each side of the bowsprit cap.

SPRUCE (ME. *Spruce*, *Pruce*, from OF. *Pruce*, from ML. *Prussia*, Prussia), *Picea*. A genus of about twenty species of coniferous trees, indigenous to the Northern Hemisphere, nearly half being natives of North America. The genus was formerly combined with Abies (see FIR), from which it differs in having pendulous cones, leaves jointed on the twigs, keeled on both sides and not arranged in ranks, but scattered and pointing in every direction. The spruces occur as trees farther north than most others, forming forests within the Arctic Circle, and extending south, especially in the mountains as far as the Pyrenees in Europe, and North Carolina and Arizona in the United States. Some of the species occur in pure forests over immense tracts, the white spruce and also the black spruce covering extensive areas in Canada to the almost total exclusion of other trees. In Europe the Norway spruce is similarly distributed. The species are pyramidal in habit of growth, the lower branches drooping when old. The Norway spruce (*Picea* *excelsa*), the principal European species, is of rapid growth, attains a height of 150 feet or more, and is extensively planted both as a forest tree and as an ornamental. The timber is valuable for fuel and for house building, and is largely exported from Norway and Sweden for masts and spars of sailing vessels. The tree yields resin and turpentine; its bark is used in tanning and for basket-making, etc. The wood is used for wood pulp and paper manufacture. In North America the prevailing species over the greatest extent of territory are the white and the black spruce (*Picea alba* and *Picea nigra*), although in lumbering the two species are seldom recognized. The former is found from New York to British Columbia and northward to Newfoundland, Hudson Bay, and Alaska. It is a handsome tree 50 to 150 feet high. The wood is light, soft, compact, nearly odorless, light yellow, and with scarcely distinguishable sap wood. It is largely used for general building, spars, flooring, etc. It also yields some of the spruce gum of commerce. The latter has a distribution somewhat similar to the white spruce, except that it descends along the mountains to North Carolina and Tennessee and probably does not reach Alaska. It is a somewhat smaller tree, but is otherwise very similar to the white spruce. It forms immense forests in Maine, New York, Canada, and elsewhere, and is largely used for wood pulp and paper. These two species are the chief and best source for wood paper-making. The gum of the black spruce is used for chewing. The branches are used in the preparation of essence of spruce, and by adding sugar or molasses and slightly fermenting, spruce beer is obtained. The bark contains tannin and is used to some extent in tanning leather. The roots are often split into narrow strips and made into baskets, coarse mats, ropes, etc. The Sitka or tideland spruce (*Picea sitchensis*) is a large tree occurring abundantly from northern California to Alaska, following the coast as far as the island of Kadiak. It is one of the largest trees of North America, attaining in its lower regions a height of more than 300 feet and a diameter of 7 or 8 feet at 100 feet from the base. Specimens upon the islands in southeastern Alaska measured more than 200 feet in height and 25 feet in circumference 4 feet from the ground. The timber of this tree is very valuable, entering into all kinds of building operations. In the tree-planting operations in the West the spruces, especially the white and the Norway, have proved among the most adaptable of evergreen species. The black, being of slower growth, less ornamental, and not so well adapted to dry soils, is less frequently planted. For ornamental planting none excels the blue spruce, which is of rather slow growth. All are hardy and all have been extensively planted in Europe. Each of the American species has developed several well-known varieties, which vary principally in the character of their foliage, branching habits, etc. A tree known as Douglas spruce or Douglas fir (*Pseudotsuga Douglassi*) is one of the important timber trees from the Rocky Mountain region to the Pacific and north to British Columbia. Upon the Pacific Coast it attains a height of more than 300 feet and a diameter of 10 to 12 feet. The timber is fine, straight-grained, heavy, and very strong, and is useful for all kinds of building, masts, etc. It has been very successfully planted in Minnesota, where it is believed it will supersede the other species for general planting.

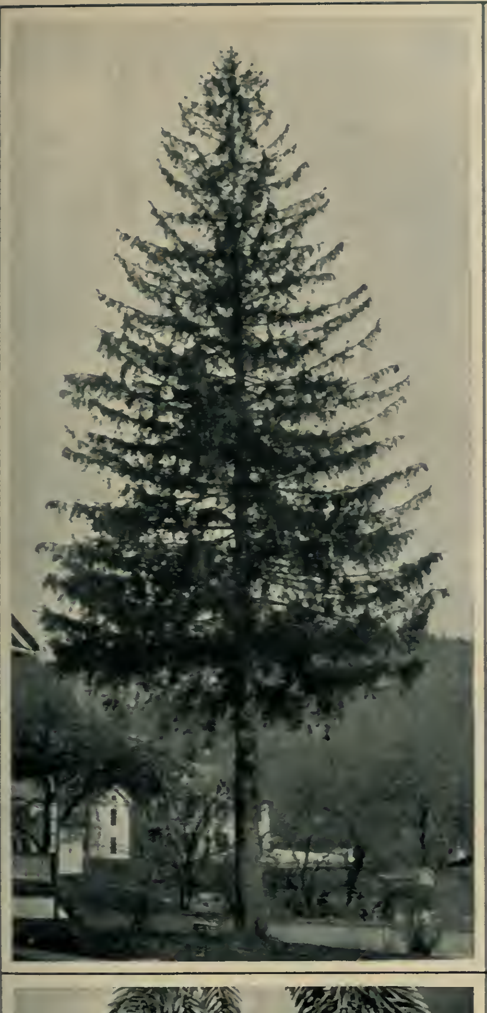
SPRUNER VON MERZ, Karl (1803-92). A German chartographer, historian, and poet, born at Stuttgart. He entered the Corps of Cadets at Munich in 1814, became lieutenant in 1825 and had attained the rank of lieutenant-colonel in 1855, when King Maximilian II. appointed him his aid-de-camp. Favored with that monarch's special confidence, he was a steadfast advocate of Pan-German and liberal principles at the Bavarian court. In 1864 King Ludwig II. appointed him his adjutant-general and in 1883 general of infantry. He retired from service in 1886 and died in Munich. His principal work is the great *Historisch-geographischer Handatlas* (118 maps, 1837-52; 4th ed. by Sieglin, 1893 et seq.); besides which he published a model *Atlas zur Geschichte von Bayern* (1838); Handatlas für die *Geschichte des Mittelalters und der neueren Zeit* (90 maps, new ed. by Menke, 1879); *Historisch-geographischer Schulatlas* (10th ed., 1880); and others. He wrote a *Leitfaden zur Geschichte von Bayern* (1853); *Pfalzgraf Rupert der Kavalier* (1854); *Charakterbilder aus der bayrischen Geschichte* (1878); several historical dramas and, anonymously, *Jamben eines greisen Ghibellinen* (1876), and *Aus der Mappe des greisen Ghibellinen* (1882), both strictly Christian, but anti-papal.

SPULLER, spụ'lâr', Eugène (1835-96). A French publicist and political leader, born at Seurre (Côte d'Or). He was educated at the college at Dijon and studied law at the University of Paris, but in 1863 became identified with journalism. After the proclamation of the Republic in 1870 he became Gambetta's secretary and one of his most trusted supporters, and with him escaped from Paris in a balloon on October 7, 1870, in order to assist him in reorganizing the provincial governments. He was elected by a Paris constituency to the Chamber in 1876, and became one of the most influential leaders of the Union Republic group. Upon the formation of Gambetta's short-lived Cabinet, in November, 1881, Spuller was made Under-Secretary of State for Foreign Affairs. He returned to the Chamber in the following year, and in 1884 was chosen one of the vice-presidents of the body. He was Minister of Public Instruction in the Rouvier Cabinet in 1887, and Minister of Foreign Affairs in the Tirard Cabinet in 1889-90. In 1892 he was elected Senator, and in 1893-94 held the portfolio of Public Instruction in the Cabinet of Casimir-Périer. He published: *Petite histoire du second empire* (1870); *Ignace de Loyola et la compagnie de Jésus* (1876); *Michelet, sa vie et ses œuvres* (1876).

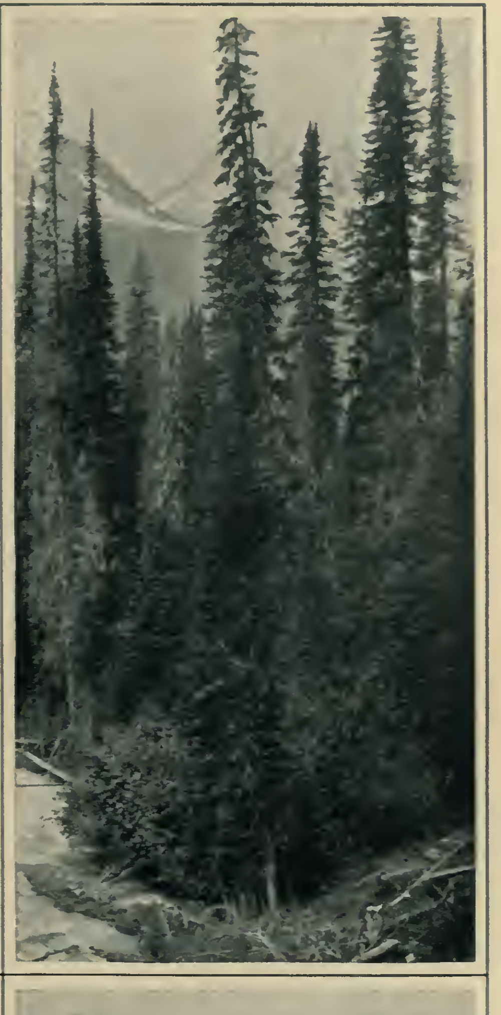
SPUNGING-HOUSES. In the law of England, the private houses of the bailiffs, who may detain there a debtor who has been arrested for debt for 24 hours, to admit him or his friends to arrange to settle the debt. The name is derived from the extortion often practiced on the debtor. The name is not used in the United States.

SPUR (AS. *spora*, OHG. *sporo*, Ger. *Sporn*, spur, from AS. *speornan*, OHG. *spurnan*, to kick, spurn; connected with Lat. *spernere*, to despise, Gk. σπαίρειν, *spairein*, to flounder, Lith. *spìrti*, to tread, Skt. *sphur*, to thrust with the foot).

SPRUCE

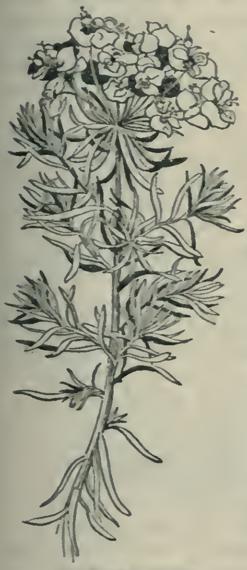


NORWAY SPRUCE AND CONES



DOUGLAS SPRUCE AND CONES

Originally spurs were made with a single point or prick and were known as the 'prick-spur' or goad-spur, but they soon developed into the rowel. In some instances the spur proper consisted of a ball from which projected a sharp point. Although the rowel is first met with in the thirteenth century, it was not common until the middle of the fifteenth century. In the Middle Ages the use of the spur was limited entirely to knights, who were granted their spurs as a symbol that they had won their right to knighthood. Similarly, the hacking off of his spurs denoted the public disgrace and degradation of the knight. During the age of chivalry, to serve a pair of spurs on a dish before a knight was a pointed declaration on the part of the host that he desired his guest to leave as speedily as possible. In the United States Army the spurs of mounted officers are of yellow metal or gilt, with ornamentation, while the rank and file wear the same pattern spur made of steel with a plain surface. Throughout Europe generally, the gilt spur denotes an officer of field rank, and the steel spur a mounted officer of regimental rank. The use of the spur is not nearly so common in these days of lightly equipped horsemen and intelligently bred horses.



CYPRESS SPURGE (*Euphorbia cyparissias*).

SPURGE (OF. *spurge*, *espurge*, from *espurger*, from Lat. *expurgare*, to purge, cleanse, from *ex*, out + *purgare*, to cleanse, from *purus*, pure + *agere*, to drive, to do), *Euphorbia*. A genus of about 600 species, mostly tropical shrubs or trees or temperate climate herbaceous species of the natural order Euphorbiaceæ, characterized by a resinous, milky, usually acrid juice. Some of the green-stemmed, fleshy, and spiny African species so resemble certain cacti in their habit of growth as to render their identification more or less uncertain when not in flower. The leaves are either wanting or fall off early, and the functions of assimilation are performed by the stems. The flowers of many species, especially of Poinsettia, have bright-colored bracts that make them very ornamental. About forty species are indigenous or introduced in the Eastern United States.

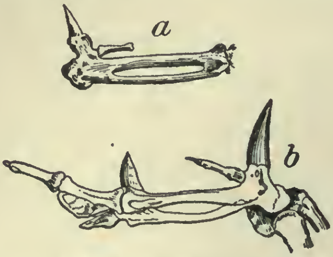
SPUR'GEON, CHARLES HADDON (1834-92). A celebrated English preacher. He was born at Kelvedon, Essex, attended school at Colchester, and spent a few months at an agricultural college at Maidstone. His family intended him for an Independent minister, but his own sympathies drew him toward the Baptists, whose connection he joined in 1850. The same year he became a school-teacher, and, removing to Cambridge, began to deliver cottage sermons in the neighborhood. The popularity of the 'boy preacher' was almost immediately established, and at the age of eighteen he had charge of a small Baptist congregation in the village of Waterbeach, Cambridgeshire. In 1854 he entered upon the pastorate of the New Park Street Chapel, London, where his preaching proved so attractive that in two years' time the building had to be greatly enlarged. The Surrey Music Hall was for some time engaged for his use, and finally his followers built for him the well-known 'Metropolitan Tabernacle' in Newington Butts, opened in 1861. Many evangelistic and philanthropic agencies grew up in connection with this immense chapel, such as the Stockwell Orphanage; a pastor's college, where hundreds of young men were trained for the ministry under Spurgeon's care; the Golden Lane Mission, etc. He was compelled in his later years to stop his work frequently because of ill health, and died at Mentone, France. His sermons were published weekly from 1854, and yearly volumes were issued since 1856. They had an enormous circulation, and many of them were translated into various languages. He also published many volumes, including: *The Saint and His Saviour* (1857); *Morning by Morning, and Evening by Evening* (1866-68); *John Ploughman's Talks* (1869); *The Treasury of David* (a commentary on the Psalms, largely from Puritan writers, 1870-85); *Lectures to My Students* (1875-77); *Commenting and Commentaries* (1876); *John Ploughman's Pictures* (1880); and after 1865 he edited a monthly magazine, *Sword and Trowel.*

In theology he was a pronounced Calvinist, in biblical science an extreme conservative, in policy an open communion Baptist, in politics a Liberal Unionist, in all things independent. He attacked the Low Church Party in the Church of England because it countenanced, he asserted, the teaching of baptismal regeneration in the Prayer Book, and in 1864 withdrew from the Evangelical Alliance because it was supported by it. He attacked his own co-religionists for their alleged rationalistic views and withdrew in 1887 from the Baptist Union. As a preacher he knew how to enchain the attention of his hearers through sermons of great length, by a flow of vigorous English and a mingling of tenderness and sternness, humor and soberness. A biography by his wife and private secretary was published in London in 1897-98.

SPURRY (OF., Dutch *spurrie*, MDutch *sporie*, *spurie*, *speurie*, *spurrie*, spurrey; of uncertain etymology). Plants belonging to the genera Spergula and Buda of the order Caryophyllaceæ. The species of Spergula are natives of Europe, those of Buda of America. Spurry is a weed sometimes cultivated as a forage crop. Corn spurry or common spurry (*Spergula arvensis*) is an annual from 6 to 12 inches high, producing a tangled mass of succulent stems with numerous whorled linear leaves. It prefers sandy or stony soil, upon which it is often planted as a green manure and as a soiling crop for sheep and cattle. The plant readily re-seeds the ground, but need not become a pest on well-tilled farms, where it is often welcomed as a catch crop. Giant spurry (*Spergula maxima*), by many botanists not regarded as a species distinct from the above, is similar to, but larger than, common spurry.

SPURS, Battle of the. See Battle of the Spurs.

SPUR-WINGED GOOSE, PLOVER, etc. Many terrestrial birds have the bend of the wing armed with one or more spurs or bony knobs, which they use for attack and defense. This armament is conspicuous in the geese of the African family Plectropteridæ, of which there are four species, and here it is based upon one of the wrist-bones, instead of on the metacarpus, as is usual elsewhere. The 'spur-winged plover' (*Hoplopterus spinosus*), one of the commonest birds of the Nile Valley, is only one of many tropical plovers so armed, the largest and finest spurs being those of a Chilean plover (*Belonopterus Chilensis*); its spur is situated just at the base of the thumb, and, as in other cases, is sheathed with horn, and sharp at the end. Some of the jaçanas have wing-spurs, and others a peculiar blade-like enlargement of the forearm. Lastly, the large, turkey-like South American screamers (q.v.) have two wing-spurs, the larger of which is an inch and a quarter long. Consult Lucas, "Weapons of Birds," in *Bird Lore*, vol. iv. (New York, 1902).



ANATOMY OF WING-SPURS.

a, spur of the spur-winged plover; *b*, relative positions of the two wing-spurs of the screamer (q. v.).

SPURZHEIM, spōōrts'hīm, Johann Kaspar (1776-1832). A German physician and phrenologist, born near Treves. While studying medicine at Vienna he was introduced to Gall (q.v.), and became his pupil and later his colleague in investigating the structure and functions of the brain. He lived in France and England alternately, and was widely known as a lecturer. In 1832 he came to the United States on a lecturing tour, but fell ill and died suddenly in Boston. Among his works are: *The Physiognomical Works of Drs. Gall and Spurzheim* (1815); *Elementary Principles of Education* (1821); *Phrenology* (1825); *Anatomy of the Brain* (1826); and *Sketch of the Natural Laws of Man* (1828). Consult Carmichael's *Memoir of Spurzheim* (Dublin, 1833). See Phrenology.

SPUTUM. See Expectoration.

SPUYTEN DUYVIL (spī'ten dī'vĭl) **CREEK.** A channel connecting the Hudson with the Harlem River, at the northern end of Manhattan Island (q.v.).

SPY (OF. *espie*, from *espier*, Fr. *épier*, to spy, from OHG. *spehōn*, Ger. *spähen*, to watch; connected with Lat. *specere*, Gk. σκέπτεσθαι, *skeptesthai*, Skt. *spaś*, *paś*, to look). A person employed to obtain information regarding an enemy by entering the latter's camp, and employing any possible means or methods by which to attain his ends. He differs from the scout in that the latter never surrenders his military character, is invariably a soldier, and secures his information without employing false pretenses. While the employment of spies is recognized by the law of nations, the spy himself is regarded as an outlaw and generally meets with an ignominious death whenever discovered. Military law (q.v.), although distinct in ordering the death of a spy, is not clear in defining what constitutes a spy.

SPY, spê. One of the most important archæological sites in Europe. In 1886 while exploring a grotto in the commune of Spy, near Namur, Belgium, MM. de Puyot and Lohest recovered two human skeletons from a bed rich in Paleolithic implements and remains of ancient animals, among which those of elephants abound. These ancient men were below the Belgians in stature and were dolichocephalic. Consult Mortillet, *Le préhistorique* (Paris, 1900).

SPY, The. A novel by James Fenimore Cooper (1821) giving the story of Harvey Birch, a spy employed by Washington in 1780 in Westchester County, New York, 'the neutral ground.' His services could not be acknowledged and he was suspected by patriots and Tories alike.

SQUADRON (OF. *esquadron*, Fr. *escadron*, from It. *squadrone*, squadron, augmentative of *squadra*, squad, square). Ordinarily two troops of cavalry. It occupies the same position to cavalry that battalion does to infantry. The actual strength of a squadron varies with that of the component troops and ranges from 120 to 200 swords. See Army Organization. For the use of the term in naval affairs, see Tactics, Naval.

SQUALODON (Neo-Lat., from Lat. *squalus*, sort of sea-fish + Gk. ὀδούς, *odous*, tooth). An extinct genus of whale based on fossil skulls and teeth found in Miocene and Pliocene deposits. See Cetacea; Mammalia, Fossil.

SQUALORAJA (Neo-Lat., from Lat. *squalus*, sort of sea-fish + *raja*, ray, skate). A fossil shark of the Lower Lias of England, ancestral to the modern chimæra (q.v.).

SQUARCIONE, skwär-chō'nâ, Francesco (1394-1474). An Italian painter of the Early Renaissance, founder of the school of Padua. He was a teacher rather than a painter. From the large number of his pupils he has been styled the 'Father of Painting,' and the influence of his school was dominant throughout Northern Italy. His method of teaching differed from that of other masters in that he had his pupils copy antique statues rather than his own works. The chief characteristics of their art are the statuesque character of the figures and the wealth of antique ornamentation, combined, however, with a trenchant realism. It is impossible to distinguish the works ascribed to him at Padua and elsewhere from those of his pupils, only one, a "Madonna," in possession of the Lazzari family, Padua, being signed.

SQUARE (in geometry). See Parallelogram.

SQUARE ROOT. See Involution and Evolution.

SQUARING THE CIRCLE. See Circle; Quadrature.

SQUARES, Method of Least. See Least Squares, Method of.

SQUASH (abbreviation of *squanter-squash, squonter-squash*, from North American Indian *askutasquash, asquash*, plural of *asq*, green, unripe). The common name for the fruits and plants of various varieties of *Cucurbita Maxima, Cucurbita Pepo*, and *Cucurbita Moschata*. The term is frequently applied in America to what are known in Europe as pumpkins. Squashes are cooked as a vegetable and also used for making pies. They are of divers forms, with early, late, and mid-season varieties of each. Squashes like a warm fertile soil. They are planted about the same time as corn in hills eight feet apart each way. From four to six seeds are put in each hill, which should be made rich with a few shovels of well-rotted manure placed in the bottom. The winter varieties are gathered upon the approach of frosty weather and left in the sun to cure for a while, being covered at night with hay or like material. Before cold weather sets in the fruits should be stored on shelves one deep in a dry, cool, not cold, room. See Plate of Cucumber Allies.

SQUASH. A ball game belonging to the family of tennis, which it is considered to have preceded in origin. It is played with a racquet the ball in an inclosed court of varying size without any affixed standard, but generally less than 40 feet by 20 feet, divided by a central line on the floor and a cross line into four spaces. The underlying principle of squash is that two players try alternately to hit the ball up against the front wall above a 'tell-tale' line. Whichever first fails to do so before the ball's second bounce from the floor loses the point. There are various rules governing the placing of the ball and of scoring, which will best be studied in *The Game of Squash*, by Eustace Miles (New York, 1901).

SQUASH INSECTS. The insect fauna of the squash and the pumpkin are practically identical, and several insects which feed upon these plants also attack melons, cucumbers, etc. (See Melon Insects.) The most important in the United States are the squash-bug (*Anasa tristis*) and its closely similar relative, the horned squash-bug (*Anasa armigera*), the squash-vine borer (*Melittia satyriniformis*), and the squash ladybird (*Epilachna borealis*). The squash-bug is a dull grayish brown musky-smelling bug of the family Coreidæ, a little over half an inch long, which hibernates in the adult stage. Its large golden brown eggs are laid in the spring upon the foliage. The young bugs, which grow rapidly and molt five times, suck the juices of the plant. Hand-picking the bugs before eggs are laid, kerosene sprayed upon vines started very early to act as decoys, and destruction of the bugs on the vines and fruits after the crop has been gathered, are the only feasible remedies. The squash-vine borer, a clear-winged moth of the family Sesiidæ, has an orange or red and black and bronze abdomen and hairy hind legs, red or orange on the outer surface, and black inside. The young caterpillars hatched from eggs laid on the stems in late spring bore into the stem, which wilts and dies. In midsummer they pupate in a tough cocoon beneath the surface of the ground, whence the adult emrges in spring. In the South a second generation appears in August. The best preventive measures consist in late fall harrowing and deep spring plowing. The squash ladybird, belonging to the genus Epilachna, which contains the only plant-feeding species of the family Coccinellidæ (see Ladybird), is a black-spotted, yellow, hemispherical species of wide geographical distribution. The adult beetles hibernate and lay their eggs upon the leaves in May or June. The yellow, spiny larvæ chew circular holes in the leaves, reach full growth in from two to four weeks, and transform to pupæ, attaching themselves by the tip of the body to a leaf or stem. There are two or more generations each year, and the insect is readily controlled by an arsenical spray.

COMMON SQUASH-BUG (*Anasa tristis*).

The pickle-worm, melon caterpillar, certain plant-bugs, and flea-beetles (qq.v.) are also troublesome. Consult: Smith, *Manual of Economic Entomology* (Philadelphia, 1896); Chittenden, *Bulletin 19, Division of Entomology, Department of Agriculture* (Washington, 1899).

SQUATTER SOVEREIGNTY. See Popular Sovereignty.

SQUAWFISH. A fresh-water fish (*Ptychocheilus Oregonensis*) of California, where it is locally known as 'Sacramento pike.' It is the largest American species of the carp family (see Cyprinidæ), and reaches a length of from three to five feet. See Plate of Dace and Minnows.

SQUEERS, Wackford. In Dickens's *Nicholas Nickelby*, the heartless, ignorant Yorkshire schoolmaster of Dotheboys Hall.

SQUETEAGUE, or Deep-Water Trout. A fish (*Cynoscion regalis*) latterly far more widely known as weakfish (q.v.).

SQUID (of uncertain etymology). A cephalopod mollusk, differing from the nautilus in having no outer shell, the body being supported by an inner pen-shaped horny structure, or, in the cuttle of the Mediterranean, by a calcareous 'bone,' flattened oval in shape. The body of the squid is somewhat fish-like, pointed behind, with two fins, while the head is rather large and armed with ten long arms, bearing cup-shaped suckers, two of the arms being longer than the others. The eyes are large and perfect. The mouth is armed with two powerful black teeth, shaped like the jaws of a parrot. At the base of the smaller jaw is the lingual ribbon (radula). With this they divide their food. The squid is provided with an ink-sac, and when attacked it will discharge the water in its mantle through its siphon, the ink passing out with the water as if from a syringe; in this way the water is colored, and under cover of the inky cloud the squid darts backward. Squids are very active and powerful in their movements; they will enter a school of fish, dart to the right or left, and seize a fish, biting it in the nape of the neck and killing it instantly. The body is beautifully tinted and spotted with all the colors of the rainbow, and the animal rapidly changes its hues, this being due to the contraction and dilatation of the pigment-cells or chromatophores. (See Metachrosis.) Flying squids (q.v.) are oceanic decapods of the genus Ommastrephes.

Ordinary squids are from 1 to 2 feet in length. The largest squid known is *Architeuthis princeps*, nearly 19 feet long in body; the longer arms measure about 29 feet, the entire animal, with extended arms, reaching a length of 40 feet. Another species (*Architeuthis monachus*) has a body about 7 feet long, with the two longer arms 24 feet in length. (For fossil squids, see Belemites.) Consult Verrill, "The Cephalopods of the Northeastern Coast of America," in *Transactions of the Connecticut Academy*, vol. v. (New Haven, 1879-80). Compare Cephalopoda and see Colored Plate with article Decapoda.

SQUIER, skwīr, Ephraim George (1821-88). An American archæologist and traveler, born at Bethlehem, N. Y. After varied experience he became known to science through his study of the antiquities of the Mississippi Valley. In 1849 he went on a diplomatic mission to Central America, which he revisited in 1853 in the interest of an interoceanic railway and of archæology. In 1863 he was appointed United States commissioner to Peru, where he investigated Inca remains. He was first president of the Anthropological Institute (1871). He made extensive contributions to the *Encyclopædia Britannica* and published: *Serpent Symbols* (1852); *Nicaragua, Its People, Scenery, and Monuments* (1852; *The States of Central America* (1857 and 1870); *Tropical Fibres and Their Economic Extraction* (1861); and *Peru, Incidents and Explorations in the Land of the Incas* (1877).

SQUILL (from Lat. *squilla, scilla*, from Gk. σκίλλα, *skilla*, squill), *Scilla*. A genus of bulbous-rooted plants of the natural order Lilaceæ, with a spreading perianth, stamens shorter than the perianth, smooth filaments, a three-parted ovary, and a three-cornered capsule with three many-seeded cells. Many of the species are plants of humble growth, with scapes like those of hyacinths and beautiful flowers.

SQUILLA. A mantis-shrimp (q.v.).

SQUINTING. See Strabismus.

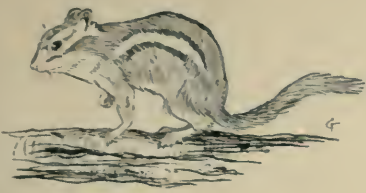
SQUIRREL (OF. *esquirel, escureuil*, Fr. *écureuil*, squirrel, from ML. *sciuriolus, sciurellus*, diminutive of Lat. *sciurus*, from Gk. σκίουρος, *skiouros*, squirrel, shadow-tail, from σκιά, *skia*, shadow + οὐρά, *oura*, tail). A rodent mammal of the family Sciuridæ, subfamily Sciurinæ. The Sciurinæ are a group of seven genera with compressed incisors, rather slender bodies, and long, hairy tails. The number of species is still a matter of doubt, owing to the remarkable range of color-variation among the individuals. Squirrels are found in all parts of the world except Australia, and are most abundant in India and Southern Asia. They range from the size of a mouse to that of a cat. In color squirrels tend toward gray, reddish brown, or black, though many species are white underneath, and the Oriental species are often handsomely variegated. The pelages differ locally in texture, being affected apparently by the climate. Some of the northern species have a fine, dense fur, and their skins have considerable commercial value, while some of the tropical species have the hair scanty and rather stiff, and in one genus spines are present comparable to those of a porcupine. The genus Sciurus includes nearly three-fourths of all known squirrels, and all but five of the American species.

The commonest and most widely distributed of these is the red squirrel or chickaree (*Sciurus Hudsonius*), which ranges from the northern and the mountainous parts of the United States to the limit of trees in British America. It is a small species only eight inches long, not including the tail. Its upper surface is bright ferruginous or chestnut red; the lower surface is pure white, and there is a black stripe along the sides. The ears are commonly tipped with a little tuft of hairs. In its habits the chickaree is a typical squirrel, very active, almost exclusively arboreal, and very fond of nuts, which are one of the most important items in its bill of fare. The diet is, however, diversified, as is true of most squirrels, for while nuts and grains are doubtless the staple articles, birds and their eggs and young, insects, young twigs, and fruit are often eaten. Many ornithologists, indeed, consider this squirrel one of the most deadly enemies of the common song birds, and this enmity is frequently expressed by the birds themselves. The home of the chickaree is usually in some hollow tree, though frequently a special nest is constructed out of branches, twigs, and leaves. The young are born in the spring, three or four in a litter. The chickaree is a rather noisy little animal, and though not gregarious, several are usually found within calling distance of each other. The sounds uttered are rapidly repeated notes, making a shrill, scolding chatter.

East of the great plains and south of the chickaree's range occur the fox squirrels, the largest and handsomest of the American Sciuridæ. They are a foot or more in length, besides the beautiful bushy tail, which is somewhat longer than the head and body. The color ranges from gray with a reddish tinge to jet black. The largest form is the black squirrel (*Sciurus niger*) of the South Atlantic and Gulf States, which is usually very dark colored, but always has the nose and ears white. The fox squirrel of the Middle States (*Sciurus cinereus*) is usually reddish, with the tips of the hairs whitish, giving it a grizzled appearance, but black specimens are common. The fox squirrel of the Mississippi Valley (*Sciurus Ludovicianus*) is more strongly and constantly reddish and is rarely, if ever, black. These large squirrels all agree in their habits, which are not essentially different from those of the chickaree, except that fox squirrels seem to do less harm to the birds. They are intelligent and in captivity make interesting pets. They have a considerable antipathy to the chickaree.

The 'gray' squirrels are a third group of common American species, somewhat smaller than the fox squirrels and more widely distributed, ranging as far west as California. They have a considerable tendency toward melanism in certain regions. They are white or whitish underneath. The common Eastern species (*Sciurus Carolinensis*) is about ten inches long, besides the somewhat longer tail. It is one of the popular game animals of New England, where the fox squirrel is very rare, and not only is it prized for food, but the skin has some commercial value. It is also often kept as a pet, and, like the fox squirrel, can be taught simple tricks. Two or

SQUIRRELS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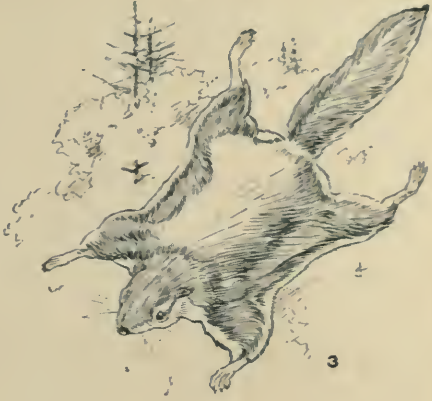
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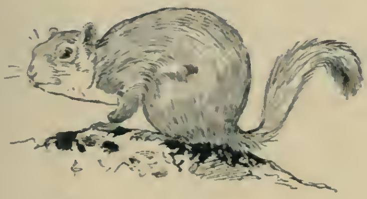
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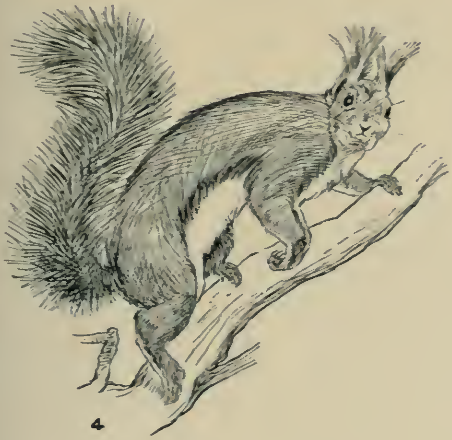
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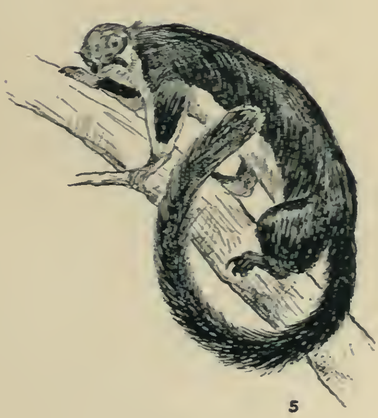
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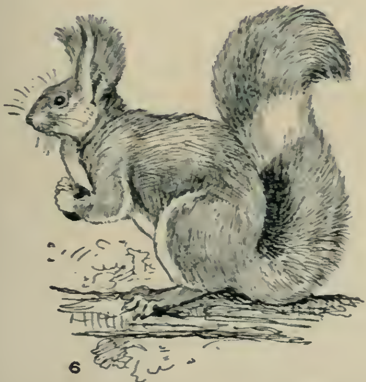
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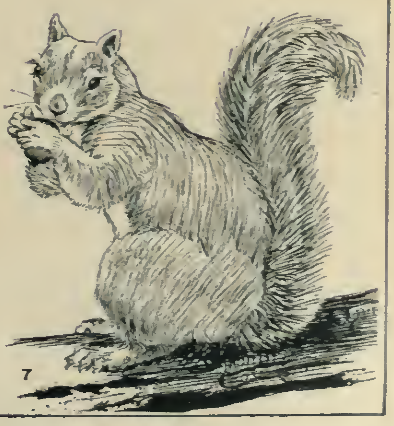
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1. GROUND SQUIRREL: CHIPMUNK (Tamias striatus).
2. RED SQUIRREL (Sciurus Hudsonius).
3. FLYING SQUIRREL (Sciuropterus volans).
4. NEW MEXICAN SQUIRREL (Otoxiurus Aberti).
5. BLACK-MUSTACHED EAST INDIAN SQUIRREL.
6. COMMON EUROPEAN SQUIRREL (Sciurus vulgaris).
7. AMERICAN GRAY SQUIRREL (Sciurus Carolinensis).

three other species of gray squirrel occur in the Southwestern United States and California, of which the chestnut-backed gray squirrel (*Sciurus Aberti*) is notable for having the ears tufted as in the chickaree. This is a very handsome species, with a broad band of chestnut on the back and a black stripe on each side; melanistic specimens are common. The California gray squirrel (*Sciurus fossor*) is remarkable for its large size and black tail.

Of the remaining sixty or seventy members of the genus Sciurus the most important is the common squirrel of Europe (*Sciurus vulgaris*), which ranges from Ireland to Japan and from Northern Italy to Lapland. It is a little larger than the chickaree, and, like that species, it is brownish red above and white beneath. In winter it undergoes some change of pelage, becoming gray or even almost white. The ears are tufted with little pencils of hair. A handsome Oriental squirrel (*Sciurus caniceps*) is remarkable as the only known instance among mammals of the temporary assumption during the breeding season of a distinctly ornamental pelage. During most of the year this squirrel is gray, but in December the back becomes a beautiful orange yellow, which becomes gray again late in March, after the breeding season is over. Of the other five genera one contains only a single species, a large and very handsome Bornean species (*Phithrosciurus macrotis*), which is very remarkable for certain peculiarities of the skull and particularly for the vertical grooves on the front surface of the incisors. The tail is also unusually long, the ears have long tufts, and the coloration is peculiar, the sides being banded with black and white. The genus Xerus includes four species known as 'spiny squirrels,' on account of the pelage, which is coarse and prickly, the hairs being intermingled with spines. They are ground-loving species, and live in burrows which they themselves dig. They are somewhat larger than the chickaree and are all natives of Africa. The genus Tamias includes the small ground squirrels, chiefly American, which connect the tree squirrels with the spermophiles. They are all similar in size and habits to the common chipmunk (q.v.). The remaining genera, mainly Old World species, are remarkable for their powers of sailing from one tree to another. They are described in the article Flying Squirrel.

Consult: Coues and Allen, *Monograph of North American Rodentia* (Washington, 1877); Stone and Cram, *American Animals* (New York, 1902).

SQUIRREL-FISH (so called from the sound made by the fish when taken from the water, which resembles the bark of a squirrel). Any of several brilliantly colored tropical fishes. One group is the family Holocentridæ, allied to the mullets, many species of which abound about coral reefs and are numerous in American tropical waters. The best-known species (*Holocentrus Ascensionis*) is about two feet long and bright red, with shining streaks along the rows of scales. Another group is the genus Diplectrum of the sea-bass family, among which one very handsome species (*Diplectrum formosum*) is common from Charleston to Montevideo, and is also called 'sewano' and 'sandfish.' It is about a foot long and brownish, with many blue markings.

SQUIRREL-MONKEY. One of the names applied to certain small, active, bushy-tailed tropical American monkeys of the marmoset group, and especially of the golden-haired genus Chrysothrix, because of their squirrel-like size, manners, and appearance. A well-known species is one of the titis (*Chrysothrix sciureus*), whose crown, muzzle, and rings about the eyes are black, giving a comical likeness to a human skull, so that it is known as the death's-head squirrel-monkey.

ŚRADDHA, shräd'hȧ (Skt. *śrāddhā*, faith, connected with Lat. *credere*, to believe). The funeral ceremony of the Hindus, in which balls of rice are offered to the deceased ancestors of the sacrificer, or to the pitris (q.v.) collectively. It is especially performed for a parent recently deceased, or for three paternal ancestors, represented by three Brahmans, and secures the residence of the souls of the dead in the heaven of the pitris at the end of a year. The term śraddha is also applied to the daily offerings to the manes in general, and to offerings performed on various domestic occurrences, as on the birth of a son. There are likewise voluntary śraddhas performed for a special object, such as the hope of religious merit. The presentation of the ball of food to the deceased, and to his progenitors in both lines, is the office of the nearest male relative. If, however, sons have divided their patrimony contrary to their father's wishes, they may be excluded from the śraddha. The widow can inherit only on condition that she has the ceremony duly performed. The śraddha is still offered in certain parts of India, as at Gaya in Behar. The entire ceremony is based on the fear of malignant ghosts, since if the śraddha is not performed, the dead man will return to seek revenge for the neglect shown him. See Ghosts. Consult: Caland, *Ueber Todtenverehrung bei einigen der indogermanischen Völker* (Amsterdam, 1888); id., *Altindischer Ahnenkult* (Leyden, 1893); Jolly, *Recht und Sitte* (Strassburg, 1896); Hillebrandt, *Ritual-Litteratur* (ib., 1897).

ŚRAVAKA, shrä'vȧ-kȧ (Skt. *śrāvaka*, Pali *sāvaka*, disciple, from *śru*, to hear). Originally any true disciple of Buddha. The term was later applied to those who were on the four-fold road to Nirvana (q.v.). The four classes of śravakas are the *śrōtāpannas* (Pali *sōtāpanna*), neophytes or converts; the *sakarāgāminas* (Pali *sakadāgāmin*), who are so far purified that they need be reborn on earth only once; the *anāgāminas* (Pali also *anāgāmin*), who will be reborn in a Brahmaloka, not in an inferior heaven or on earth; and the *arhats* (Pali *arahā*), who have attained such sancity that they are freed from reincarnation. The general name among the Northern Buddhists for the Southern sect is śravakas.

SRINAGAR, srē'nȧ-gŭr', or **SERINAGUR**, se-rē'nȧ-gŭr'. The capital of the native State of Kashmir, India, on the Jhelam River, 195 miles by rail northeast of Rawal Pindi (Map: India, C 2). It is in the 'Vale of Kashmir,' a region noted for its picturesque lakes. lofty mountain peaks, and interesting ruins. The Jhelam River flows through the city, and the numerous canals extend in all directions. Within the wall-girt citadel are the city fort and a summer residence of the Maharaja. Dal Lake, a beautiful sheet of water on the eastern border of the city, was formerly a favorite resort of the Mogul rulers. Srinagar is surrounded by a rich agricultural section, and manufactures shawls, papier maché, and leather. The city was founded in the sixth century, and came under British protection in 1846. Population, in 1901, 122,618.

SRIRANGAM, srē-rŭng′äm, or **SERINGHAM**, sê-rĭng′häm. A town in the Province of Madras, India, two miles north of Trichinopoli, on an island of the same name in the Kaveri River (Map: India, C 6). It is connected with the mainland by a bridge of 32 arches and is noted for its great temple to Vishnu. (See Indian Art.) The temple of Jambukeshwar, about a mile distant, and the neighboring anikuts or dams of the Kaveri River are also noteworthy. Population, in 1891, 21,632; in 1901, 23,039.

SRIRANGAPATAM, srē-rŭng′à-pà-täm′. A town of Mysore, India. See Seringapatam.

ŚRUTI, shrōō′tê (Skt., hearing, revelation). In Sanskrit literature, the technical term for those works which are regarded as divine revelation. It originally applied only to the texts of the Vedas (q.v.) and to the Brahmanas (see Brahmana), but at a later period it included also the Upanishads (q.v.). The term *śruti* is therefore contrasted with *smṛti*, or tradition. See Smriti.

SS, Collar of. A collar composed of a series of the letter S, either linked together or set in close order, on a blue and white ribbon, with the ends connected by two buckles and a trefoil-shaped link, from which hangs a jewel. Such collars have been much worn in England by persons holding great offices in the State, as well as by gentlemen of various ranks, from esquires upward. The origin of the device has not been satisfactorily explained. It had, without doubt, originally a Lancastrian character. Collars of SS are still worn, with certain recognized distinctions, by the Lords Chief Justices, the Lord Chief Baron of the Exchequer, the Lord Mayor of London, the heralds, and the sergeant-at-arms.

SSÁSZ, säs, Károly (1829—). An Hungarian poet and translater, born at Nagy-Enyed, Transylvania. During the revolution of 1848-49 he fought in the Honvéd army, then studied theology, was engaged in teaching and pastoral work until 1867, when appointed councilor in the Ministry of Public Worship and Instruction. In 1884 he became reformed bishop at Budapest. He was elected to the Hungarian Academy in 1858. Besides numerous lyrics he wrote the epic poems *Almos and Salamon*, the dramas *Zrinyi*, *Emperor Joseph*, *Herodes*, *Georg Frater*, and the tragedy *The Death of Attila* (1888), but won wide reputation especially through his masterly translations of Shakespeare, Molière, Moore, and Tennyson, the *Nibelungenlied* and Dante's *Divina Commedia*, and poems of Goethe, Schiller, Heine, Victor Hugo, and Lamartine, also through those embodied in *A világirodalom nagy eposzai* (The Great Epics of the World's Literature, 1882).

STAAL, stäl, Marguerite Jeanne [Cordier] Delaunay, Baronne de (1684-1750). A French writer of memoirs and letters of much historic value. She was born in Paris. Her father was an artist. Having studied in a convent at Rouen, she became maid to the Duchess of Maine (1711), took part in Cellamare's plot to deprive the Duke of Orleans of the Regency, and was imprisoned (1718-20) in the Bastile. She afterwards married (1735) Baron de Staal, captain in the guard of the Duke of Maine. She spent the rest of her life at the ducal Court at Sceaux and died in Paris. Her *Mémoires* (Paris, 1755, best edited by Lescure, 2 vols., 1878) are remarkable for keen observation, sincerity, and irony, as well as for their style. Her letters and two comedies are in her *Œuvres* (Paris, 1821). Consult: Sainte-Beuve, *Portraits littéraires*, vol. iii. (2d ed., Paris, 1864), and a monograph by Frary (ib., 1863).

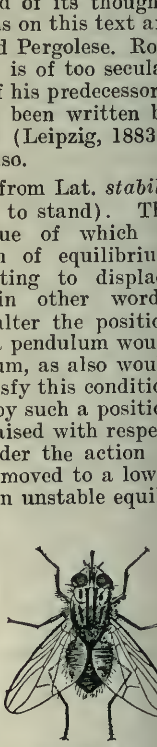
STA′BAT MA′TER. One of the most famous of the great mediæval hymns, describing the sufferings of the Virgin Mary as she stood by the cross of Jesus. It is generally spoken of by the above name, from the words with which it begins:

Stabat mater dolorosa
Juxta crucem lacrymosa,
Dum pendebat Filius.

It was formerly attributed to various authors, including Pope Innocent III., Saint Bonaventura, and Saint Bernard; but it is now generally ascribed to Jacopone da Todi (q.v.). It was adopted as the sequence for the feast of the Seven Sorrows of Mary in many places, and came into the Roman missal, as one of the few sequences retained in it, in 1727, when the feast was extended to the entire Church. It is a magnificent example of the rhyming Latin poetry of the Middle Ages, deservedly famous for the beauty both of its language and of its thought. Well-known musical compositions on this text are those of Palestrina, Astorga, and Pergolese. Rossini's version, although popular, is of too secular a character to rank with those of his predecessors. Monographs on the hymn have been written by Lisso (Berlin, 1843) and Ritter (Leipzig, 1883), the latter covering the music also.

STABILITY (Fr. *stabilité*, from Lat. *stabilitas*, steadfastness, from *stare*, to stand). The property of a body by virtue of which it tends to return to a position of equilibrium if it receives an impulse acting to displace it from this position, or, in other words, where work must be done to alter the position of its centre of gravity. Thus a pendulum would be said to be in stable equilibrium, as also would be a well-ballasted ship. To satisfy this condition the centre of gravity must occupy such a position that when it is displaced it is raised with respect to its original position. If under the action of a force the centre of gravity is moved to a lower position the body is said to be in unstable equilibrium. Stability of floating bodies is an important consideration in shipbuilding (q.v.). See Buoyancy; Equilibrium; Hydrostatics; Mechanics; Metacentre.

STABLE FLY. A biting fly (*Stomoxys calcitrans*) of the family Muscidæ, probably introduced into the United States from Europe long ago. The larvæ feed in fresh horse manure, and the flies live chiefly on the blood of vertebrate animals, frequently causing much an-



STABLE FLY.

noyance to horses and cattle, and biting human beings. Another cosmopolitan muscid fly (*Muscina stabulans*) is sometimes known as 'stable fly.'

STACCATO, stȧ-kä′tō (It., detached). In music, a term implying a detached, abrupt mode of performance. A certain amount of time is subtracted from the proper value of any note played staccato, and a rest substituted. A dot placed over a note indicates that it is to be played staccato. A dash implies a greater degree of staccato; and a very light degree of staccato is expressed by uniting the dot with the slur.

STACHYS, stā′kĭs (Lat., from Gk. στάχυς, woundwort, ear of corn, spike). A genus of plants of the natural order Labiatæ, containing numerous species widely distributed in temperate and tropical climates except Australia and New Zealand. *Stachys sylvatica*, hedge nettle, common in shady places, is a coarse herb from 2 to 3 feet tall with ovate, heart-shaped leaves on long stalks and whorls of purple unpleasant smelling flowers. *Stachys elatior*, common in moist places, sometimes proves a troublesome weed in meadows. It was formerly used as a vulnerary, hence the name woundwort. Several species are cultivated in flower gardens. To this genus some botanists refer the common betony or wood betony (*Stachys Betonica*), plentiful in woods and thickets in Europe. It is a hairy-stemmed plant one or two feet high, has oblong heart-shaped leaves, whorls of purple or white flowers, and a fetid smell. A Japanese species (*Stachys Sieboldi*, often called *Stachys tuberifera*) has small edible tubers an inch or two long used as a vegetable in China and Japan; in the latter country they are known as chorogi, under which name they have been introduced into America.

STADE, stä′de. A town in the Province of Hanover, Prussia, on the Schwinge, an affluent of the Elbe, about 4 miles from its mouth (Map: Prussia, C 2). It manufactures machinery, ships, trimmed lumber, salt, bricks, wine, and cigars. Stade was designated a city as early as the tenth century. Population, in 1900, 10,575.

STADE, BERNHARD (1848—). A German theologian, born at Arnstadt and educated at Leipzig and Berlin. In 1875 he was appointed professor of theology at Giessen. He wrote *De Isaiæ Vaticiniis Æthiopicis Diatribe* (1873), *Ueber die alttestamentlichen Vorstellungen vom Zustand nach dem Tode* (1877), *Lehrbuch der hebräischen Grammatik* (1879), and *Geschichte des Volkes Israel* (vol. i. 1881-84; vol. ii., with O. Holtzmann, 1888). In collaboration with Karl Siegfried (q.v.) he published (1893) a *Hebräisches Wörterbuch zum alten Testament*. In 1871 he became the editor of the *Zeitschrift für alttestamentliche Wissenschaft*.

STADIA (ML. *stadia*, station, from Lat. *stadium*, from Gk. στάδιον, standard of length, furlong). An attachment fitted to the telescope of a transit and used in surveying to measure distances. Stadia surveying is a modification of transit surveying, and is effected by the use of the stadia or gradienter attachment. The telescope of the ordinary transit (see ENGINEERING INSTRUMENTS) contains a vertical and a horizontal wire dividing the field of vision into four quadrants; but the stadia telescope contains extra horizontal wires mounted on an independent diaphragm, so that the distances between the respective wires are adjustable. The principle of its operation is simple. If the space between two auxiliary wires, one on each side of the horizontal wire of the telescope, is so adjusted as to subtend a foot on a rod at a distance of 100, the space will subtend two feet on a rod at two hundred feet, and so on. Thus by proper adjustment the approximate distances to various near-by points can be calculated at once by reading the rod. If from any convenient point in a field the corners are all visible, and the stadia instrument be set at this point, the distance to each corner can at once be read and also the angles between these lines. Thus with two sides and the included angle of each triangle, the areas of the different parts and that of the whole field can be calculated. This plan is known as the method of *radiation*. The gradienter attachment is a micrometer screw which takes the place of the tangent screw to the axis of the telescope. A mounted scale registers the number of turns of a micrometer screw. The value of the thread is usually such that one revolution of the screw moves the horizontal wire of the telescope over a space of one foot on a rod at the distance of a hundred feet. If the micrometer screw is divided into one hundred spaces, it is clear that when the screw is turned through 25, 50, or 75 spaces, or $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{3}{4}$ of a space on the scale, the wire of the telescope will pass over $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{3}{4}$ of a foot on the rod, and so on. See SURVEYING.

STADIMETER (from Gk. στάδιον, *stadion*, standard of length, furlong + μέτρον, *metron*, measure). A nautical instrument invented by Commander B. A. Fiske, United States Navy, and designed for measuring the distance of objects when their height is known. It is somewhat similar in principle to the sextant, but its readings are in yards instead of angular measure. See RANGE-FINDER.

STADIUM (Lat., from Gk. στάδιον, standard of length, furlong, race-course, from ἱστάναι, *histanai*, Skt. *sthā*, Lat. *stare*, to stand; ultimately connected with Eng. *stand*). The name for the Greek race-course, within which also other athletic contests took place. It was used only for contests, not apparently as a place for exercise. The spectators stood or sat on the high banks of earth at the sides and across the ends. In some cases one end was curved like a horseshoe, and at times one end was open. At Olympia there seems to have been no permanent seats at the sides, but we hear that at Athens Herodes Atticus (see ATTICUS) fitted the stadium with Pentelic marble seats. The floor of the stadium was sand or loose earth. The course was straight away, and at each end was usually a long strip of marble which served to mark the start and finish. The length of the course was always 600 Greek feet, but, as the foot varied in different localities, the stadium was not of uniform length. At Athens the standard foot seems to have been 0.2957 meter, like the Roman foot, and the stadium was 177.42 meters. This seems to be the length of the stadium used commonly as a measure of distance, of which $8\frac{1}{3}$ made a Roman mile, and a little more than 9 an English mile. Consult: Hultsch, *Griechishe und römische Me-*

trologie (2d ed., Berlin, 1882); Dörpfeld, in *Mittheilungen des deutschen archäologischen Instituts Athens* (Athens, 1882).

STADTHOLDER (Dutch *stadthouder*, Ger. *Stadthalter*, stead-holder, lieutenant, viceroy, governor of a province). The title bestowed on William of Orange (q.v.) by the Dutch provinces which rose in revolt against the tyranny of Alva in the sixteenth century. (See Netherlands.) On the assassination of William in 1584 his son Maurice of Nassau was appointed to the office. The stadtholderate was considered to be at an end on the death of William III. in 1702, but in 1747 William IV., descended from a collateral branch of the House of Nassau, was proclaimed stadtholder, captain-general, and admiral-in-chief of the United Provinces. His son, William V., the seventh stadtholder, was driven from the country by the French in 1795 and resigned his office in 1802.

STAËL-HOLSTEIN, stā′ĕl hōl′stīn, *Fr. pron.* stäl ôl′stăN′, Anne Louise Germaine, Baronne de, commonly called Madame de Staël (1766-1817). A famous French authoress, born in Paris, April 22, 1766. She was the daughter of the Genevese banker and distinguished French Minister of Finance, Jacques Necker (q.v.), and of his wife, Suzanne Churchod, Gibbon's youthful beloved. She passed her childhood in one of the most brilliant literary salons of Paris, where her naturally active mind was stimulated by association with the keenest wits and critics of the pre-Revolutionary decade, chief among them F. M. Grimm, Thomas, Marmontel, and Raynal. In this vortex of disintegrating ideas she assimilated more than any other of her generation the intellectual spirit of that age. She married in 1786, in obedience to her mother's wish, the Swedish Minister, Baron de Staël-Holstein, by whom she had three children. But she kept the tenor of her independent way, always positive and self-assertive, a little boisterous and rather vain, writing much, but publishing nothing until the appearance of her *Lettres sur Jean Jacques Rousseau* (1788), whose social ideas she warmly admired. She had fallen also under the spell of Goethe's *Werther*, and thus she sympathized with the Revolution till the imprisonment of the King caused a revulsion to an equally indiscreet 'incivism.' She abused her ambassadorial right of asylum, and, in fear of the consequences, left Paris before the massacres of September, 1792, going to Coppet, near Geneva, where she gathered some political sympathizers. In 1793 she tried to make herself the centre of a more important group in England, not without some personal scandal. For nine years (1794-1803) she played at politics in Paris, with brief visits to Coppet. She was amicably separated from Baron de Staël in 1788, and irritated Napoleon by biting epigrams till the consular police banished her from Paris (1803). She went to Germany, which then 'ruled the kingdom of the air' (Richter), and in her unwearying search for noted people to talk to she came in the winter of 1803-04 to Weimar. Goethe, after at first excusing himself on the score of ill health, saw much of her and later on in his *Annalen* spoke of "her brilliant way of showing her readiness of thought and repartee." On the whole, in spite of her 'passionate demands' for ready information on the most important subjects, he admitted that "one could get on with her easily and pleasantly if she was taken in her own way." Schiller found her "with little ideality or poetry and no feminine reserve." The Romanticists were more attracted, and A. W. Schlegel (q.v.), an eccentric prophet of the new school, became her devoted companion and counselor. Thus the German ideas that she introduced into France were seen through Schlegel's eyes, far from impartially, as is constantly obvious in her *De l'Allemagne*, written in 1809-10 and printed in England in 1813. Before her exile Madame de Staël had written two essays, *De l'influence des passions* (1796) and *De la littérature considerée dans ses rapports avec les institutions sociales* (1800), the latter curious for its marks of the close association with Benjamin Constant (q.v.), who gave his impression of their relation in *Adolphe*. Her literary power was first revealed in the novel *Delphine* (1802), a half-autobiography of the 'misunderstood woman,' to be exploited later by George Sand. Much finer is a second story, *Corinne* (1807), wherewith she made the novel carry artistic discussion, as Goethe and Richter had done in Germany.

In 1810 she published her *De l'Allemagne* in Paris, but Napoleon condemned the entire edition and expelled her from France. She retired to Coppet, and there, in 1811, she married secretly a young officer, De Rocca, more than twenty years her junior. In the same year she set out on her travels in Russia, Sweden, and England, and after Napoleon's fall returned to France, though she still spent much time abroad, for her health was gradually failing, as her last book, *Considérations sur la révolution française* (1818), witnesses. She died in Paris, July 14, 1817. Of her three children by her first husband, Auguste (1790-1827) became known as the author of *Lettres sur l'Angleterre;* Albertine (died 1838) married the Duke Achille de Broglie, and Albert became a Swedish officer and fell in a duel. By her second husband she had one child.

In her person, excepting her fine eyes and well-formed figure, Madame de Staël was not attractive. In conversation she often repelled even those who appreciated her talents. If one considers only language and style she was not a great writer, but she had great enthusiasms, faith in human progress, and in democracy. Thus she did much to free French literature from the self-imposed fetters of the classical criticism. Studiously cosmopolitan, she compelled France to contrast and compare her ideals of letters and art with those of Germany and England. The French spirit, she said, needed to be regenerated by some more vigorous sap. It was artistic, rationalistic. They were idealistic, individually subjective. To establish in France Ossian, Byron, Goethe, Richter, was to complete the work begun by Rousseau. Thus the French romantic movement, one of the greatest literary regenerations in history, is in large measure the work of Madame de Staël.

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trans., 1882); Sainte-Beuve, *Causeries du lundi*, vol. iv.; Brunetière, *Evolution de la critique* (Paris, 1890); Dejob, *Madame de Saussure et l'Italie* (ib., 1890); Faguet, *Politiques et moralistes*, vol. i. (ib., 1898).

STAFF (AS. *stæf*, staff, Goth. *stafs*, rudiment, letter, OHG. *stap*, Ger. *Stab*, staff; connected with OChurch Slav. *stabŭ*, staff, Lith. *stábas*, *stóbras*, pillar, Skt. *sthāpay*, to make stand, from *sthā*, to stand, and ultimately with Eng. *stand*). In military and naval usage, the aides or assistants of a commanding officer. The staff of an army comprises the assistants of the general-in-chief and of his generals, and their duties are to relieve the chief of the details to which he cannot personally attend.

In the *United States* this body is divided into the *military* staff and the *administrative* staff. The former is charged with the more purely military duties, and comprises the chiefs of staff (the assistants and executive officers of the generals in the office and in the field), the adjutants-general (who attend to the correspondence, orders, etc.), the inspectors-general (who are charged with the inspection of the troops), the chief of artillery (the assistant and adviser in all matters relating to the artillery, and responsible for the artillery materiel and personnel), the chief of cavalry, the chief of engineers, the chief signal officer (responsible for the military telegraph, signal stations, and balloons), the provost-marshal-general (who has charge of the police, prisoners, deserters, secret service, and post-office), and the aides-de-camp (attached more directly to the person of a general, assisting him by carrying orders, studying and reporting on portions of the field, and attending to a part of the correspondence). The administrative staff is charged with the service of administration and supply, and comprises the judge advocate (who supervises the proceedings of military courts and boards), the commissary of musters (who supervises the muster and pay rolls, and makes musters into and out of the service), the chief ordnance officers (who are charged with the supply of ordnance material), the chief quartermasters (providing transportation, forage, clothing, and camp and garrison equipage), the chief commissaries (providing commissary stores), the chief paymasters, and the medical directors and their respective assistants.

General Staff Corps. Since the passing of the General Staff Bill, which was approved on February 14, 1903, and which entered into legal effect August 15 of the same year, a general staff organization has been instituted as follows: The General Staff Corps establishment consists of officers detailed from the army at large under such rules as may be prescribed by the President. The duties of the General Staff Corps are to prepare plans for national defense and mobilization of troops in time of war; to investigate and report on questions relating to the efficiency of the army and its preparation for war; to aid and assist the Secretary of War or other general officers and commanders, and to act as their agents in informing and coördinating other officers, who are subject to the supervision of the chief of the staff; and to perform such other military duties as may be prescribed by the President.

The General Staff Corps consists of one chief of staff, and two general officers chosen from the army, not below the grade of brigadier-general, four colonels, six lieutenant-colonels, and twelve majors from corresponding grades, twenty captains from grades of captain and first lieutenant, to have rank, pay, and allowances of captains mounted. Time of detail, four years, unless otherwise relieved. When relieved these officers return to their former branch of the army, and are not eligible for service in the General Staff Corps until they have served two years in that branch of the army in which they hold their commission, except in case of war or emergency.

The chief of staff supervises all troops of the line, and the adjutant-general's, inspector-general's, judge-advocate's, quartermaster's, subsistence, medical, pay, and ordnance departments, corps of engineers and signal corps, and performs such other military duties as may be assigned by the President. All duties previously prescribed by statute for the commanding general, as member of the Board of Ordnance and Fortification and of the Board of Commissioners or of the Soldiers' Home, are performed by the chief of staff or other officers designated by the President. Acts or sections of acts authorizing aides-de-camp and military secretaries do not apply to officers of the General Staff Corps.

The chief of artillery serves as an additional member of the general staff and enjoys the rank, pay, and allowances of a brigadier-general.

In *England* the regular army officers, non-commissioned officers, and men doing duty with a militia, volunteer, or yeomanry corps correspond very nearly to the French *cadres complementaires.* The English up to 1902 had no regular staff institution, answering to that of the French or Germans, but strong efforts were being made to secure the organization of such a system. The staff college prepares officers for staff duty, but officers are frequently thus employed who have not passed the staff college. Officers of the British army desirous of serving with the native army in India join what is called the *Indian Staff Corps*, from which they are appointed to any regiment to which they may be assigned.

In *Germany* the Prussian general staff organization is known as the general staff of the army, Bavaria, Württemberg, and Saxony maintaining their own establishments, but subordinate to the Prussian corps. It consists of the chief of the general staff, usually a high ranking officer, subject only to the Kaiser; the *Haupt-Etat*, or principal establishment of the general staff; and the *Neben Etat*, or auxiliary establishment of the general staff. The duties and functions of the general staff are as follows: Collecting, adding to, and arranging military information necessary for the knowledge of the German Empire and all foreign States, and the further training of officers of the general staff and of the officers attached to it for duty. The great general staff consists of a central and six other sections. The central section is under a major-general, who is the principal assistant of the chief of the general staff. The first section keeps informed about everything that would be useful in case of war with Russia, Austria, Sweden, Norway, Denmark, the Balkan Peninsula, and Asiatic Russia. The second section deals with corresponding details regarding Germany itself.

The third section deals with England, France, Italy, Belgium, Holland, Switzerland, Spain, Portugal, America, and Asia exclusive of Russian Asia. The fourth section covers the subject of fortifications and fortresses and technical engineering affairs. The fifth class is a military historical section, and the sixth has charge of all railway questions. Each section is in charge of the chief of section, whose staff varies according to the work in hand. All general officers must have served on the general staff, an important essential being that they must have held regimental command. In order that officers of other corps or arms of service may be eligible for the rank of general officer, every major in the general staff, independent of the arm of the service to which he belongs, is assigned for a period to the command of a battalion of infantry.

In *France* the general staff is not a permanent organization, but is composed of officers temporarily assigned from the line. It is directly under the Minister of War as chief, and comprises the military household of the President, the special staff of the military governments of Paris and Lyons, the staff of the army corps, divisions, and brigades, the staffs of the fortification commands, the staffs of the marshals of France, the military attachés abroad, and the staffs of the artillery and engineer commands. The general staff of the army is under the chief, who has three brigadier-generals as assistants, and comprises four military bureaus (one for organization and mobilization, one for studying foreign armies, one for military operations and education, and one for railroads), and five sections (one for personal matters relating to the general staff, one for materiel, one for Algiers and Tunis, one for history, and one for land survey). The general staff together with the Ministry of War administers the affairs of the army. The War Ministry is subdivided into bureaus corresponding to the sections of the German greater general staff. The *army staff* itself is under a general of division, called the chief of staff, who is himself assisted by three other superior officers with their subordinates. The staff has its own sections, bureaus, and special services, and is occupied with the organization and mobilization details of the army, the procuration of information regarding that of foreign armies, instruction, railways.

In the *Italian* army system the general staff constitutes the second division of the war university and has in charge the preparations for war. It is subdivided into divisions and sections which are known as the 'office in charge of the Eastern or the Austro-Italian frontiers,' the 'office in charge of the Western or Swiss and French frontiers,' etc. The staff has charge of the archives, geography department, information, intendance, transport, and the Turin War Academy. The chief of staff in time of war is also chief of the intelligence department.

In *Russia* the higher general staff is not practically an independent organization, as is the German Grosser Generalstab, but instead acts entirely under the Ministry of War, which latter consists of various branches. The general staff has to do principally with army organization, manœuvres, camps, fortifications, promotions, rewards, equipment, remounts, geography, and topography, home and foreign, transport, literature, etc. When it happens that the Czar is not an active military leader the War Ministry is dominated by the Minister or some conspicuous and concededly able general officer, who is also a member of the council of war.

REGIMENTAL STAFF. The commissioned staff of a regimental commanding officer would consist of such officers as are not duty officers in the battalion squadron or regiment, as the regimental adjutant, quartermaster, commissary, etc.

The aides-de-camp of a general officer constitute his staff, together with such departmental and technical officers as may be temporarily detailed to assist the general in some specific undertaking.

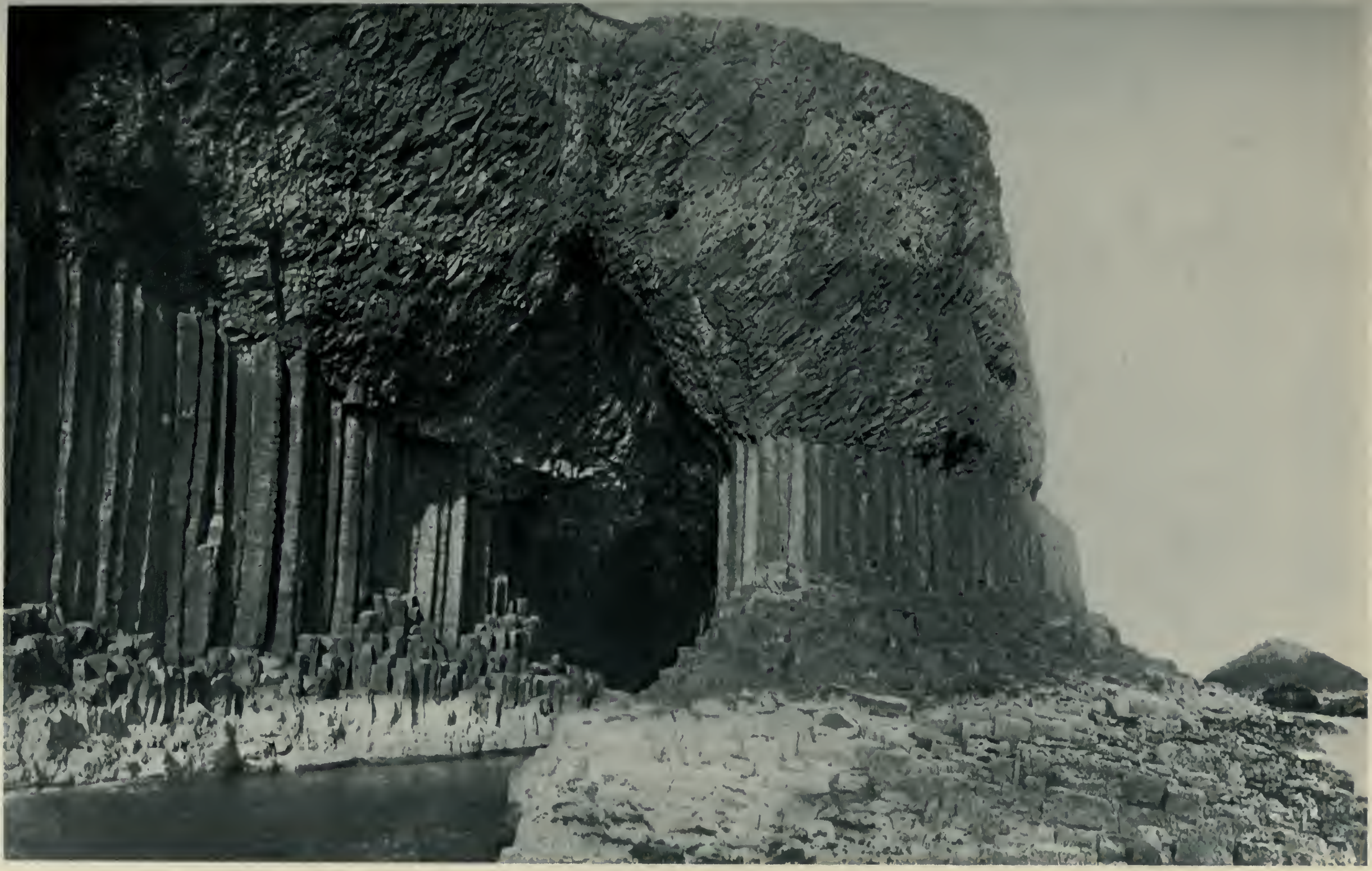
THE NON-COMMISSIONED STAFF consists of non-commissioned officers not forming part of the company establishment proper and who have relationship only to the battalion, squadron, or regiment, as sergeant major (battalion or regimental), quartermaster-sergeant (regimental), commissary sergeant (regimental), chief musician, chief trumpeters, and principal musician. In the United States army non-commissioned officers doing duty as part of the permanent establishment of an army post or fort are termed the *post non-commissioned staff*, which ordinarily consists of an ordnance sergeant, post quartermaster-sergeant, electrician-sergeant, hospital steward, etc. Throughout the armies of Europe battalion, regimental, and post (depot or fortress) staffs, commissioned or non-commissioned, include practically the same descriptions of officers. See STAFF COLLEGES AND SCHOOLS; ARMY ORGANIZATION.

In the navy the staff does not play as important a part as in the army, nevertheless what is essentially a general staff is required to control the *personnel* and direct the movement of fleets, etc. In the United States Navy the term staff officer is applied to those officers who do not belong to the executive or line branch, as surgeons, paymasters, chaplains, etc.

STAFF (in music). See MUSICAL NOTATION; NEUMES.

STAFFA, stăf′fȧ. A celebrated but uninhabited Scottish islet, one of the Inner Hebrides (q.v.), seven miles west of Mull (Map: Scotland, B 3). It rises to a height of 144 feet, is 1½ miles in circumference, and oval in shape. Except on the northeast its cliffs hollowed by caverns rise from the water 84 to 112 feet high. There are seven caves, of which the most remarkable is Fingal's or Great Cave. The entrance, formed by regular basaltic columnar ranges on each side, supporting a lofty arch, is 33 feet wide and 65 feet high. The length of the cave is 230 feet. As one of the most perfect and beautiful specimens of natural architectural phenomena it is much frequented by tourists.

STAFF COLLEGES AND SCHOOLS. Military training schools for officers candidates for staff appointments. To prepare officers for duty on the staff of an army special colleges or schools have been instituted by all the leading military nations of the world. (See MILITARY EDUCATION.) In the United States there is the General Service and Staff College at Fort Leavenworth, Kan., to which officers are ordered for their technical and professional instruction, and students showing marked proficiency in their studies are considered to be eligible for staff or other duties for which they are best fitted. In



FINGAL'S CAVE, ISLAND OF STAFFA

England officers desirous of qualifying for staff appointment must have had five years' service in the army, undergo the two years' course at the Staff College at Sandhurst, and serve at least four months at Aldershot in some arm of the service other than the one to which they belong. The rule in Germany is to select officers for the general staff from among the graduates of the military colleges having the best qualifications and the highest percentages in examination. The training is received at Berlin and Munich. In France staff officers are educated at the Higher War School at Paris, which was first organized as a staff college at the beginning of the nineteenth century, and reorganized in 1875 as the permanent college for general staff candidates. Austria-Hungary sets apart the Kriegsschule at Vienna for instruction in staff work. The Italian general staff school is at Milan, where about 24 officers graduate each year. The Saint Nicholas Academy at Saint Petersburg is the staff school of Russia, entrance to which is competitive to all officers of three years' service and upward. See STAFF.

STAF'FORD. The county town of Staffordshire, England, on the Sow, 29 miles northwest of Birmingham (Map: England, D 4). Tanning and the manufacture of cutlery and of shoes are the chief branches of industry. Population, in 1891, 20,270; in 1901, 20,900. Stafford was of importance before the Conquest, is mentioned in Domesday, and King John confirmed and enlarged the privileges of an old charter.

STAFFORD. A town, including the borough of Stafford Springs, in Tolland County, Conn., 20 miles north by west of Willimantic, on the Willimantic River, and on the Central Vermont Railroad (Map: Connecticut, F 1). It is a summer resort, with mineral springs. It manufactures woolens. There is a public library. Population, in 1890, 4535; in 1900, 4297.

STAFFORD, HENRY, second Duke of Buckingham (c.1454-83). An English nobleman and political intriguer. He was the grandson of the first Duke and succeeded to the title in 1460. He was a prominent adherent of the Duke of Gloucester, afterwards Richard III., while the latter, then Protector, was conspiring to seize the throne, and assisted him in his efforts against Earl Rivers and Lord Grey. After the downfall of those noblemen he received as a reward for his services the office of Chief Justice and constable of the royal castles in Wales, and later that of Lord High Constable of England. A few months later, however, he joined the Lancastrians in an effort to overthrow Richard, but his projects were frustrated, and he was summarily tried and beheaded at Salisbury in 1483. He is "the deep revolving wily Buckingham" mentioned in Shakespeare's *Richard III.*

STAFFORD, WILLIAM HOWARD, Viscount (1614-80). An English statesman. He was the fifth son of Thomas, Earl of Arundel and Surrey, and was educated as a Roman Catholic. In 1634 he married a sister of the thirteenth Baron Stafford, and on the latter's death assumed the title. This marital claim was afterwards disputed, but finally decided in his favor, and a new creation was made by the King, declaring him Baron and afterwards Viscount Stafford. During the Civil War he was a firm adherent of the King, but after the Restoration (q.v.) frequently opposed the royal will from his place in the House of Peers. In 1678 Stafford was one of those denounced by the infamous Titus Oates (q.v.) as a conspirator in the pretended popish plot. He was impeached on a charge of high treason, and, despite a spirited defense against suborned testimony, was found guilty and publicly executed on Tower Hill. In 1824 the act of attainder was reversed by Parliament.

STAF'FORDSHIRE. An inland county of England, bounded on the west and northwest by Shropshire and Cheshire (Map: England, D 4). Area, 1128 square miles; population, in 1891, 771,258; in 1901, 879,618. In the north wild moorlands in long ridges, separated by deeply cut valleys, extend from northwest to southeast. The surface is low and undulating in the midland regions, but becomes hilly again in the south. The Pottery coal field occupies the north, and the Dudley coal field, remarkable also for its abundant and rich iron ores, occupies the south. The Trent, flowing first southeast through the county, then northeast along its eastern border, is the chief river. The climate is humid, much of the soil is clayey, and agriculture is in a backward condition. The manufactures, however, are extensive and varied, including cutlery and ironware, pottery, shoes, and glass, and cotton, silk, and leather goods. Stoke-upon-Trent and Burslem are the chief seats of the pottery industry. Capital, Stafford.

STAG, or RED DEER. See DEER; ANTLERS.

STAG-BEETLE. Any member of the Lucanidæ, a family of beetles including 500 to 600 species. The common name is derived from the shape of the mandibles of the males, which are developed in some species so as to equal in length nearly that of the entire body, and are armed with spines or teeth. The males are of varying size and exhibit remarkable differences in the development of the head and mandibles. In each species in which these extraordinary variations occur there are no subtle intergradations, so that distinct 'forms' or 'states' occur, the largest being termed 'teleodont,' the smallest 'priodont,' and two intermediate forms 'mesodont' and 'amphiodont.' *Lucanus cervus* is the common English species. *Lucanus dama* is the commonest North American species. In the Southern States *Lucanus elaphus*, the giant stag-beetle, occurs. See Colored Plate of BEETLES.

STAGE, THE (OF. *estage*, Fr. *étage*, stage, floor, loft, from Lat. *stare*, to stand; ultimately connected with Eng. *stand*). A term frequently employed to designate the profession of the actor. This will accordingly be discussed in the present article, with reference especially to the life and training of actors, past and present; while in the article THEATRE will be found details of the construction and management of theatres as they affect the audience. Until the beginning of the nineteenth century the actor was classified by English law with vagabonds. In the Middle Ages actors, like poets and musicians, were more or less upon a footing with the household servants of the great; in fact, often were the servants of the nobility. Until 1875 in great English houses it was not uncommon to see a silken cord placed somewhere in one of the drawing rooms to separate the artists or performers at a formal soirée from the invited guests. If this was the feeling toward acknowledged artists, it can be readily believed that the strolling player from Shakespeare's time down to the beginning of the last century was looked upon as but one step above the tramp. Within the last fifty years the social status of the actor has vastly improved, because of the more universal interest taken in stage performances, the higher salaries paid to actors, and the better organization of the theatrical business as a whole. For the first time in the history of England an actor, Sir Henry Irving, has been knighted for his services to the stage. With the growth of importance of the theatrical business, the character of its management has changed, with a decided loss in some directions and a gain in others. The old-time manager from Shakespeare's day to that of Sir Henry Irving in England, and of Lester Wallack in this country, was always an actor and not a business man. Within the last twenty-five years the management of most American theatres has fallen into the hands of business men, with a consequent loss in artistic quality and a gain in financial stability. The permanency of theatrical enterprises, and the fair certainty that contracts will be carried out, have made the profession less of a hazardous undertaking than it formerly was. At the same time, the fact that theatrical contracts are seldom made but for one season, commonly of forty weeks, that few plays please the public for more than a year, and that there are always several thousand unemployed actors and actresses in the United States alone, renders the actor's life, for the rank and file at least, a more or less uncertain one. Among the other disadvantages of the stage as a profession may be mentioned the absence of home life, nine-tenths of the profession having to travel from town to town, and the loss of earning capacity after a certain age. The advantages of the profession are that it requires no capital, and that there is always a possibility of earning a much larger salary than the average man or woman can expect in other businesses or professions.

Within the last thirty years the number of theatres in this country has increased from hundreds to thousands, and according to trustworthy statistics there are now about 10,000 stage performers in the United States, to which number must be added about as many more persons employed as musicians, scenic artists, stage hands, costumers, and theatrical employees, making an army of about 20,000 persons who look to the stage for support. The people on the stage are employed by 400 theatrical companies, with an average of twenty persons to each company, The Actors' Fund of America, the charitable organization of the dramatic profession in the United States, has a record of 17,000 persons employed in capacities entitling them to its recognition. Few plays are given in Germany and France for more than a few weeks at a time. In England and the United States the same play is performed as long as it attracts a playing audience, and most American companies are organized for one particular play, which is given throughout the season. This system entails constant traveling, which is one of the hardships of the actor's life. Scores of companies play the 'one-night stands,' as they are called, for month after month right through the season, traveling by day and acting at night. Miss Clara Morris, in her reminiscences, speaks of traveling all day without food to get to a town where she had to play the light-hearted daughter of a millionaire in the evening; she had to wear a low-necked dress upon a stage in Winnipeg, with Arctic blasts sweeping the stage; while a month later in Texas, with the thermometer at 100°, the part called for furs.

The number of women stage performers now exceeds that of men. Until 1660 they were forbidden upon the English stage, the female parts in Shakespeare's day being taken by boys or young men, which was also the custom in France and Germany. Women so soon became popular as actors that one of Dryden's comedies was produced in 1668 in London with all the parts, both male and female, played by women. With the employment of women greater attention was paid to costuming. A Parisian dancer, Mlle. Sallé, raised a storm in 1740 by appearing in the ballet of Pygmalion in Greek costume. Paris audiences objected to the innovation, but London accepted it. It was not, however, until Talma insisted in 1800 upon playing Brutus at the Théâtre Français in Roman costume and without a powdered wig that classical plays were costumed according to the epoch represented. It may also be supposed that the appearance of women as actors led to a more natural style of acting. So far as may be inferred from the books of the seventeenth and eighteenth centuries, acting in England and France was then as stilted and artificial as the manners of the time. Talma, Rachel, and Lemaître in France, Garrick, Kean, and Macready in England, instituted more natural methods. In more recent years what is known as 'realism' has made itself felt in acting as well as in literature. The old-time actor underwent a long training in the traditions and technicalities of the art; he was expected to play many parts. The actor of to-day has usually a narrower range.

Whether to trust to study and calculation or to inspiration when on the stage is a question on which expert's differ. The noted French comedian Coquelin teaches that all acting is a distortion of nature so regulated by study and experience that it will seem to be nature when seen by an audience. The actor, says Bronson Howard, the American playwright, must make the people in the audience, some of them a hundred feet away, think that he is moving, appearing, and speaking like the character he assumes, and to do so he must do something that he would never think of doing in real life in the same circumstances. His talk and gesture must be as false as his complexion in order that they may seem real. Such exaggeration is an art that must be learned like any other. The foremost dramatic school of Europe has been that of the Paris Conservatoire, whose prize winners are engaged by the Paris Théâtre Français and the Odéon. In the United States the stage is now partly recruited from schools in New York, Boston, and Chicago, which graduate yearly several hundred pupils who have studied elocution, acting, make-up, costuming, etc., and have taken part in constant rehearsals of standard plays. Of these schols the oldest is the American Academy of Dramatic Arts (q.v.), founded in New York in 1884 by Franklin H. Sargent. Many actors who have retired from the stage also make a business of teaching.

A prosperous theatre in the city of New York may in a favorable season do a business of about $400,000 and keep in employment 150 persons. Only a few theatres, and those in large cities, now maintain stock companies of their own; local managers accept the performance given by an American or English company which comes for a shorter or longer period, taking as its pay a certain share of the receipts. As a rule the dramatic author receives from five to ten per cent. of the gross receipts in return for the use of his play. There is also an arrangement called the 'sliding scale,' by which the author's royalties are in a changing ratio to the gross receipts. The employees of the theatre consist of actors, stage hands, or men who move the scenery, manage the lights, etc., musicians, door-keepers, ticket-sellers, and ushers. Where stock companies are maintained there are also a number of scene-painters and costumers employed. Costumes are sometimes provided by the manager and sometimes by the actor. In costume plays—those in which scenery and elaborate costumes of another age are used—the manager provides them; where modern plays are the rule, the male members of the company generally provide their own clothes.

The salaries paid vary according to the standing of the company. In a first-class New York theatre the leading four or five people in the company may receive from $100 to $250 a week. From these figures, which are five times what actors were paid half a century ago, there is a gradual drop to $20 or $25 a week for the people who have but a line or two to say. In companies playing burlesque or light opera, the chorus girls receive from $12 to $20 a week, while the male chorus singers average $20. The star, as the leading actor of the company, male or female, is called, usually makes a special arrangement to take a share of the receipts in lieu of salary. All companies include a stage manager, who often plays one of the parts; for elaborate productions a special stage manager at a salary of from $75 to $100 a week is engaged to arrange the stage pictures. The cost of mounting a new play may vary from $2000 to $20,000, according to the number of people employed upon the stage, their costumes, the scenery, and properties. It is not unusual for the three or four costumes used by a chorus singer in one play to cost $100; the costumes for the dozen or more important characters may cost $500 for each player. The expense of putting on a big London Christmas pantomime, which sometimes employs 250 people on the stage, seldom falls short of $40,000. If a play proves to be a great success a second, third, and even fourth company may be organized to give it on 'the road,' one company going south, another north, thus covering the country before the fame of the original performance has died out.

The arrangement between the owner of the theatre and the manager of the company is a sharing plan. The latter furnishes the play, the actors, such special scenery and properties as have to be carried, the costumes, the street bills, and window advertisements; he also employs a man known as the advance agent to go ahead of the company to awaken interest in the performance by the insertion of newspaper articles and by any other devices that may serve. The manager of the theatre furnishes everything else, including as many extra stage hands as may be necessary to handle especially heavy scenery. The average division of receipts is 60 per cent. to the manager of the company and 40 per cent. to the theatre. A very popular actor may insist upon better terms.

The business of carrying a company through the country is so complicated that it has now largely fallen into the hands of a few large firms, who undertake to lay out the route, to make the engagements with local managers, and the contracts with the railroads for transportation. To lay out a route for a traveling company it is necessary to know (1) the seating capacity of every theatre in order that the company may not be sent to a house which it might pack and still lose money; (2) the number, character, and taste of the population, in order that a play wholly unsuited to it may not be offered; (3) the cost of railroad transportation. The company has to be kept going. In some places it can play a week, in others three nights, in others only one. The manager of the company has to pay all railroad fares, so that the nearer the towns in which he plays the better. Furthermore, he must as far as possible know what other attractions will be offered against him; a circus in a country town will 'kill' any play. The dramatic agencies do all this work for the companies, receiving a certain share of the profits in return and also payment from the managers of theatres to whom they furnish attractions. The most important agencies some years ago organized themselves into a syndicate, which made it almost impossible for any outside manager to engage 'time' in any of the best houses of the larger cities. The syndicate refused to send companies to any theatre which received an outsider. It not only controlled theatres, but it produced plays, recognizing only such playwrights and actors as consented to its terms. As the members of this powerful syndicate are business men rather than artists, art has suffered. A few prominent actors and managers, tired of the syndicate rule, have within the last year or two cut loose from it and have encouraged the building of independent houses in the largest cities of the country. There are now such independent theatres in New York, Philadelphia, Boston, and a few other cities.

The ordinary dramatic company is divided somewhat as follows: (1) leading man and woman, to whom are allotted the most important parts of the play; (2) juvenile man and woman, who play the two parts next in importance; (3) character actors, men or women, who play parts requiring eccentric acting or appearance; (4) old man and woman; (5) heavy man, who is mostly the villain of the piece; (6) utility people, minor actors who can be trusted with small parts; (7) walking gentlemen and ladies, people who simply appear but have nothing to say beyond a few unimportant words; (8) supernumeraries, commonly known as 'supes,' people who fill up stage pictures, but have no lines to speak and are usually under the direction of a 'captain;' (9) the stage manager. Other necessary employees in every theatre are the wardrobe woman, who cares for all the costumes, the property man, who looks out for the furniture and any articles needed upon the stage, the stage carpenters, the electricians, who attend to the lights, and the scene-shifters. The stage manager is responsible for the smooth working of the performance. He sees that the stage is properly prepared for each act, he 'rings' the curtain up and down, and makes sure that each actor is ready for his cue to come on. The stage manager usually plays a small part that will give him time to attend to his other duties. In large companies there is also a stage director, who rehearses the play, calls extra rehearsals when he thinks they are necessary, and is generally responsible for the artistic part of the performance. Each part is studied by two persons in the company, so that in case of sickness the understudy can step in. Rehearsals made necessary by the substitution of an understudy are conducted by the stage manager, who also has charge of the music, the behavior of the supernumeraries, stage hands, etc.

The 'greenroom,' where in the old days the actor could wait while not on the stage, has been sacrificed in most modern theatres to the need of room for the elaborate scenery now used. In Europe it is still an institution and in important theatres, such as the Théâtre Français of Paris, it is a reception room handsomely fitted up, to which the favored patrons of the house are admitted. All important European theatres maintain stock companies, the important members of which are State employees. The company as a whole seldom plays outside of the home theatre, but leading actors are allowed to appear elsewhere as 'guests,' when they receive double pay. This visiting system, which is much in vogue in Germany, enables the chief actors to see what is done in rival theatres and provides variety of entertainment.

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STAGGER BUSH. See Andromeda.

STAGGERS. Various affections of animals. In horses, mad or sleepy staggers is attributed to inflammation of the brain and is considered fatal. Grass or stomach staggers is said to result from indigestion. In sheep a tapeworm in the brain cavity is held accountable for the phenomenon.

STAGHOUND. See Greyhound.

STAGING. Staging and scaffolding are interchangeable terms for the temporary frameworks of timber erected about a building under construction or repair, to furnish platforms for the workmen and for the materials and implements of construction required for immediate use. For exterior work the staging may be built up in one of three ways: by series of movable trestles or 'horses' supporting planks, in successive tiers or stages; by 'putlogs' projecting horizontally through temporary holes in the masonry, to support the platforms; or by rows of lofty poles or posts standing on or in the ground, to which are nailed, bolted, or lashed with ropes the necessary girts and cross-pieces, with braces to prevent the sidewise racking of the frame. In cities a very heavy staging is also built of heavy timbers over the sidewalk for the protection of passers-by. Materials are hoisted by derricks, or in France by means of scaffold-towers of poles, often of elaborate construction. For the erection of interior trusses, as in railway stations, stagings on wheels or rollers are often used, being moved from one truss to the next, as each is completed. Similar stagings are used in decorating and repairing the vaults, domes, or ceilings of lofty interiors. The construction of stagings often calls for a high degree of engineering skill. The stagings erected to support the trusses of bridges while building are called *falsework*.

STAGI′RA or **STAGIRUS.** An ancient town in southeastern Macedonia, on the Strymonic Gulf, celebrated as the birthplace of Aristotle. It was founded in the seventh century B.C. by a colony from Andros, but declined during the Peloponnesian War. The modern village of Stavro is on its site.

STAGIRITE, The. A name frequently given to Aristotle from his birthplace, Stagira.

STAGNELIUS, stȧg-nā′lê-ṳs, Erik Johan (1793-1823). A Swedish poet born on the island of Onland, and educated at Upsala and Lund. He was deeply interested in Gnosticism and treated all sides of this question in his books. He is considered a master of form. He published the epic poem *Wladimir den store* (1817), the philosophico-religious *Liljor i Saran* (1821), *Martyrene, his best drama* (1821), and the tragedy *Bacchanterna* (1822).

STAHL, stäl, Ernst (1848—). A German botanist, born near Strassburg, and educated there, at Halle, and at Würzburg. He became professor in Strassburg in 1880, and professor and director of the botanical gardens at Jena the following year. He visited Ceylon and Java in the winter of 1889-90. Among his books are *Entwickelung und Anatomie der Lenticellen* (1873), *Einfluss des Lichtes auf den Geotropismus einiger Pflanzenorgane* (1884), *Zur Biologie der Myxomyceten* (1884), and *Regenfall und Blattgestalt* (1893).

STAHL, Friedrich Julius (1802-61). A German politician and political philosopher. He was born in Munich of Jewish parents, turned Protestant in 1819, studied at Würzburg, Heidelberg, and Erlangen, and in course of time became professor of law at Erlangen, Würzburg, and Berlin. In 1849 he was made a member of the Upper House of the Prussian Legislature, and in 1850 he was a member of the Erfurt Parliament. Stahl was a leader in the Lutheran Church, and became one of the most powerful influences for reaction in Germany. He stood for an absolute monarch and an absolute Church that should control the monarch. The basis of his political philosophy was the conception of the subserviency of all things lay and clerical to the will of God as expounded by the clergy. His most important work is the *Philosophie des Rechts nach geschichtlicher Ansicht* (1830). Some of his other works are *Ueber Kirchenzucht* (1845), *Das monarchische Prinzip* (1845), *Der* *christliche Staat* (1847), *Die Revolution und die konstitutionelle Monarchie* (1848), *Die lutherische Kirche und die Union* (1859).

STAHL, Georg Ernest (1660-1734). A German physician and chemist, born at Ansbach. He was called in 1694 to the chair of medicine, anatomy, and chemistry in the newly founded university of Halle, whence he removed to Berlin in 1716, and was appointed physician to the King of Prussia. Stahl was one of the ablest chemists of his time, and destroyed numberless absurd opinions which had found their way into science, and propounded the first general theory of chemical transformations (see Chemistry), which was universally accepted till the time of Lavoisier. His works, according to Haller, number 250, the most important being *Theoria Medica Vera* (1707, and 1831-33), which contains his medical theory, and *Experimenta, Observationes et Animadversiones Chymico-Physicæ* (1731), in which his chemical opinions are set forth. An account of his opinions is found in Lemoine, *Le vitalisme et l'animisme de Stahl* (Paris, 1864). Consult also Lasègue, *De Stahl et sa doctrine médicale* (ib., 1846).

STAHR, stär, Adolf (1805-76). A German author, born in Prenzlau, Prussia. After study at the University of Halle he went to the gymnasium at Oldenberg, and in 1836 became professor there. While on a tour through Italy in 1845, which was afterwards described in *Ein Yahr in Italien* (1847-50), he met the author Fanny Lewald, whom he married in 1855, after separating from his first wife. Perhaps the most noteworthy of his writings are his classical studies, which include translations from Aristotle, Suetonius, and Tacitus, and *Bilder aus dem Altertum* (1863-66). His miscellaneous works, some of which have been translated into English, include: *Charakteristik Immermanns* (1842); *Die Republikaner in Neapel* (1849); *Die preussische Revolution* (1850); and *G. E. Lessing, sein Leben und seine Schriften* (1858).

STAIGG, Richard M. (1820-81). An American genre and portrait painter. He was born at Leeds, England, and studied drawing in an architect's office before coming to America in 1831. He began painting miniatures on ivory, and soon attained a high degree of excellence. He was elected member of the National Academy of Design in 1861. In 1867-69 he studied at Paris, and after his return he ceased miniature painting and devoted himself to portraiture and coast scenes. His work is pleasing in color and detailed in execution. His genre pictures, characterized by an unaffected simplicity and grace, include "Learning to Slide" and the "Sailor's Grave," Stuart collection, Lenox Library, New York City, and the "Cat's Cradle."

STAINED GLASS The process of coloring glass requires particular care. When it is to be of full color (as commonly for windows of rich decorative effect) it is called 'pot metal;' but, while colored glass of many hues and tints is used in which the whole mass of the glass is equally stained throughout, certain colors are prepared by covering one side of a piece of colorless glass with pot metal of the color required. Crimson and ruby glass for windows is made in this way, the process being called 'flashing.' Opaline glass, much used for windows in America since 1885, though known and used long before, when very much clouded or stained so as to be nearly opaque, for utilitarian purposes, has some of the opal's power of giving at once the general color and its complementary color; thus glass of smoky blue shows also a spark of orange or of pinkish light. It has been found practicable to give the opaline character to glass of the full color of pot metal; and upon this depends much of the splendor of recent American windows. Glass so colored is often not of the same degree of translucency throughout. Some pieces of opaline and other glass prepared for windows vary much in the same piece with regard to this matter of translucency. The designer, while directing the choice of glass for a rich mosaic window, will sometimes be in doubt just where to cut off the sheet, and will experiment with rays of sunlight falling upon the glass to see where it becomes too nearly opaque for his use. Some of these sheets of glass prepared for rich windows have much change of color in their mass, cloudings, and veinings of different hues, the contrasts being enhanced by the varying thickness of the parts of the same sheet. The composer of a rich window knows how to utilize these contrasts and gradations.

Iridescence, as found on the surface of ancient glass vessels and fragments which have been long buried in the earth, is the result of a curious process of decay, in the course of which the substance of the glass becomes disintegrated, forming thin laminæ, which are no longer brittle as a thin piece of undecayed glass would be, but have rather the crumbling texture of flakes of mica or the like; that is to say, this part of the glass has lost its vitreous qualities. Modern attempts to produce iridescence are, of course, not in that direction; the attempt has been to give the changing play of colored light to the surface of perfect glass. They are of different character, according to the greater or less degree of translucency desired. The ancient and partly decayed glass is of course mainly non-transparent, but still allows some light to pass through it. Thus in a phial or plate of that pale green transparent glass so common in the Greco-Roman period, parts will be brilliantly iridescent when the piece is found, and still other parts will have a whitish degeneracy which is incipient change of mass. These parts will be comparatively opaque, not allowing a small object to be clearly seen through their substances, while other parts of the same vessel will be entirely transparent as soon as the earthy deposits have been removed. The most common iridescent glass of modern manufacture is, however, entirely clear, and an iridescent effect of the surface, like that of the surface of a soap-bubble, is given by some process which is often kept secret. During the last two decades of the nineteenth century a very brilliant glass was made in America by a single establishment. In this glass, the uniting of successive layers of the material, one imposed upon another while hot, allows of giving to one or both surfaces a brilliant iridescence which, when fully developed, makes the whole mass entirely nontranslucent. It is full of the play of brilliant color, nearly like a rich piece of mother-of-pearl. This process differs wholly from enameling (q.v.). in that the glass to be made iridescent is not allowed to lose its high degree of heat. It is continually returned to the furnace at very brief intervals, and the layers of glass become a solid mass, although close examination will often reveal their once separate existence and their number. The idea may have been taken from the Greco-Roman pieces, which are often amber or violet in the natural state of the glass, like modern pot metal, and rendered opaque and iridescent by the gradual decay of the exterior surface.

In the course of experiments upon iridescent and lustrous surfaces, much was done in the way of depositing iron, tin, and other metals in a nearly pure state. By way of producing *tours de force* for exhibition pieces, these metallic deposits were sometimes carried to surprising extremes; thus about 1890 a vase was exhibited which was of glass within, but had its outside almost wholly non-vitreous and showing only an opaque and rough surface of warm brown; and this piece was described by the exhibitor as containing as much iron as glass could possibly receive and retain.

STAINED GLASS WINDOWS. By far the most important use of stained glass is its application to the artistic decoration of windows, usually termed glass painting, though properly speaking it is not painting at all. Originally, there was but one method of making ornamental glass windows, and that was to produce the pattern in outline with finely made leaden frames, into the grooves of which pieces of colored or stained glass were fitted. It appears to have been a branch of art unknown to antiquity and to have been used in a primitive fashion in churches of the fourth and following centuries, the different colors forming not figures, but ornamental patterns. These are described by early authors such as Prudentius, Sidonius, Apollinaris, and Gregory of Tours, but nothing of this period has been preserved. The majority of windows up to the eleventh century were closed by thin slabs of alabaster or other translucent material often pierced by holes arranged to form patterns, as at Santi Vincenzo ed Anastasio and other Roman churches.

One of the best known of the early examples of the use of figures in glass windows is of the eleventh century in the former monastery of Tegernsee (Bavaria); like all of the first attempts, they were only tasteful arrangements of colored glass in imitation of the stone mosaics used for floors, etc. Shortly afterwards in the twelfth century the monk Theophilus describes in his treatise the method of making such windows as the earliest ones at Chartres, Saint Denis, and Vendôme. The centre of the steady progress throughout the twelfth and thirteenth centuries was in Northern France, where the use of Gothic architecture, with its immense increase in the size of the windows, suddenly brought stained glass windows into prominence, not only as one of the most important accessories of architecture, but as the one prominent color factor in the great Gothic interiors. As the windows occupied the entire wall-space between the piers, both in the aisle-walls and clerestories of the churches, they afforded the same opportunity for composition that the solid walls had previously offered to fresco-painting. The French cathedrals of the thirteenth century at Le Mans, Chartres, Bourges, and to a less degree Rheims and Rouen, preserve whole series of contemporary windows, which gave the type to other countries and to the succeeding century. Those of the Sainte Chapelle in Paris are also of extreme beauty. The characteristics of the earliest Gothic windows are: multiplication of small figures in many separate compositions grouped in tiers or rows of framed medallions; rich and dark coloring; wide decorative borders; heavy leads bent so as to outline the figures or cut them in the deep shadows.

The development during the fourteenth century was toward lighter coloring, larger figures, narrow borders, more ornamentation in the body of the windows, more delicate gradations of color, and increase of modeling, loss of simplicity, and tendency to mannerisms, while in the fifteenth century much clear glass was introduced into the backgrounds, and inscribed ribbons and architectural accessories became conspicuous, whereas the earlier windows are composed of many small and distinct pictures set in a groundwork of grisaille (q.v.) or of color ornament, the later ones comprising a single figure or picture for each light or even a composition occupying the whole window. The designers of the Gothic age did not, to any great extent, give the details of their pictures on glass as their successors—Renaissance and modern—mistakenly attempted to do, but obtained their superb effects by a clear knowledge of the interaction of colors, by juxtaposition of complementary colors, and the effect of distances; the technique being that of glass colored not on the surface, but in the mass either by stain or incorporation. This branch of art was, therefore, governed by totally different artistic principles from those governing opaque painting (fresco, oil, tempera, tapestry, etc.), and these principles were thoroughly understood.

The practice of painting on glass, i.e. of applying color with the brush on fusible pigments fixed by heat, began in the use of grisaille, a browning pigment, for cross-hatching and outlining on clear glass the ornamental details of the backgrounds, in order to soften the glare of the clear glass without introducing disturbing color-elements. It was then applied, even in early French windows, to the faces and hands to indicate the features and fingers; and its use extended gradually to all the shaded details, the inscriptions and ornaments, of the later windows. The perfection of the French work of the thirteenth century has never been equaled. These series of cathedral windows were also one of the principal branches of Christian iconography (q.v.), joining with sculpture in expressing the subjects of religious thought in art.

During the latter part of the thirteenth century the art was carried to England, Germany, and Italy, where it did not really flourish before the following century. In Italy the imperfect understanding of Gothic methods did not allow of the use of such immense windows, and the art never became thoroughly acclimated. At Arezzo Cathedral are some windows by a French artist, Guillaume de Marcillati, proving the transmission from France. Other interesting examples are in San Francesco at Assisi, San Petronio in Bologna, and the Cathedral and Santa Croce in

Florence. Many of the best Italian examples belong rather to the early Renaissance than to the late Gothic. England would have possessed some very fine series, as is shown by the examples at York and Canterbury, had it not been for the vandalism of the Reformation. In Spain there are fine windows at Toledo and Leon, very close to French models. Germany, however, ranks next to France in the importance of its remaining windows, beginning in the fourteenth century, with those of the choir of Cologne Cathedral, those of the cathedrals of Freiburg, Strassburg, and Regensburg, and the churches at Oppenheim, Esslingen, and Nuremberg. German works, however, do not approach the French in quality either of technique or art.

As the fifteenth century approached the use of *grisaille* or light colorless monochrome windows increased. This process had always been in use for smaller windows or borders with geometric designs, as at Obasine and Auzerre in France, Heiligenkreuz in Austria, and Sainte Gudule at Brussels, but it became more popular and was used in larger windows as the Renaissance period approached; the brown enamel on the white or greenish ground became lighter, all the glass less opaque, and the leads more delicate. In colored glass windows a brilliant window became very popular, while green and violet went out of fashion. The doner's window at the Cathedral of Evreux shows how the fourteenth-century artist substituted realism for the older conventions, and introduced profusely architectural forms as framework and background of the figures. The increased use of the white line and background and the invention of the yellow stain, used profusely in place of the applied enamel, increased the light effect. With the approach of the fifteenth century the increased perfection in drawing and naturalism does not compensate for the loss of the special methods of glass painting, for which artists commenced to substitute effects taken from wall and other forms of opaque painting. In Germany a peculiar novelty popular during the Renaissance was the use of coats of arms as the exclusive or almost exclusive design. The extreme of possible realism was then reached in the architectural and landscape effects of the windows at Gouda in Holland. Jean Cousin in France; Holbein, Ghiberti, and Paolo Uccello in Italy; Dürer and Baldung Grün in Germany, were among the prominent artists of the Renaissance who designed windows. At the same time this very fall of the glass-painter to the rank of an artisan and the influence of painting on his art hastened its fall in the seventeenth century.

The attempts to revive it during the two following centuries, as exemplified by Sir Joshua Reynolds's remarks, were based upon the same mistaken principles. The glass windows produced to the middle of the nineteenth century were paintings on glass in imitation of oil or water-color pictures—of opaque effects in painting. The majority are, therefore, inadequate and commonplace, works of industry rather than art. The Munich School bettered the process somewhat; the revival of the study of Gothic art between 1850 and 1875, especially that initiated in France by Viollet-le-Duc, led to a better appreciation of and an attempt to revert to mediæval processes. The French first re-discovered them, and American artists, of whom the most prominent is John La Farge, have done perhaps more than any others during the last decade to replace glass painting again in the sphere of real art. Besides studying again the irradiation of colors, the special requirements of transparent painting, and the consequent grouping of complementary colors, artists like La Farge and Tiffany have produced wonderful effects in iridescence with an increase of richness in tones similar to glass mosaic-work. A questionable but extremely popular American innovation has been the introduction of what may be called modeled glass, to reproduce the effects of shading by its purposed or accidental variations of thickness. American artists also make large use of the accidental streakings of vari-colored glass ('pot metal') to produce pictorial effects without painting and without too minute subdivision and leading of the picture.

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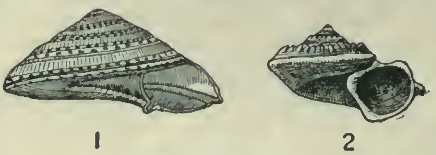
STAINER, stīn′ẽr, JAKOB (1621-83). A German violin-maker, born at Absam, Tyrol. He was the son of poor peasants, but at an early age began to make violins and subsequently studied at Cremona under the best makers of his time. His extravagances kept him in continual poverty and he died in an insane asylum in Absam. Stainer violins are rare and command high prices, though they do not rank with the instruments of Guarnerius, Stradivarius, or the Amati (qq.v.).

STAIN′ER, Sir JOHN (1840-1901). An English composer and organist, born in London. In 1854 he became organist and choirmaster of Saint Benedict and Saint Peter's Church, and two years later was selected by Sir Frederick Ouseley as organist for the newly founded College and Church of Saint Michael, Tenbury. He held this appointment for three years, during which time he had matriculated at Christ Church, Oxford, and had taken his degree of bachelor of music. He next became organist of Magdalen College, Oxford, at the same time entering the university as an undergraduate. In 1863 he took his degree and was appointed organist of the university and conductor of the two musical societies. In 1865 he was made doctor of music, and in 1866 became one of the examiners for musical degrees. He succeeded Sir John Goss as organist of Saint Paul's, London, from 1872 to 1888, when he was knighted by Queen Victoria, and the following year was appointed to the chair of music at Oxford University. He was also professor in the Royal College of Music. In 1878 he was made a chevalier of the Legion of Honor. His compositions are nearly all for the church and include the oratorio *Gideon*, and the cantatas *The Daughter of Jairus* (1878), *Saint Mary Magdalene* (1883), and *The Crucifixion* (1887). Other compositions include numerous anthems, services, canticles, songs, and primers; and, in conjunction with W. A. Barret, a dictionary of musical terms (1876, 3d ed. 1880). His text-books are among the best in the English language.

STAIR, VISCOUNT and EARLS OF. See DALRYMPLE.

STAIRCASE-SHELL. A collector's name for the low, conical, handsomely colored tropical shells of the mollusks of the family Solariidæ, and especially of the genus Solarium. In this genus the umbilicus is widely open, and the sculptured edges of the whorl seen within it are comparable to a spiral staircase. These mollusks are related to the wentletrap (q.v.).



STAIRCASE-SHELLS.

1, The common existing species (*Solarium perspectivum*). 2, A fossil form (*Solarium Leyerici*) from the Upper Cretaceous of Belgium.

STALACTITE (from Gk. *σταλακτός*, *stalaktos*, oozing, from *σταλάσσειν*, *stalassein*, *σταλάζειν*, *stalazein*, *σταλᾶν*, *stalạn*, to ooze) and STALAGMITE (from Gk. *σταλαγμός*, *stalagmos*, dripping, from *σταλάζειν*, *stalazein*, to ooze). Elongated masses of lime, chalcedony, or other mineral substances that depend from the roof or rise from the floor of caves. Water impregnated with carbonic acid is able to dissolve lime, and as all rain and surface water contains more or less carbonic acid, it takes up in its passage through the earth to the roofs of caves a certain amount of lime. When the water is exposed on the roof or floor of the cave, evaporation takes place, and so both the bulk of the water and its solvent power are reduced, and a thin pellicle of solid carbonate of lime is deposited. When this takes place on the roof of the cave, long icicle-like pendants are formed, which are called stalactites; and when the water drops upon the floor, a stalagmitic layer is formed, which rises at the points where the largest supply of material exists in the form of pillars to meet the overhanging stalactites.

STA′LEY, CADY (1840—). An American civil engineer and educator, born in Montgomery County, N. Y. He graduated at Union College in 1865, prospected for gold in the foothills of the Rockies, became a civil engineer on the Central Pacific Railway, in 1867 became assistant in civil engineering at Union, and in 1868 professor of that subject. From 1876 to 1886 he was dean, and in the latter year was appointed president of the Case School of Applied Science at Cleveland, O. His publications include, besides an edition (1875) of Gillespie's *Roads and Railroads*, *Notes on Bridge Engineering* (1875), *Strength of Materials and Stability of Structures* (1876), and *The Separate System of Sewage* (with G. S. Pierson, 1882).

STALK-BORER. A caterpillar which bores commonly into the stems of potatoes, geraniums, spinach, cauliflower, dahlias, corn, and many other plants. It is the larva of a brown noctuid moth (*Papaipema nitela*) commonly found throughout the Eastern United States. The whitish brown striped larva bores longitudinally within the stalks, which wilt. When full-grown they burrow in the ground, where they pupate until fall, when the moths emerge and hibernate. Many other insects bore in the stalks of the plants mentioned.

STALKER, stạk′ẽr, Rev. JAMES (1848—). A minister of the Free Church of Scotland, born at Crieff, in Perthshire. He was educated at the University and New College of Edinburgh, and studied at Halle and Berlin. In 1874 he became minister of Saint Brycedale Church, Kirkcaldy, and in 1887 of Saint Matthew's, Glasgow. In 1902 he accepted the chair of Church history in the United Free Church College, Aberdeen. His works have been widely read throughout the Anglo-Saxon world, and some of them have been translated into several languages. Among them are: *The Life of Jesus Christ* (1879); *The Life of Saint Paul* (1884); *Imago Christi* (1889); *The Preacher and His Models*, lectures delivered at Yale (1891); *Men and Morals* (1892); *The Two Saint Johns* (1895); *The Four Men and Other Chapters* (1892); *The Christology of Jesus* (1899).

STALWARTS. The name applied to those members of the Republican Party in New York State in 1881 and afterwards who adhered to Senators Conkling and Platt and were opposed to the Half-Breeds (q.v.), who favored the administration of Garfield. See CONKLING, ROSCOE.

STALYBRIDGE, stā′lĭ-brĭj. A municipal borough, partly in Lancashire and partly in Cheshire, England, on the Tame, 8 miles east of Manchester (Map: England, E 3). It has fine municipal buildings and is noted for its cotton manufactures, which date from 1776; print works, iron foundries, and machine shops are numerous and important. Population, in 1891, 26,800; in 1901, 27,700. Consult Butterworth, *Historical Account of Stalybridge* (Ashton, 1842).

STAMBUL, stäm-bo͞ol′. The Turkish name of Constantinople (q.v.).

STAMBULOFF, stȧm-bo͞o′lŏf, Stephen (1855-95). A Bulgarian statesman, born at Tirnova of poor parentage. He studied at Odessa, but was expelled from Russia for complicity in the revolutionary propaganda. Upon his return to Bulgaria he engaged in several conspiracies looking toward the liberation of his country from the Turks. In 1879 he was elected to the Sobranye, or national assembly, of which he became president in 1884. Stambuloff combated the Russian influence in Bulgaria and lent his support to the annexation of Eastern Rumelia in 1885. He acted as member of the Regency after the abduction of Prince Alexander in August, 1886, until the election of Prince Ferdinand, in July, 1887, then became Premier, and for nearly seven years ruled autocratically, establishing amicable relations with the Porte, but antagonizing Russia. In time his masterful course gained him bitter enemies and aroused the dissatisfaction of Prince Ferdinand. In May, 1894, the Minister resigned. On July 15, 1895, Stambuloff was set upon by three assassins in the streets of Sofia and was left for dead, expiring three days later. The murderers were sentenced to nominal terms of imprisonment. A confession made by one of them in 1902 implicated several men then in power, and tended to cast suspicion on Prince Ferdinand. Consult: Hulme-Beaman, *M. Stambuloff* (London, 1895); id., *Twenty Years in the Near East* (ib., 1898).

STAMEN (Lat., warp, thread, fibre, stamen). The organ in flowers which produces pollen (q.v.). It is usually differentiated into two regions: (1) A stalk-like portion, called the filament, and (2) the terminal anther which bears the pollen sacs. See FLOWER.

STAM′FORD. A market town in Lincolnshire, England, on the Welland, 16 miles by rail northwest of Peterborough (Map: England, F 4). It is remarkable for its history and its antiquities, of which four fine churches, two old gateways, and the ruins of a priory remain. Its charter dates from 982. Population, in 1901, 8,300. Consult Neirnson, *History of Stamford* (London, 1879).

STAMFORD. A city in Fairfield County, Conn., 33 miles northeast of New York City, on Long Island Sound, and on the New York, New Haven and Hartford Railroad (Map: Connecticut, A 5). It is attractively situated, and contains the homes of many New York business men. There are the Ferguson Library, with more than 10,000 volumes, and the Stamford Hospital. Stamford is especially known for its manufactures of hardware, including locks and keys. Dyestuffs, drugs, pianos, typewriters, and foundry and machine shop products are also extensively manufactured. In the census year 1900 there was invested in all industries capital to the amount of $5,189,195. The output was valued at $4,743,704. The government, under the revised charter of 1899, is vested in a mayor, chosen annually, and a unicameral council. Population, in 1900, 15,997. Stamford was settled in 1641 by a company from Wethersfield, some of whom were natives of Stamford, England. Until 1662, when the Connecticut and New Haven colonies united, it was under the jurisdiction of the latter. Out of part of Stamford, Darien was created in 1820. Stamford was incorporated as a city in 1893. Consult: Huntington, *History of Stamford* (Stamford, 1868), and an article, "Stamford—1641-1900," in *Connecticut Magazine*, vol. vi. (Hartford, 1900).

STAMMERING (from *stammer*, OHG. *stammalōn*, *stamalōn*, Ger. *stammern*, *stammeln*, to stammer; connected with OHG. *stammal*, *stamal*, stammering, *stam*, Ger. *stumm*, mute, Goth. *stamms*, stammering). An imperfect enunciation of words due to irregular or spasmodic action of the muscles of articulation. The trouble is sometimes a form of chorea (q.v.), sometimes entirely an emotional incoördination. In many sufferers, difficulty lies in the enunciation of the initial syllables of certain words, especially if they begin with *b*, *p*, *t*, or *d*. In some cases, when once pronounced, the syllable is involuntarily repeated again and again. This variety of stammering is sometimes termed *stuttering*. The latter is physical, while stammering is mental. The trouble often begins merely as hesitancy with a disposition to avoid certain words, or a little imperfect articulation and stumbling over certain words. Many regard their condition as hereditary because there are other members of their family who stammer. This is probably an error. Mimicry is the cause in many cases. Some begin at the time of an illness, some are due to fright. The great majority of stammerers begin at the age of five years or earlier. Very rarely is the habit formed after twenty years of age. The proportion of males to females is as 4½ to 1. Malformation of organs of speech in stammerers is so rare that it may be denied. In the very rarest instances disease or defect in the hypoglossal nerve and its muscles exists. Emotion, fear, anger, argument, and embarrassment all increase stammering and are in some instances entirely accountable for it. If the bodily condition is improved, the stammerer acquires more self-control and prevents the occurrence. Out-of-door exercise, mental and moral hygiene, avoidance of all undermining influences, and great care result in conquest of the condition in most cases. Boldness and self-reliance will render it impossible. Measured tones, care in attacking each word, and thoughtful deliberation are almost always absolutely successful. Stammerers can always sing without difficulty. Some learn to enunciate distinctly while performing an associated movement, as tilting the head or lifting a finger with each word. It is stated that in the United States there are over 400,000 cases of this speech defect. Consult Lewis, *Practical Treatment of Stammering and Stuttering* (Detroit, 1902).

STAMP (from AS. *stempan*, OHG. *stamfōn*, Ger. *stampfen*, to stamp; connected with Gk. *στέμβειν*, *stembein*, to stamp, *στείβειν*, *steibein*, to tread, Skt. *stambh*, to make firm or steady). A piece of paper upon which a mark or device has been printed or impressed by authority of law, and which is adapted for the purpose of attaching it to some object chargeable with a duty or tax of some nature. The stamp is usually gummed on the back and attached to the instrument or article by adhesion. Such stamps are usually made to represent different values to suit the requirements of the tax law or revenue act under which they are imposed.

The British Government has long employed stamps for the above purposes, and the United States Government for the purpose of raising revenue during the Civil War imposed a stamp tax upon legal instruments and a great variety of other articles of property. The method is to require a stamp to be affixed to an article before it can be sold, which duty is usually performed by the manufacturer of the article. During the Spanish-American War the United States Government passed a war revenue act requiring stamps on legal instruments and certain articles of commerce. This law was repealed when the necessity for the increased revenue had ceased. However, internal revenue stamps are still required on tobacco, snuff, liquors, cigars, etc., under excise laws, and this is considered to be the most satisfactory method of collecting revenue upon such articles. Where a stamp tax is imposed on legal instruments the revenue act usually provides that an instrument shall be void unless it has the proper stamp. However, the courts are liberal in their construction of such provisions, and will usually hold an instrument good if the parties inadvertently have omitted to affix the stamp. Consult: Cooley, *Constitutional Limitations;* Parsons, *Contract.* See Postage Stamps.

STAMP ACT. In American history, an act passed by the British Parliament and signed for George III. (then insane) March 22, 1765, "for granting and supplying certain stamp duties, and other duties, in the British colonies and plantations in America, towards further defraying the expences of defending, protecting, and securing the same." This act, which was to go into effect on November 1st, prescribed (1) that stamped paper be used for legal and official documents, diplomas, and certificates; (2) that stamps be placed on playing cards, dice, books (excepting those used in the schools), newspapers, pamphlets, calendars, almanacs, and various other articles; and (3) that jury trial be denied to offenders at the discretion of the authorized prosecuting officers. Lord Grenville had given notice in March, 1764, of an intention to introduce such an act, and the various colonies had protested vigorously through their authorized agents, but had been unable to suggest any satisfactory substitute. News of its actual passage reached America early in May, 1765, and immediately a fierce opposition everywhere manifested itself on the ground that the colonists were not represented in Parliament and therefore could not legally be taxed without their formal consent. It was urged, moreover, that the duties would be exceedingly burdensome and would cause the withdrawal from circulation of what little specie there was in various colonies. The stamp agents were nearly everywhere compelled by the 'Sons of Liberty' (q.v.) to resign or to destroy their stamps, or both, while many of them were mobbed and much property was destroyed; so that by the time it was to go into effect the act had been virtually nullified. Resolutions, moreover, were passed by many of the colonial assemblies, notably by Virginia (May 30th) (see Henry, Patrick), insisting on the general rights of the colonists as British subjects, and denying the jurisdiction of Parliament over the colonial pocketbook. The famous Stamp Act Congress, composed of delegates from New York, Massachusetts, Connecticut, Rhode Island, New Jersey, Pennsylvania, Delaware, Maryland, and South Carolina, assembled at New York on October 7th, in pursuance of a circular letter sent out June 8th by Massachusetts, and issued a dignified "Declaration of Rights and Grievances," a formal address to the King, and petitions to each House of Parliament. In addition many able pamphlets were written to oppose the act, and on November 1st, when it was to go into effect, bells were tolled, flags were placed at half-mast, and newspapers were put in mourning. Finally, on March 18, 1766, after a long and bitter debate, Parliament repealed the objectionable measure, having previously, however, passed (March 7th) a "Declaratory Act" asserting a right to "bind the colonies and people of America . . . in all cases whatsoever." The repeal caused great rejoicing throughout America, though dissatisfaction was soon expressed with regard to the Declaratory Act. The whole affair has been regarded as one of the chief immediate causes of the Revolution. For the text of the act, consult Pickering's *Statutes at Large,* xxvi. Consult also Frothingham, *Rise of the Republic* (Boston, 1872), and Tyler, *Literary History of the American Revolution* (New York, 1896).

STAMPING OF METALS. See Dies and Die-Sinking; Mint.

STAMP MILL. See Grinding and Crushing Machinery.

STAN'BERY, Henry (1803-81). An American lawyer and jurist, born in New York City. He was educated at Washington College, Pa., was admitted to the bar in 1824, and for several years was in circuit practice in Lancaster County, Ohio. In 1846 he became the first Attorney-General of the State, and in 1866 was appointed Attorney-General of the United States under Andrew Johnson. This office he held until 1868, when he resigned to act as counsel for the President during the impeachment proceedings. He was then nominated for the Supreme Court bench, but the appointment was not confirmed by the Senate, and he resumed his professional labors in Cincinnati.

STANDARD. A battle-flag; in a broader sense, the emblem of a ruler or a nation. On the Egyptian monuments are representations of standards, usually consisting of the image of some sacred animal, a fan or semicircular disk, an ostrich feather, the symbol of victory, the name of the king, or some other symbolic device. The standard-bearer was an officer of approved valor, and distinguished by a badge representing two lions symbolizing courage, and two other emblems of doubtful meaning. In an Egyptian representation of the siege of a town of the Khita, the enemy appear to have as a standard a shield pierced with arrows. The Bible also refers to the use of banners or standards to mark the divisions and subdivisions of the children of Israel on their march from Egypt to Palestine. The Assyrian monuments show standards attached to the chariots. These are circular disks mounted on a pole, and bear the image of two bulls galloping in opposite directions, a disk supported on two bulls' heads, or the god Asshur represented as an archer standing on the back of one or two bulls. According to Xenophon the Persian standard was a golden eagle. The Greeks do not seem to have used flags or standards of any kind, though we hear on some occasions that the signal was given by displaying a scarlet cloak on a spear or pole.

Legend claimed that the first Roman standard was a wisp of hay (*manipulus*) on a pole. In historic times, however, we find a thorough system of military standards or signa. One of these belonged to each maniple (consisting of two centuries), and their details naturally differed with the legion, and the nature of the troops, for the auxiliaries and cavalry naturally bore ensigns not like those of Roman legionaries. As represented on the monuments, the *signum* of the maniple of the legion was a long pole, shod with metal, and near the top a cross-bar, on which seems to have been a plate with the name of the company. From the ends of this bar hung ribbons tipped with silver oak-leaves. Below the bar along the pole are a number of metal disks, which seem to have been marks of distinction, and consequently vary with the legion and company. Above the bar is sometimes a disk, or a hand, the emblem of fidelity, or the figure of an animal, though these latter seem to appear on the standards of native troops in the Roman service. Another standard bore the image of the Emperor. The standard of the legion was a golden eagle, with spread wings, and usually holding a thunderbolt in its claws. It was placed near the commander in battle, and in the camp had a special shrine, for, like all the standards, it was sacred. Another form of standard was the vexillum, a piece of fringed cloth, hanging from a cross-bar on a pole. This was a very old form, as it was the banner hoisted when the Comitia Centuriata was in session. It gave the signal for battle when raised over the general's tent, and was used by any division on detached duty. It was carried by the cavalry of the legion, and seems sometimes to have been attached to the *signum*. The color of the cloth was red or white. For modern standards and national emblems, see FLAG, and HERALDRY, section on *National Coat of Arms*.

STANDARD, BATTLE OF THE. A name frequently given to the battle fought between the English and the Scotch, August 22, 1138, at Northallerton (q.v.).

STANDARD OF LIVING. In economics, the term used to designate the degree of comfort or enjoyment derived from the use of material goods which each social class regards as essential to tolerable existence. Those have a 'high standard of living' who demand control over a large and varied quantity of consumption goods; those whose wants are few and tastes inexpensive have a 'low standard of living.' The terms are usually used without moral connotations, injurious and degrading modes of consumption entering into a 'high' standard of living, as well as consumption of goods which exercise a refining influence. In some sociological studies, however, the test of a high standard of living is its moral influence. Students of the housing problem (q.v.) regard the development of a higher standard with respect to house room as an advance in the standard of life, although such a development may result in checking expenditure in other directions. In a developing society like that of the United States, the gradations of standards of living are as numerous as those of social classes. In a rough way it may be said that the professional and business classes have a higher standard of living than artisans; and the standard of the latter is higher than that of the laborer. Comparing societies as wholes, the American standard of living is higher than the European, which in turn is higher than the Asiatic. While preserving a certain fixity within relatively brief periods of time, the standard of living of classes or of nations tends to rise or fall as a result of general economic conditions. Throughout the Western world standards of living have been rising for the past hundred years, although the standards of isolated classes have fallen.

In recent discussion much emphasis has been laid upon the influence of the standard of living upon wages. If a social class has a high standard, each individual in it will exert himself to the utmost to maintain the same control over goods as his fellows. A rising standard thus acts as a spur to those whose individual wants would demand no great degree of exertion. To raise the standard of backward races or classes is therefore regarded as a prerequisite to industrial improvement. In the second place, a high standard, assuming that it consists in the consumption of goods which improve the physical and mental condition of the laborer—e.g. good food, clothing, housing, a thorough education and technical training for children—tends in the long run to increase industrial efficiency. Thus the native American workman, owing to his high standard of life, is capable of more effective work than underfed and ignorant immigrants. Thirdly, it is difficult for an employer to beat down wages of laborers whose standard is high. Thus a greater share in the social dividend may be diverted to labor. Fourthly, men whose standard is high refuse to marry until they have a fair prospect of bringing up their children in a way in keeping with class standards. Hence the supply of labor is kept from exceeding the demand for it and wages are kept from falling to a subsistence level. See WAGES; POLITICAL ECONOMY.

STANDARD TIME. See TIME, STANDARD.

STANDARD-WING. Either of two African nightjars of the genus Macrodipteryx, in which the second primary wing-quill of the male is enormously elongated, so as to look like a pennant floating from the wing as the bird flies. In one species it has no vane except near the tip; and when the bird sits upon the ground these feathers stand upright. See Plate of NIGHTJARS, ETC.

One of the birds of paradise (*Semioptera Wallacii*) is also known by this name.

STANDING STONES. See MEGALITHIC MONUMENTS.

STAND′ISH, MILES or MYLES (1584-1656). An American colonist, born in Lancashire, England. He served in the English army in the Netherlands, and emigrated to America in 1620, being one of the passengers on the *Mayflower*. He was active among the Plymouth colonists as an explorer and Indian fighter and became military leader of the colony. In the summer of 1625, the colony being in great straits, Standish was sent to England to secure the intervention of the Government against the merchant adventurers, but was unsuccessful. He returned to the colony in the following year with supplies and became one of the proprietors and settlers of Duxbury, Mass., where he held the office of magistrate for the remainder of his life. A granite monument to his memory has been erected in Duxbury. The second courtship of Standish has been made the subject of one of Longfellow's best known poems, *The Courtship of Miles Standish*. Consult Bradford, *Plymouth Plantation* (last ed., Boston, 1898).

STANDPIPE. See WATER-WORKS.

STAN′FIELD, CLARKSON (1793-1867). An English marine and landscape painter. He was born of Irish parents in Sunderland, Durham, and was a sailor and a scene-painter. In 1853 he became a member of the Royal

Academy, and in 1848 settled at Hampstead, where he executed some of his finest pictures. The "Battle of Trafalgar," painted for the United Service Club, is his best work. He painted in a broad style, but his coloring is cold, and he was seemingly untouched by the sentiment of the sea. His realism brought to him the approval of Ruskin, but more recent critics do not find the same pleasure in his works.

STAN'FORD, Charles Villiers (1852—). A British composer, born in Dublin. In 1872 he became organist of Trinity College. In 1883 he received the appointment of professor of composition and conductor of the orchestra at the Royal College of Music; in 1885 he became conductor of the Bach choir, and in 1887 succeeded Macfarren as professor of music at Cambridge. In 1897 he became conductor of the Leeds Philharmonic Society and in 1901 of the Leeds Festival. He received the degree of doctor of music from Oxford and Cambridge, and in 1902 was created a knight. His compositions include many operas, notably *Savonarola* (1884) and *Shamus O'Brien* (1896), but he appealed to a larger public in his oratorios and choral works.

STANFORD, Leland (1824-93). An American capitalist, born at Watervliet, N. Y. In 1849 he removed to Wisconsin and for a time practiced law in Port Washington. In 1856 he established a commercial business in San Francisco. He was elected Governor of California on the Republican ticket in 1861. In the same year he became president of the new Central Pacific Railway Company, and, repairing to Washington, successfully lobbied for the passage by Congress of the bill granting Government aid to the project. In the construction of the road he personally undertook the responsibility and supervision of that part of the road crossing the ridge of the Sierra Nevada Mountains, and as a result 530 miles of mountain road were constructed in 293 days. The road was completed in 1866 to Ogden, Utah, where it was subsequently connected with the Union Pacific system. Stanford was elected United States Senator in 1884 and in 1890. He founded Leland Stanford, Junior, University (q.v.) at Palo Alto, California, as a memorial to his son.

STANG, stäng, Emil (1838—). A Norwegian statesman, son of Frederik Stang. He studied law in Christiania and in 1884, two years after his election to the Storthing, was reckoned the leader of the Conservative Party. In 1891 he was forced to retire after two fairly successful years as Prime Minister and became an assessor of the Christiania Supreme Court. He was called upon again in 1893 to form a Ministry, and stayed in office through the confusion of the early part of 1895, when the task of forming a new Cabinet was declined by nearly every leader of the Radical Party. The dispute as to the division of the consular offices between the two parts of the kingdom caused his overthrow. Stang then returned to his former post in the Supreme Court.

STANG, Frederik (1808-84). A Norwegian statesman, leader of the Conservative Party and Norway's first Prime Minister. He represented Christiania in the Storthing in 1859-60; in 1861 formed a Ministry; and in 1873 became first Prime Minister under the new Cabinet regulations. He became popular owing to his part in the introduction of railroads and telegraphs and kept office in spite of a large radical majority in the Storthing until 1880, when he voluntarily resigned. Stang was a national authority on jurisprudence and constitutional law, his principal works being *Systematisk fremstilling of Kongeriget Norges konstitutionelle eller grundlovsbestimmte ret* (1833) and *Om den kongelige sanktionsret efter Norges grundlov* (1883).

STANHOPE, stăn'op, Charles Mahon, third Earl of Stanhope (1753-1816). An English statesman and scientist. He was born in London and was educated at Eton and at Geneva. Returning to London, he married the eldest daughter of Lord Chatham (1774), was elected to Parliament (1780), and succeeded to his father's peerage (1786). Sympathizing with the French Revolution, he introduced into the House of Lords a motion against English interference in the affairs of France. As his motion had no support, he was thereafter known as 'the minority of one.' He was caricatured as 'Citizen' Stanhope. He devised several mechanical inventions, of which the most important was an iron hand press, called the Stanhope printing press. He also perfected a process of stereotyping, and constructed two calculating machines. Consult Fletcher, *Earl Stanhope's Opinions* (London, 1819).

STANHOPE, Edward (1840-93). An English statesman, second son of the fifth Earl of Stanhope, born in London, and educated at Oxford. He was appointed by Lord Salisbury (1886) Secretary of State for the Colonies. In the following December he was transferred to the War Office and introduced nearly all of the important measures for army reform in England and for the reorganization of the War Department. His administration was sustained in Parliament and the Ministry, but did not enjoy popular support.

STANHOPE, Lady Hester Lucy (1776-1839). The eldest daughter of Charles, third Earl Stanhope. In 1803 she went to reside with her uncle, William Pitt, as superior of his establishment, and became his most trusted confidant and private secretary. Till his death she had full scope for the exercise of her imperious instincts. On the death of Pitt a pension of £1200 a year was assigned her by the King. Conceiving a disgust for society, she left England and wandered for a year or two in the Levant, finally settling among the semi-civilized Druses of Mount Lebanon in a convent, which she fortified, at the village of Djoun. Here she adopted Eastern manners and by the force and fearlessness of her character obtained a curious ascendency among the rude races around her. She was regarded with superstitious reverence as a sort of prophetess, and gradually came so to consider herself. Assuming the garb of a Mohammedan chieftain, she adopted a religion which seems to have been sincere and profound, and was compounded in about equal proportions from the Koran and the Bible. The main sources of information about her are the notes of the frequent travelers, including Lamartine and Kinglake, who visited her in her strange seclusion, and of Dr. Meryon, her occasional medical attendant. Consult: Meryon, *Memoirs of Lady Hester Stanhope* (3 vols., London, 1845); id., *The Seven Years' Travels of Lady Hester Stanhope* (ib., 1846).

STANHOPE, JAMES, Earl (1673-1721). An English soldier born in Paris and educated at Oxford. He took a prominent part in the siege of Barcelona in 1705, and in 1706 was appointed Minister to Spain. In 1708, under Eugene's orders, he captured Port Mahon, and in 1710 saw the final success of his policy of offensive action in the victories of Almenara and Saragossa. But at the close of the year, separated from his allies and surprised by the swift approach of the Bourbon army under Vendôme, after a brief defense he surrendered at Brihuega. Upon his return to England (1712) he entered politics; became Secretary of State for the Southern Department in 1714; and, after being Chancellor of the Exchequer, was again Secretary of State. His foreign policy was vigorous and excellent, especially in the formation of the Quadruple Alliance in 1718.

STANHOPE, PHILIP DORMER. An English statesman and letter-writer, fourth Earl of Chesterfield (q.v.).

STANHOPE, PHILIP HENRY, Earl (1805-75). An English historian, born at Walmer. To his efforts are largely due the National Portrait Gallery, the Historical Manuscript Commission, and the copyright law. Though not a great historian, as Macaulay said, he was clear, concise, and exhibited "great diligence in examining authorities, great judgment in weighing testimony, and great impartiality in estimating characters." His most important works are: *The War of the Succession in Spain; A History of England from the Peace of Utrecht to the Peace of Versailles, 1713-1783*, in 7 vols.; *The History of England, Comprising the Reign of Queen Anne, Until the Peace of Utrecht* (4th ed. 1872). The two works last named are the most elaborate of his writings, but are perhaps not so valuable as his *Life of the Right Hon. W. Pitt.*

STANIMAKA, stä′nė-mä′kȧ. A town of Eastern Rumelia, 12 miles southeast of Philippopolis (Map: Balkan Peninsula, E 3). It has a trade in wine. Population, in 1893, 13,089.

STAN′ISLAS I. LESZCZYNSKI, lyĕsh-chĭn′y′skē (1677-1766). King of Poland from 1704 to 1709, and again in 1733. He was born at Lemberg, Galicia, of one of the greatest among the old Polish noble families. He was Palatine of Posen at the time of the war between Augustus II. (q.v.) of Saxony and Poland and Charles XII. (q.v.) of Sweden, which cost Augustus the Polish throne, and conducted negotiations between them in such a manner as to win the regard of the Swedish King, who secured the election of Stanislas to the Polish throne in 1704. In 1709, when Charles XII. was crushed by Peter the Great in the battle of Poltava, Augustus recovered Poland. The property of King Stanislas was confiscated and he joined Charles at Bender, in Bessarabia. He was Governor of Zweibrücken, in the Palatinate, from 1714 until the death of Charles XII., when he took up his residence in Alsace. His daughter Maria became the wife of Louis XV. of France in 1725, and this alliance enabled Stanislas to obtain the election to the Polish throne on the death of Augustus II. in 1733. The latter's son, Augustus III., was, however, installed with the support of a Russian army. The War of the Polish Succession ensued, and by the preliminary treaty of Vienna, in 1735, Augustus III. was recognized as King of Poland. Stanislas retained his estates and received the duchies of Lorraine and Bar, which after his death were to fall to France, together with a pension of two million francs. He was also allowed to retain the title and dignity of King of Poland. He maintained a court at Lunéville and Nancy, encouraged letters, established institutions of learning, and earned the title *le bienfaisant*. He left four volumes, *Œuvres du philosophe bienfaisant* (1767).

STANISLAS II. AUGUSTUS (1732-98). The last King of independent Poland (1764-95). He was the son of Count Stanislas Poniatowski (q.v.) and was born at Wolczyn. In 1752 he was elected to the Diet and afterwards was sent as a representative to the Russian Court. There he gained the favor of the future Catharine II., who, after the death of Augustus III. of Poland (1763), successfully exerted her influence to bring about the election of Stanislas to the throne in September, 1764. He lacked the force of character to impose submission on the turbulent nobles, and the anarchic condition of the country during his reign rendered its spoliation by Russia, Austria, and Prussia easy. On the third and final partition of the kingdom, in 1795, he laid down his crown. See POLAND.

STANISLAU, stän′ĭs-lou (Pol. *Stanislawów*). A town in the Crownland of Galicia, Austria, on the Bistritza, 75 miles southeast of Lemberg (Map: Austria, J 2). There are railway construction shops, flour mills, dye works, and tanneries. Population, in 1900, 29,628.

STAN′LEY, ARTHUR PENRHYN (1815-81). An English scholar and divine. He was born at Alderley, of which his father (afterwards Bishop of Norwich) was rector. From 1829 to 1834 he was at Rugby, where he was profoundly impressed by the extraordinary influence of Dr. Arnold, then head master, which molded his whole life. His own position in the school was one of marked power, the impression of which is reproduced in Hughes's *Tom Brown's School Days*, though Hughes and Stanley were not, as is frequently supposed, intimate friends at Rugby. He went up in 1834 to Balliol College, Oxford, where he achieved a brilliant reputation. In 1838 he was elected a fellow of University College, was ordained deacon in 1829, and priest in 1843, and soon acquired a great influence, taking a definite stand in favor of latitude and liberality in religious matters, defending both Ward and Hampden, as in later years he defended Jowett and Colenso. He was made Canon of Canterbury in 1851, regius professor of ecclesiastical history and Canon of Christ Church in 1856, and Dean of Westminster in 1864. Here he assumed a commanding position, and used it, as the recognized leader of the Broad Church party in England, for widening the bounds of the national Church. His preaching was more ethical than doctrinal, and his intercourse with those outside the Church of England, whom he welcomed to the Abbey and even to its pulpit, although it offended many strict churchmen, gained him a wide popularity. He accompanied the Prince of Wales (now King Edward VII.) on his tour through the East in 1862, and was closely associated with Queen Victoria, whose chaplain he was for many years. In 1863 he married Lady Augusta Bruce, daughter of the Earl of Elgin; her death in 1876 gave him a shock from which he did not recover. He visited the United States in 1878, traveled widely, and made many memorable addresses which were published under the title of *Addresses and Sermons in America.* His most important literary work was his *Life and Correspondence of Dr. Arnold* (1844). Other noteworthy books were his *Sinai and Palestine* (1856); *Lectures on the History of the Eastern Church* (1861); *Lectures on the History of the Jewish Church* (1863-76); *Essays on Church and State* (1870); and *Christian Institutions* (1871). Consult: Prothero, *Life and Correspondence of Dean Stanley* (London, 1893); id., *Letters and Verses of Dean Stanley* (ib., 1895); Bradley, *Recollections of A. P. Stanley* (ib., 1883).

STANLEY, David Sloane (1828—). An American soldier, born in Cedar Valley, Ohio. He graduated at West Point in 1852. During 1861 he served in Kansas and Missouri, taking part in several engagements, including the battle of Wilson's Creek, and on September 28, 1861, was appointed brigadier-general of volunteers. In 1862 he commanded a division of the Army of the Mississippi in the operations against New Madrid and Island Number 10, and in the battles of Iuka and Corinth. On November 24, 1862, he became chief of cavalry of the Army of the Cumberland, and on November 29th was promoted major-general of volunteers. He took part in the battle of Stone River, in most of the battles of the Atlanta campaign, in the movement of concentration about Nashville, and in the battle of Franklin, November 30, 1864. A wound received at Franklin terminated his active campaigning in the war. For gallantry in this battle he received the brevet of major-general, U. S. A. After the war he became colonel of the Twenty-second Infantry and was actively engaged in campaigning against the Indians in the Northwest. In 1884 he became a brigadier-general, retiring in 1892.

STANLEY, Edward Henry Smith. An English statesman, fifteenth Earl of Derby (q.v.).

STANLEY, Frederick Arthur, Earl of Derby (1841—). An English statesman, second son of the fourteenth Earl of Derby. He was born in London and was educated at Eton. Elected to Parliament in 1865, he sat in that body as a member for various Conservative constituencies until 1886, and was nominated to several important offices, including Secretary of State for the Colonies (1885-86). In 1886 he was raised to the peerage as Baron Stanley of Preston, and from 1888 to 1893 was Governor-General of Canada. In 1893 he succeeded his brother as sixteenth Earl of Derby. Upon the accession of King Edward VII. Lord Derby was nominated supernumerary aide-de-camp to his Majesty and Lord Lieutenant of Lancashire.

STANLEY, Sir Henry Morton (1841—). An African explorer. He was born at Denbigh, Wales, the son of John Rowlands, who died when the boy was two years old. When 16 years old he worked his way on a sailing vessel to New Orleans, where he found employment in the office of a merchant, named Stanley, who became his friend. For this reason the youth changed his name to that of his benefactor. He enlisted in the Confederate Army and in the battle of Shiloh (1862) was taken prisoner, but managed to escape and soon after returned to his Welsh home. In 1863 he went to New York, enlisted in the Federal Navy, was assigned to the flagship *Ticonderoga,* and soon became secretary to the admiral. For gallantry in swimming 500 yards under fire to fix a line to a Confederate steamer he was made an officer. After the war he left the navy and in 1867 acted as newspaper correspondent in one of the Indian campaigns in the West. In 1868 he was sent by the New York *Herald* to Abyssinia with the British expedition under Sir Robert Napier. In 1869 the *Herald* dispatched Stanley to find David Livingstone (q.v.) in Central Africa. After spending a year in traveling through various countries of the East, Stanley started from Zanzibar February 5, 1871, with about 200 men, and on November 10th met the feeble and almost helpless Livingstone at Ujiji, on Lake Tanganyika (q.v.), nursed him back to better health, and, as he declined to return to Europe, gave him the supplies needed to continue his explorations. After taking part with Livingstone in an exploration of the northern end of Lake Tanganyika, Stanley returned to Europe in 1872, and in 1873 was sent by the *Herald* to West Africa to report the British campaign against the Ashantis.

In 1874 Stanley determined to take up the exploration of Africa where Livingstone had left it. The New York *Herald* and the London *Daily Telegraph* shared the expense of fitting out this expedition. On November 12, 1874, Stanley left Bagamoyo, near Zanzibar, with 356 men in his caravan, including three young white men. Stanley's first great work was a boat survey of the coasts of the Victoria Nyanza (q.v.). He also spent some time with the Waganda on the shores of the Victoria Nyanza. To the west of the Victoria Nyanza Stanley discovered the Muta Nzige (Lake Albert Edward), one of the head reservoirs of the Nile. He found that the Kagera or Alexandra Nile, rising near Lake Tanganyika, was the most important feeder of the Victoria Nyanza. Arriving at Tanganyika (1876), he sought in vain for its outlet, the fact being that the level of the lake was then so low that no water was passing through the Lukuga into the Congo (q.v.). His expedition had been greatly enfeebled by fever and smallpox, but he pushed westward to Nyangwe, on the Lualaba, which Livingstone and Cameron had visited. Stanley determined to make his way down the great river, and in November, 1876, embarked on the perilous journey. He was frequently attacked by cannibals, thousands of whom sometimes pursued him in canoes, and if it had not been for his guns his expedition would undoubtedly have perished. After a voyage of over 1500 miles, in the course of which he twice crossed the equator, he emerged on the Atlantic coast, having lifted the veil that had hitherto hung over the Congo, which was thus shown to be the same river as the Lualaba. On August 9, 1877, the party marched into Boma, on the lower Congo, 999 days after leaving Zanzibar, having traveled over 7000 miles. Besides his three white companions Stanley lost 170 of his porters. In the spring of 1879 Stanley sailed again for Africa under the auspices of the Africa International Association (q.v.), and began five years of incessant toil, founding his stations from Vivi, on the lower Congo, to Stanley Falls, about 1300 miles up the river, making treaties with 450 native chiefs, carrying all his supplies and steamboats in sections on the heads of men 235 miles around the rapids of the lower Congo, building station houses, and planting gardens. The years 1885 and 1886 were a period of comparative rest for the explorer, who had now been the recipient of honors from learned societies all over the world and was the most distinguished of living explorers.

In 1886 Stanley was placed at the head of an expedition for the relief of Emin Pasha (q.v.), Governor of the Equatorial Province of the Egyptian Sudan. In March, 1887, he reached the mouth of the Congo, ascended it to the Aruwimi, pushed on to the head of navigation on this tributary, and then struck out through the equatorial wilderness in the direction of the Albert Nyanza. The party marched for months through interminable tropical forests, where they had literally to hew their way, and did not reach the Albert Nyanza until December 13, 1887. Out of 389 men only 174 were left, and they were little more than skeletons. In April, 1888, the intrepid Emin Pasha made his appearance on the shores of the lake. Stanley now retraced his steps to the Aruwimi in order to bring up a detachment of men which he had left there. He found but a remnant of them. For the third time he crossed the vast forest, and in January, 1889, he rejoined Emin, with whom he proceeded to the coast. On this journey Stanley made his second crossing of Africa, emerging at Zanzibar after discovering the extent of the great forest, the water connection between Lake Albert Edward and the Albert Nyanza, the snow-capped Ruwenzori mountain chain between the two lakes, and the southwestern prolongation of the Victoria Nyanza. This expedition ended his active career in Africa, of which he had given to the world more information than any other man, excepting Livingstone. Stanley was patient and kind to the natives, and his success in founding the Congo Free State (q.v.) was largely due to the confidence he inspired and the friendships he won by his unfailing tact. At the same time he did not hesitate to fight the Africans with every resource at his command if their hostility threatened the destruction of his expeditions or imperiled his enterprises.

Stanley was married to Dorothy Tennant, the artist, in 1890. In 1892 he became a naturalized citizen of Great Britain, and in July, 1895, he entered the British Parliament for North Lambeth as a Liberal Unionist. In 1899 he received a Knighthood of the Bath. His books, which were published in London and New York, and most of which have been translated into several languages, are: *How I Found Livingstone* (1872); *My Kalulu* (1872); *Coomassie and Magdala* (1874); *Through the Dark Continent* (1878); *The Congo* (1885); *In Darkest Africa* (1890); *My Dark Companions* (1893); *Slavery and the Slave Trade in Africa* (1893); *My Early Travels and Adventures in America and Asia* (1895); and *Through South Africa* (1898).

STANLEY, Thomas (1625-78). An English translator, born at Cumberlow, Hertfordshire, and educated at Cambridge. During the Civil War he traveled on the Continent, returning near its close and taking rooms in the Middle Temple, where he devoted himself to literature. He wrote considerable verse, and translated many classical writers. Long famous were his edition of Æschylus with a Latin translation (1663) and his compilation under the title *History of Philosophy* (4 vols., 1655-62). Consult Stanley's *Poems and Translations*, edited with memoir by S. E. Brydges (London, 1814-15), and his translations of Anacreon, edited by A. H. Bullen (Bohn's Classical Library, ib., 1893).

STAN'NARD, Henrietta Eliza Vaughan (Palmer) (1856—). An English novelist, born at York. She became well known under the pseudonyms John Strange Winter and Violet Whyte. In 1884 she married Arthur Stannard, a civil engineer. Her first great successes were *Sketches of Cavalry Life* (1881), *Bootles' Baby* (1885), and *Houp-la* (1885). Till she threw off the mask of anonymity, these stories were supposed to have been written by an army officer. Among her later novels are: *On March* (1886); *Garrison Gossip* (1887); *A Siege Baby* (1887); *Beautiful Jim* (1888); *A Blameless Woman* (1895); *Heart and Sword* (1898); *The Married Miss Binks* (1900); *A Blaze of Glory* (1902); and *Marty* (1903).

STANOVOI (stä'nō-voi') **MOUNTAINS.** A mountain range of Eastern Siberia. It begins on the Mongolian frontier south of Lake Baikal, where it merges with the Altai Ranges and is known as the Yablonoi Mountains (Map: Asia, O 2). Thence it extends northeast in a large zigzag line 2400 miles, following for a part of its length the shores of the Sea of Okhotsk, and terminating in the East Cape on the Bering Strait. For a long time imperfectly explored, it is now known to be not a true mountain range, but a plateau or height of land forming the water-parting between the Pacific and Arctic Oceans. It reaches its highest altitude, over 8000 feet, in Mount Tehokhondo, or Sokhondo, in the extreme southern part, where it consists of rounded ridges covered with birch and larch forests. Farther north its mean elevation is only 3000 feet.

STAN'TON, Edwin McMasters (1814-69). An eminent American statesman, born at Steubenville, Ohio, December 19, 1814, of Quaker descent. He studied at Kenyon College from 1831 to 1833, later studied law, and was admitted to the bar in 1836. He first practiced in Cadiz, Ohio, and in 1837 became prosecuting attorney of the county. Later he practiced in Steubenville, Ohio, and in Pittsburg, Pa., where he became the leader of the bar, and gained a high reputation, in particular, for his conduct of the case of the State of Pennsylvania vs. the Wheeling Bridge Company. In 1856 he removed to Washington and practiced extensively before the United Sates Supreme Court. In 1858 he was in California acting as counsel of the United States in certain important land cases. After President Lincoln's election in 1860, on the reorganization of Buchanan's Cabinet, Stanton was appointed Attorney-General to succeed Jeremiah Black. In politics he was originally a Jacksonian Democrat, but later he became a stanch anti-slavery advocate, and while a member of Buchanan's Cabinet took a firm stand for the Union, declaring that the surrender of Fort Sumter would be a public crime. In the following March he retired with the other members of the Cabinet, but in January, 1862, was recalled by Lincoln, and was given the portfolio of Secretary of War, in which office he shared with the President the burden of the vast war operations of the Government. His administration was marked by a course of integrity, comprehensive judgment, determination, and force which won for him the admiration of his countrymen, although at the same time provoking criticism on the part of his opponents.

Shortly after the assassination of President Lincoln, Stanton tendered his resignation, but was induced by President Johnson to remain at the head of the War Department. After the breach between President Johnson and Congress over the various questions growing out of the reconstruction of the Southern States, Stanton took sides against the President and supported Congress. The President called for his resignation on August 5, 1867. Stanton refused to resign, on the ground that his withdrawal would seriously interfere with the execution of the reconstruction acts, to which the President was strongly opposed, and was encouraged by leading men of the Republican Party to hold to the office. On the 12th of August the President suspended him, but Stanton still refused to surrender the office, after which the President removed him in spite of the Tenure of Office Act (q.v.), and designated a Secretary *ad interim* Again Stanton refused to give up the office and continued to hold it until after the impeachment and acquittal of the President, when he sent in his resignation and turned the office over to his successor. He then resumed the practice of his profession, but his health had been broken by his long and arduous labors. On December 20, 1869, President Grant nominated him an associate justice of the Supreme Court, and he was at once confirmed by the Senate. He died four days after this appointment. The most comprehensive *Life* is that by Gorham (2 vols., Boston, 1899).

STANTON, Elizabeth (Cady) (1815-1902). An American reformer and promoter of the woman's rights movement, born at Johnstown, N. Y. She was educated at Johnstown and at Troy, N. Y., and married Henry B. Stanton (q.v.), the anti-slavery reformer. She became interested in the anti-slavery and other reform movements at an early age, and through acquaintance with Lucretia Mott (q.v.) was led to sign the call for the first woman's rights convention, which was held in Seneca Falls, N. Y., in July, 1848. This convention made the first formal demand for the extension of the suffrage to women, and of the National Woman's Suffrage Association there formed Mrs. Stanton became the first president, retaining that office until 1893. From 1848 she devoted a greater part of her time to traveling from State to State, addressing political conventions, State Legislatures, and educational bodies in behalf of woman's rights. In 1868 she was a candidate for Congress. She was connected editorially with various reform periodicals, was a frequent contributor to magazines, and was joint author of *A History of Woman's Suffrage* (3 vols., 1880-86). *Eighty Years and More,* an autobiography, was published in 1895.

STANTON, Frank Lebby (1857—). An American poet and journalist, born at Charleston, S. C. After an apprenticeship as a printer, Stanton was connected editorially with newspapers in Atlanta, and finally became an editor of the Atlanta *Constitution.* He contributed to many magazines and some of his poems were collected in volumes such as *Songs of the Soil* (1894) and *Comes One With a Song* (1898). Stanton's verse, appearing at random, and mostly in newspapers, has distinct literary merit, in that it presents faithfully the folk-lore and crude poetry of the Southern negro. In this field, though at present less conspicuously (especially in the North), his position is not unlike that of Joel Chandler Harris and Thomas Nelson Page.

STANTON, Henry Brewster (1805-87). An American reformer and journalist, born in Griswold, Conn. In the abolition movement he became prominent and allied himself with the political abolitionists in opposition to the followers of William Lloyd Garrison, who did not believe that anything could be accomplished by political action. In 1840 he married Elizabeth Cady, and proceeded to London, where he was secretary of the World's Anti-Slavery Convention. Later he studied law, and practiced first in Boston, and then in Seneca Falls, N. Y., being elected from the latter place to the State Senate in 1849 and 1851 as a Free-Soil Democrat. He took part in the organization of the Republican Party. In addition to his connection with various anti-slavery papers, he was a member of the staff of the New York *Tribune* for several years, and was an editor of the New York *Sun* from 1868 until his death. He published *Sketches of Reforms and Reformers in Great Britain and Ireland* (1849), and *Random Recollections* (1886).

STANTON, Oscar Fitzalan (1834—). An American naval officer, born at Sag Harbor, N. Y. He graduated at the U. S. Naval Academy in 1855, and after considerable service in Mediterranean and African waters, cruised with the Pacific Squadron from December, 1860, to March, 1862. Promoted to be lieutenant-commander in June, 1862, he commanded the steamer *Tioga* of a squadron operating on the James and Potomac rivers, and from December, 1863, to November, 1864, was with the West Gulf Blockading Squadron in command of the *Panola.* After ordnance duty at the Brooklyn Navy Yard, and some service with the East Gulf Blockading Squadron, he held the command of various vessels and served at the Norfolk Navy Yard, the United States Naval Station, the New London Naval Station, and at the Naval Academy. In 1891 he was made commodore and in 1893 was given the command of the North Atlantic Station with the rank of acting rear admiral. In 1894 he was retired.

STAN'WIX, John (1690-1766). An English soldier. He entered the army in 1706 and in 1756 he came to America as commander of the Sixtieth or Royal Americans, and was put in charge of the southern district with headquarters at Carlisle, Pa. He was sent to Albany in 1758 and erected Fort Stanwix at the Oneida portage. At the time of Wolfe's expedition against Quebec, Stanwix commanded in Pennsylvania and restored Fort Duquesne, now Pittsburg. He returned to England in 1760, and was appointed Governor of the Isle of Wight. He was drowned while crossing the Irish Channel.

STAN'YHURST, Richard (1547-1618). A translator of Vergil, born in Dublin, Ireland. He was educated at Oxford. He contributed a "Description of Ireland" and a "History of Ireland" (during the reign of Henry VIII.) to Holinshed's *Chronicles* (1577). Two years later he passed over to the Continent never to return. At Leyden he published his translation of the first four books of the *Æneid* into English hexameter verse (1582). The work is curious as an attempt to base English verse on quantity rather than on stress or accent. He thereafter devoted himself to histories and theological treatises in Latin prose. Having become a Roman Catholic, probably not long after he had left England, Stanyhurst was appointed chaplain to Archduke Albert, the Spanish ruler of the Netherlands, and was involved in the intrigues against Elizabeth. He died at Brussels. Consult the reprint of the *Translation of Vergil,* edited, with introduction, by Arber (London, 1895).

STAPFER, stȧp'fâr', Paul (1840—). A French essayist, born in Paris, where he was educated at the Bonaparte Lyceum. He was tutor in the family of Guizot, and afterwards obtained a position in the faculty of Grenoble as a professor of foreign literature. In the same capacity he went to Bordeaux in 1883. Stapfer's essays are remarkable for their clearness of style, perfection of finish, and accuracy of detail. Among his works are: *Petite comédie de la critique littéraire de Molière selon les trois écoles philosophiques* (1866); *Causeries guernesiaises* (1881); *Shakespeare et l'antiquité* (1883); *Gothe et ses deux chefs-d'œuvre classiques* (1881); *Racine et Victor Hugo* (1886); *Rabelais, sa personne, son génie, son œuvre* (1889); *Montaigne* (1894); and *La grande prédication chrétienne en France: Bossuet, Adolphe Monod* (1898).

STAPH'YLOCOC'CUS. See Bacteria.

STAPH'YLO'MA (Neo-Lat., from Gk. *σταφύλωμα*, defect of the eye within the cornea, from *σταφυλή*, *staphylē*, bunch of grapes, swollen uvula). A term employed to signify a protrusion of one of the coats of the eye, chiefly of the sclera or cornea. Staphyloma of the sclera may be anterior, equatorial, or posterior. *Posterior staphyloma* usually results from choroiditis or is associated with myopia. Ophthalmoscopic examination shows a crescentic white patch at the temporal side of the optic disk. *Anterior* and *equatorial staphyloma*, bulging of the sclera at its anterior or middle portion, are the result of increased intraocular tension, caused by inflammatory processes. If the entire cornea is involved the staphyloma is called *total;* if only a portion protrude, it is spoken of as *partial.*

STAPLE (AS. *stapel, stapol, stapul,* prop, post, OHG. *staffal, staphal,* Ger. *Staffel,* step, from AS. *stapan,* OHG. *stephan, staphōn,* to go, step; ultimately connected with Eng. *stand*). In England, a town officially designated by the Government as a market for sale and exportation. All towns were not staple towns. They were originally for the convenience of the tax collector, but their inhabitants appreciated the monopoly and jealously guarded their privileges.

STAPLES, stā'p'lz, William Read (1798-1868). An American jurist and historian, born in Providence, R. I. He graduated at Brown University in 1817, studied law, and in 1819 was admitted to the bar. He rose rapidly in his profession, was an associate justice of the Supreme Court of Rhode Island from 1835 to 1854, and from 1854 to 1856 was Chief Justice. He was an authority on Rhode Island history and published *Annals of Providence to 1832* (1843); *Documentary History of the Destruction of the "Gaspé"* (1845); *Proceedings of the First General Assembly for the Incorporation of Providence Plantations in 1647* (1847); and *Rhode Island Form-Book* (1859). He edited vol. ii. of the Rhode Island Historical Society's *Collections,* and Samuel Gorton's *Simplicities' Defense Against Seven-Headed Policy* (1835).

STAPPEN, *Fr. pron.* stȧ'päN', Charles Pierre van der (1843—). A Belgian sculptor, born at Saint Josseten-Noode, near Brussels. He began his artistic training in 1860, under the painter Portaels, but afterwards formed an independent style in Paris under the influence of Rude, Mercié, and Carpeaux. His first successful production, the bluntly naturalistic "Faun's Toilet" (1869, gold medal, Brussels), brought him the election to the Brussels Academy. It was followed by "The Sorceress" (1872) and the "Man with the Sword" (1876, Brussels Museum). A sojourn of several years in Italy, during which he studied Donatello and Michelangelo, resulted in maturer works, of which a youthful "David" (Munich Academy) is the most remarkable. Upon his return to Brussels, in 1883, he was appointed professor at the Academy, and thereafter produced in rapid succession the allegorical group of "Instruction in Art" (Palais des Beaux-Arts), "Saint Michael Overcoming Satan" (Staircase, Hôtel de Ville), and the statue of "William the Silent" (Place du Petit Sablon). Gradually developing an individual style of his own, which combines severe and lofty conception with a wholly untrammeled naturalistic treatment, he aimed especially at a vigorous dramatic expression. His most noteworthy creations of this kind include "The Wrestlers," "The City Builders," and the "Chimera Fountain" (Parc du Cinquantenaire, Brussels). He also fashioned numerous portrait busts of great vivacity, genre figures, allegorical and realistic reliefs, designs for épergnes, candelabra, and various other objects of industrial art, and contributed actively to the revival of the chryselephantine statuary of Greek antiquity, recently inaugurated in Belgium. In 1898 he was appointed director of the Brussels Academy.

STAR (AS. *steorra,* OHG. *sterro, sterno,* Ger. *Stern,* Goth. *staírnō,* star, connected with Lat. *stella,* Gk. *ἀστήρ, astēr,* Corn., Bret. *steren,* Arm. *ast*λ, Skt. *tāra,* star, Av. *starə,* star, and possibly with Skt. *star,* to strew). One of those heavenly bodies which remain *apparently* immovable with respect to one another. Hence they were early called *fixed* stars, a name which they still retain, although their perfect fixity has been completely disproved in numerous cases, and is no longer believed in regard to any. Twinkling or scintillation is another mark which distinguishes stars from planets. The first thing that strikes the observer is the apparent daily motions of the stars. The greater part appear to rise in the east, describe smaller or greater arcs in the heavens, and set in the west; while others describe complete circles around the pole of the heavens. These apparent motions arise from the rotation of the earth on its axis. (See Earth.) With few exceptions the distance of the fixed stars is still unknown, and must in all cases be enormously great. Since the time of Bradley many attempts have been made to measure what is called the annual parallax (q.v.) of the stars, and thus determine their distances. When we consider that the motion of the earth round the sun alters our position in space a whole diameter of its orbit (185,000,000 miles) in six months, we should expect a change in the relative positions of certain stars as seen from two opposite points of the orbit. But no such change is seen to take place, and this was one of the early objections to the theory of Copernicus (q.v.). The only answer that the Copernicans could give was that the distance of the stars from us is so great that the diameter of the earth's orbit shrinks into insignificance when compared with it. The detection of the parallax of the fixed stars depended upon the perfection of instruments. The parallax of a star is the minute angle contained by two lines drawn from it, the one to the sun, the other to the earth. If that angle amounted to a second the distance of the star would be at least 206,000 times that of the sun; and when the measurement of angles came to be reliable to a second and still no parallax was discernible astronomers could say that the distance of the nearest stars must be more than 206,000 times that of the sun, i.e. 206,000 times 93,000,000 miles.

The method now in use for measuring stellar parallaxes was first applied successfully by Bessel (q.v.) in 1838. He employed in his observations a remarkably fine heliometer (q.v.) and adopted what is called the differential method. Having selected a star which he suspected might be near us, and therefore have a parallax large enough to measure, he proceeded to determine every clear night its position in the sky relatively to two neighboring very small stars. Such relative (differential) determinations of positions can be made with far greater accuracy than measures with the meridian circle (q.v.); and Bessel judged rightly that the two minute comparison stars were really so immeasurably far away that they would themselves suffer no appreciable parallactic displacement. Sure enough, he found his 'parallax star,' 61 Cygni, slowly describing day after day a tiny oval curve in the sky, reproducing there the earth's orbit in space. But the comparison stars did not move. The proof was complete that 61 Cygni had an apparent motion due to the real motion of our earth, and that it was *measurable.* This observation of Bessel's is one of the most famous in the annals of astronomy.

When other astronomers had succeeded in repeating Bessel's observations, and quite a number of stars came to have known parallaxes, their distances were found to be too great to be expressed conveniently in miles, or any other linear unit. Therefore astronomers invented a new unit, the 'light-year,' being a distance equal to the space traversed by light in one year. As light moves about 180,000 miles per second, it will be seen that the light-year is a unit of stupendous magnitude, and will be fitted to measure the profound distances of stellar space. A few of the larger stellar parallaxes at present known are as follows:

STAR	Magnitude	Parallax	Distance in light-years
Centauri α..................	1	0″.75	4.4
Lalande 21,185............	6.9	0 .50	6.5
61 Cygni.....................	5.1	0 .40	8.1
Sirius..........................	1	0 .39	8.4

In this table the second column gives the 'magnitude' of the stars. The third column gives the parallax, or angle subtended by the earth's orbit-radius at the star. The corresponding distance in light-years is in the last column. Thus we do not see the stars as they are to-day, but as they appeared so many years ago.

The principal constellations north of the Zodiac (q.v.) are:

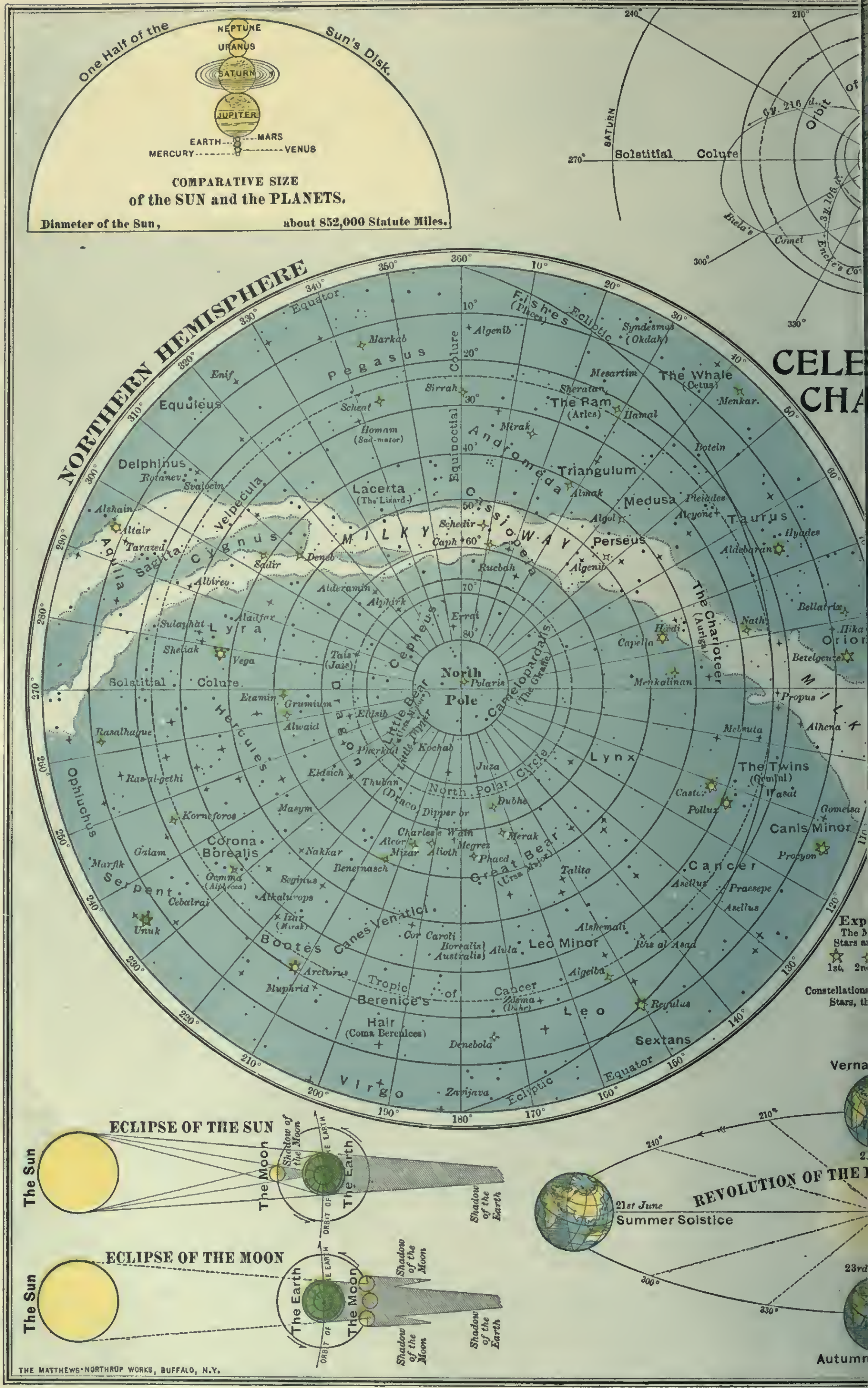
Ursa Major.
Ursa Minor.
Draco.
Cepheus.
Cassiopeia.
Camelopardus.
Andromeda.
Perseus.
Auriga.
Leo Minor
Canes Venatici.
Coma Berenices.
Boötes.
Corona Borealis.
Hercules.
Lyra.
Cygnus.
Vulpecula.
Aquila.
Antinous.
Delphinus.
Pegasus.
Ophiuchus.

The principal constellations south of the Zodiac are:

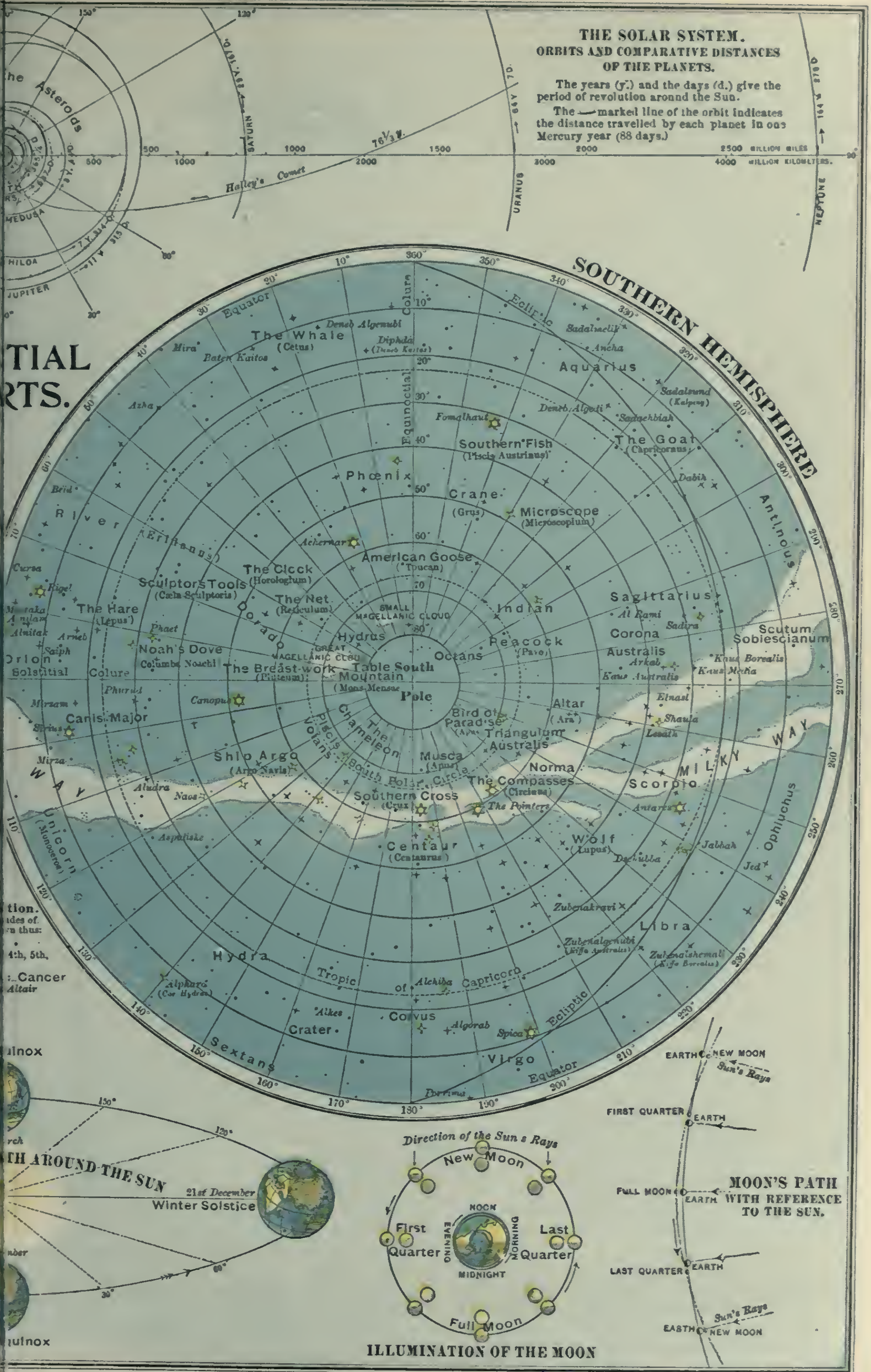
Cetus.
Orion.
Lepus.
Centaurus.
Lupus.
Monoceros.
Canis Major.
Canis Minor.
Crux.
Argo-Navis.
Hydra.
Crater.
Corvus.
Eridanus.

For the constellations of the Zodiac, see Zodiac. The several stars belonging to the same constellation are usually distinguished from one another by Greek letters, beginning the alphabet with the brightest; and when these are not sufficient by Roman letters and by numbers. Many of the most brilliant stars have special names. They are also divided according to their brightness into stars of the first, second, third, etc. magnitudes, a division which is necessarily somewhat arbitrary. The smallest stars discernible by the unaided eye are usually called stars of the fifth magnitude; but an unusually sharp eye can discern those of the sixth and even seventh magnitude. All below are telescopic stars, which are divided down to the twentieth magnitude. The quantity of light given by a star of any magnitude is taken as 2.512 times as great as the quantity given by a star one magnitude fainter. This number is called the 'light-ratio,' and it is so chosen that a diminution of five magnitudes corresponds to a division of stellar light by just 100 ($2.512 = \sqrt[5]{100}$). In other words, 100 average stars of the sixth magnitude should give as much light as one of the first.

But the whole matter of stellar photometry is subject to some uncertainty. According to the *Harvard Photometry* the following are the brightest stars in the order of lucidity: Sirius, Canopus*, Arcturus, Capella, Vega, α Centauri*, Rigel, Procyon, Eridani*, β Centauri*, α Orionis, Altair, Aldebaran, α Crucis*, Antares, Pollux, Spica, α Piscis Austria*, Regulus. Those marked with an asterisk are not visible in our northern latitudes. No real magnitude in the proper sense of the word has yet been observed in any star. In the best and most powerfully magnifying telescopes, even the brightest stars of the first mag-



THE MATTHEWS-NORTHRUP WORKS, BUFFALO, N.Y.



THE SOLAR SYSTEM.
ORBITS AND COMPARATIVE DISTANCES OF THE PLANETS.

The years (y.) and the days (d.) give the period of revolution around the Sun.

The ⟶ marked line of the orbit indicates the distance travelled by each planet in one Mercury year (88 days.)

SOUTHERN HEMISPHERE

ILLUMINATION OF THE MOON

MOON'S PATH WITH REFERENCE TO THE SUN.

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nitude appear, not with small disks as all the planets do, but as luminous points without any visible diameter, and always the smaller the better the telescope. We are, therefore, totally ignorant of the real size of the fixed stars; nor could it be determined though we were sure of their distances, for the apparent diameter is an essential element in the calculation. We cannot, then, say whether the greater brilliancy of one star, when compared with another, arises from its greater nearness, its greater size, or the greater intensity of its light. But it is certain that the fixed stars are self-luminous. The number of the stars is beyond determination. Those visible to the unaided eye in the Northern Hemisphere amount only to about 3000. Stars of the first magnitude visible north of 35° south declination are reckoned by Heis at 14, of the second at 48, of the third at 152, of the fourth at 313, of the fifth at 854, and of the sixth at 2010. But in the following classes the numbers increase rapidly, so that it is impossible to say how many there are. Recent photographic observations seem to indicate that if the exposure of the sensitive plate in the telescope was continued long enough the entire plate would be light-struck. If this be so we must conclude that the entire heavens would be found covered with stars if we were able to see the faintest ones in existence.

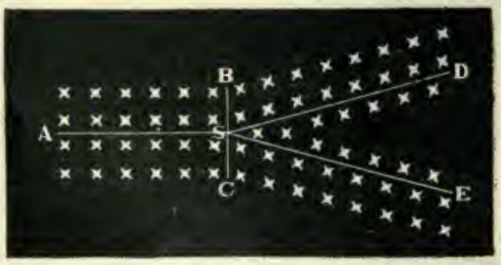
That the fixed stars are not really immovable, as their name would imply, is seen in the phenomenon of *double* or *multiple* stars, which are systems of two or more stars that revolve about one another, or rather about their common centre of gravity. As they can be seen separate only by means of a telescope, and in most cases require a very powerful one, their discovery was possible only after the telescope was invented. Galileo himself discovered their existence and proposed to make use of them in determining the yearly parallax of the fixed stars. After a long lapse of time, Bradley, Maskelyne, and Mayer again directed attention to the phenomena of double stars, but nothing important was made out respecting them until the elder Herschel made them the subject of a protracted series of observations, which led to the most remarkable conclusions as to their nature. At present over 10,000 stars are known to be double; and in many cases more than one companion accompanies the principal star. The apparent angular distance between two stars must be less than about thirty seconds in order that they may be counted a double. The theory of probabilities renders it almost certain that this vast number of double stars could not exist unless there were some real physical connection between the component numbers of a double. Still, there is always a possibility of duplicity being merely apparent, the two stars lying nearly in the same direction in space, but at widely different distances from the earth. Such apparent doubles are called *optical* doubles, and those in which a real physical connection has been demonstrated by observed gravitational rotation of the component members are called *binary stars.* Of these only about 250 are known. In some cases one of the components of a double star is much larger than the other, as in the star Rigel, in Orion, and in the polar star; but very often the connected stars are nearly equal in luminous power. The two members of double stars are mostly of one color when the two components are nearly equal; but a difference of color is often observed when the components are widely different in size. In many of these cases the one color is the complement of the other. It was Sir W. Herschel who first advanced the view, which has been confirmed since, that double stars are connected systems of two or more stellar bodies revolving in regular orbits around one another, or rather round their common centre of gravity. Their motions are found to follow the same laws as prevail in the solar system, and the orbits are elliptical. These distant bodies are therefore subject to the Newtonian law of gravitation. The period of revolution has, in many cases, been computed; the shortest is estimated at 5½ years; others are set down at hundreds. In cases where the parallax is known the size of the orbits can be determined, and thus the astronomer is able to assert in regard to the double star α Centauri that the orbit described by the two components about each other is 24 times as large as that of our earth around the sun. Even the masses of these stars have been calculated as being together 2, that of our sun being 1. It is a consequence of these revolutions that some stars are now seen double that formerly seemed single, and vice versa. If the plane of revolution has its edge presented to the earth the stars will seem to move in a straight line, and at times to cover one another. In addition to these double stars that can be seen to revolve and change their relative positions there are others of which the components are so close together that even our most powerful telescopes fail to separate them. These doubles are known to exist from peculiarities in their spectra. They show a doubling of the spectral lines that must be caused by a duplicity in the source of light, and where this doubling is shown to occur periodically we must conclude that the two sources of light are revolving in some way or other.

The proper motion of stars is of another kind. It consists in a displacement in various directions of the individual stars, so that the configuration of constellations is slowly changing. The annual proper motions yet observed vary from nothing to 8.7″. The proper motion of the binary star 61 Cygni amounts to 5.2″, so that in 360 years it would pass over a space equal to the moon's diameter. It must thus take thousands of years to alter sensibly the aspect of the heavens; although, taking into account the enormous distances, the actual velocities must be great. But the observed proper motions of the stars do not give us very accurate information as to their real motions and velocities. In the first place, it is only the *angular* change of the star's position that we observe; and we cannot tell the corresponding linear shift unless we know the distance of the star from the earth. And even where this distance (parallax) is known we can obtain only the transverse motion, as projected on the sky. There may be also a component of motion directly toward us or away from us. This *radial* component remained entirely unknown until recently, when it became possible to measure it with the spectroscope.

It was first observed by Sir W. Herschel that there is a perceptible tendency in the proper motions, as observed, to make the stars generally diverge or open up in one quarter of the heavens, and draw together in the opposite quarter; and this he attributed to a proper motion of our sun with his planets in the direction of the former point. The apparent motion thus caused is complicated with the real independent motions of individual stars. The point toward which the motion is directed, which is called the 'solar apex,' was fixed by Herschel in the constellation Hercules; and the result of subsequent and independent researches gives a nearly coincident point. The velocity has been calculated at about 11 miles per second, a figure still very uncertain.

Coming now from a consideration of stellar motions and velocities to their physical characteristics, we must again have recourse to information derived from a study of star spectra. Fraunhofer was the first to study them, and his researches have been followed by Rutherford, Huggins, Secchi, Vogel, Pickering, and others. It has thus been possible to identify in the stars many of the terrestrial chemical elements. Many stars exhibit well-marked periodic alterations of magnitude, and are hence called *variable* stars. A considerable number have been observed, of which perhaps the most remarkable are Mira (the wonderful) in Cetus, and Algol in Perseus. The first attains its greatest lustre every 334 days, and sometimes appears for 14 days as a star of the second magnitude; it then decreases for two or three months, till it becomes of the sixth and even tenth magnitude, so as to be for half a year invisible to the naked eye. After this it begins to increase, but more rapidly than it decreased. It is visible to the naked eye for three or four months of its period. Of all the variable stars yet observed Algol has the shortest period, being 2 days 20 hours 48 minutes 55.4 seconds. It appears for about 60 hours a star of the second magnitude, then decreases for four hours, and appears for a quarter of an hour of the fourth magnitude, after which it increases again for four hours. Various explanations have been offered of these mysterious appearances; that generally accepted postulates a large dark body revolving about the luminous one, so as to intercept more or less of its light in different positions and making of Algol-type variables simple eclipse phenomena.

Allied to the variable stars are the *new* or *temporary* stars that appear suddenly in great splendor, and then disappear without leaving a trace. Fourteen instances are on record. It is not improbable that these also may be periodic.



STAR SYSTEM.

Star Systems. From the appearances connected with the Milky Way or Galaxy (q.v.), Sir W. Herschel came to the conclusion that the stars forming our firmament do not extend indefinitely into space, but are limited in all directions, the mass having a definite shape. He conceived the shape to be something like that of a huge millstone, having one side cleft, and the two luminæ set apart at a small angle. Let the diagram represent a vertical section of such a broad flat stratum, suppose the solar system situated as at S to a spectator looking on either side, in the direction of the thickness, as SB, the stars would appear comparatively sparse, but all round in the direction of the breadth (as SA) there would appear a dense ring, which would separate into two branches (SE, SD) in the direction of the cleft side. This supposition accounts for the appearance of the Milky Way, and subsequent observations have tended to confirm the conjecture.

Consult: Young, *General Astronomy* (Boston, 1900); Clerke, *System of Stars* (London, 1890); id., *History of Astronomy* (ib., 1893); Chambers, *Handbook of Astronomy*, vol. iii. (Oxford, 1890); Newcomb, *The Stars* (New York, 1901); on the constellations, consult Walentiner, *Sternbilder* (Breslau, 1901).

STAR. A frequent charge in heraldry (q.v.). See Estoile.

STAR AND GARTER. A former London Tavern on Pall Mall, the meeting place of the Literary Club.

STAR ANISE. See Illicium.

STAR APPLE (*Chrysophyllum Cainito*). A West Indian tree about 20 or 30 feet high, introduced in other warm countries, beyond which it is not hardy. It is named from the star-like cross-section of its large white or rose-colored, green, and yellow fruits, with an agreeably flavored soft, sweet pulp. The tree is very beautiful in foliage.

STARAYA LADOGA, stä′rȧ-yȧ lä′dô-gȧ. A small village in the Government of Saint Petersburg, Russia, on the Volkzhov, a few miles south of Lake Ladoga. It is one of the oldest Russian settlements and has considerable historic interest.

STARAYA RUSSA, rụs′sȧ. An ancient town and noted health resort in the Government of Novgorod, Russia, 181 miles south-southeast of Saint Petersburg (Map: Russia, D 3). It is well built, and has a number of fine parks. The saline springs are used both for drinking and bathing. Population, in 1897, 15,234.

STARBOARD. A naval term to denote the right side of a vessel to an observer looking forward. See Helm.

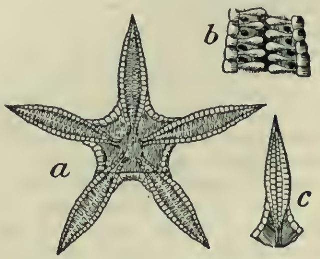
STARCH (assibilated form of *stark*, stiff, strong, AS. *stearc*, OHG. *starc*, Ger. *stark*, strong, stiff, Goth. *ga-staúrknan*, to dry up; connected with Lith. *stregti*, to become rigid, Pers. *suturg*, strong). A form of carbohydrate (see Carbohydrates), occurring as stored food in many plants. Its composition corresponds to the empirical formula $C_6H_{10}O_5$, but its molecular formula, and, of course, its constitution, are as yet unknown. The number of atoms in its molecule is probably very large. Starch is formed as a condensation product from sugar by the action of certain specialized portions of the protoplasm of plant cells. The typical starch-formers are leucoplasts (q.v.), which occur in all cells where starch is permanently stored. But the chloroplasts of the leaves may form starch when the green cells become overloaded with sugar. Thus leaves are often found to contain large quantities of starch, especially at the end of a long period of bright illumination. The sugar formed by the process of photosynthesis (q.v.) is constantly diffusing away into other parts of the plant, but during periods of bright light it is formed more rapidly than it can diffuse, and it is then condensed by the chloroplasts to form starch. During periods of darkness or of weak illumination, when the photosynthetic process ceases or lags, the starch of leaves is reconverted into sugar by the enzyme diastase (q.v.), and then diffuses to other regions of the plant. Thus leaves seldom contain starch in the morning or on cloudy days. But by far the greater part of the starch found in any plant is organized into grains by leucoplasts. By the action of these bodies, sugar which comes from the green leaves is condensed or polymerized into starch. Starch is thus formed in all parts of plants, being especially plentiful in tubers, in thickened roots, and in the endosperm and embryo of seeds.

STAR CHAMBER. A celebrated English tribunal, which met in the council-chamber of the old palace of Westminster. The origin of the name is unknown. According to Sir Thomas Smith it was derived from a decoration of gilded stars on the ceiling. This theory is unsupported by evidence, but it is now well established that since the middle of Edward III.'s reign the star chamber (Camera Stellata) was the usual meeting place of the King's Council, or Privy Council, as it was afterwards known. The history of the Star Chamber Court is particularly associated with the act of 3 Henry VII., c. 1. By this statute the "chancellor and treasurer of England for the time being and keeper of the King's privy seal, or two of them, calling to them a bishop and a temporal lord of the King's most honorable Council and the two chief justices of the King's Bench and Common Pleas for the time being, or other two justices in their absence," are given jurisdiction in seven offenses: Unlawful maintenance; giving of liveries, signs, or tokens; retainers by indentures. oaths, writings, or otherwise; embraceries of the King's subjects; untrue demeanings of sheriffs in the making of panels, and other untrue returns; taking of money by juries; and great riots and unlawful assemblies. Since the days of Elizabeth it has been very commonly held that the historical Star Chamber was created by this act; and that its proper jurisdiction was restricted to the offenses just enumerated. Recent research has shown that such was not the case. The Star Chamber possessed the entire jurisdiction of the King's Council. During the reigns of Henry VII. and Henry VIII. neither the membership nor the jurisdiction of the court conformed to the statute of 3 Henry VII., c. 1, as usually interpreted. Moreover, the King's Council is seen performing the same functions as the court, whether sitting in the Camera Stellata or elsewhere; and, conversely. the powers of the Star Chamber appear to be equivalent. even in State matters, to those of the Council itself. The Star Chamber, in fact, claimed its vast jurisdiction on the ground that it was the King's Council. As a criminal court, it could inflict any punishment short of death, and had cognizance of all cases that might be brought under the head of contempt of the royal authority. Jurors were there punished for verdicts against the Crown. Offenders against the royal proclamations or the religious laws were there condemned. The form of proceeding was by written information and interrogatories, except when the accused person confessed, in which case the information and proceedings were oral; and out of this exception grew one of the most flagrant abuses of this tribunal in the later period of its history. Regardless of the existing rule, that the confession must be free and unconstrained, pressure of every kind, including torture, was used to procure acknowledgments of guilt; admissions of the most immaterial facts were construed into confessions; and fine, imprisonment, and mutilation were inflicted on a mere oral proceeding, without hearing the accused, by a court consisting of the immediate representatives of prerogative. The proceedings of the Star Chamber had always been viewed with distrust by the commons; but during the reign of Charles I. its excesses reached a height that made it absolutely odious to the country at large; and in the last Parliament of that sovereign a bill was carried in both Houses (16 Car. I., c. 10) which decreed its abolition. See especially Burn, *The Star Chamber* (London, 1870).

STARE DECISIS, stā′rē dē-sī′sĭs (from the Latin: *Stare decisis, et non quieta movere*—"to stand by decisions and not to disturb matters once settled"). A phrase employed to describe a doctrine prevailing in most judicial systems of modern times, which, briefly expressed, is that the courts will follow the principles of law declared in former decisions where they are not contrary to the ordinary principles of justice. The theory on which this doctrine was established is that when a point of law is once decided it will be followed by the public as a guide. The doctrine of *stare decisis* does not apply to a decision until the time for appeal has elapsed; and a superior court may at any time overrule or repudiate the principles of a case previously decided in an inferior court and never appealed. Under such circumstances the original case erroneously decided would not be affected, and would remain *res judicata* between the parties thereto, but would no longer be cited as an authority. Courts of equal jurisdiction in the same State are not bound by each other's decisions, and one United States circuit court is not bound by the decisions of another. The United States courts will usually follow the decisions of the courts of the various States where an interpretation or application of their laws is involved. The courts of one State are not bound by the decisions of the courts of another, nor by those of a foreign country.

The courts are especially averse to disturbing the principles of law involving titles to and interests in real estate. The policy seems to be not to do so where it is only a question of expediency, and to do so with caution where the principles of a decision are erroneous and will tend to work injustice in the future. Consult: Wells, *The Doctrines of Res Adjudicata and Stare Decisis* (Des Moines).

STARFISH. Echinoderms with a star-like or pentagonal body, with two or four rows of ambulacral feet or tentacles on the oral side. The body is covered with small, short spines, often arranged in groups. The nervous system is pentagonal, with nerves extending into the arms. Most of the species are bisexual; the young usually pass through a metamorphosis, the starfish budding out from the water-vascular system of the pluteus, bipinnaria, or brachiolaria form, which previously passes through a morula, gastrula, and cephalula stage. Starfishes are covered with scattered pedicellariæ, pincer-like spines consisting of two prongs. Sense organs (sphæridia) are also present. Starfish have the sense of smell, which is supposed to be localized in the suckers at the back of the eye-plate.



A PALEOZOIC STARFISH.

a, Ventral aspect of *Aspidosoma petaloides* (Lower Devonian); *b*, ambulacral surface of an arm, in detail; *c*, dorsal plates of an arm.

Starfish crawl or glide by means of from two to four rows of slender tubular processes or 'feet,' with a sucker at the end. These ambulacral feet are thrust out, fastened to the bottom, and by means of them the body is warped or pulled along over mussel or oyster beds, rocks, or weeds, the arms being capable of slightly bending. At the end of each arm is the red eye, terminating the radial nerve. Starfish are very destructive to oysters, clams, mussels, barnacles, snails, worms, and small crustacea. To devour an oyster or clam the starfish grasps both valves of the shell, and by persistently exerting a constant steady strain, finally fatigues the adductor muscles closing the valves so that they slightly gap open. Then the stomach is protruded between the shells or valves and the soft body of the mollusk is digested. The injury to the oyster beds of Rhode Island caused by starfish in one year was estimated at $100,000. See ECHINODERMATA (and Plate); OYSTER.

Fossil starfish are found first in the Ordovician rocks, and they occur sparingly in later formations, with some increase in the Devonian and Carboniferous, but they are never of geological importance. Some Mesozoic sandstone formations of Middle Europe have furnished abundant casts, and they are found also in a few Tertiary localities. The Paleozoic species are grouped in the subclass Encrinasteriæ, in which the ambulacral ossicles alternate with each other along the middle line of the ambulacra; while the Mesozoic and Tertiary species, and also the recent, are included in the Euasteriæ, which have the ambulacral ossicles opposite each other.

Consult: Romanes, *Jellyfish, Starfish, and Sea Urchins* (New York, 1885); Mead, *29th Report Rhode Island Commissioners of Inland Fisheries* (Providence, 1899).

STARGARD, stär′gärt. A town in the Province of Pomerania, Prussia, situated on the navigable Ihna, 22 miles east-southeast of Stettin (Map: Prussia, F 2). It is the most important town in the eastern part of the province. The Marienkirche and town hall are noteworthy. The town manufactures railway supplies and other machinery, has foundries, and is a woolen and cotton market. It belonged to the Hanseatic League and was strongly fortified. Population, in 1900, 26,858.

STAR GRASS. A popular name for several grass-like plants whose flowers or other parts resemble stars in outline. Among them are species of Hypoxis, Chelone, Callitriche, Aletris, and Rhinchospora. See Colored Plate of AMARYLLIDACEÆ.

STARHEMBERG, stä′rem-bĕrk, ERNST RÜDIGER, Graf (1638-1701). An Austrian general, born at Gratz and educated for the army by Montecuccoli. He took part in the last campaigns of the Thirty Years' War, was present at Saint Gotthard in 1664, and gained especial glory by his brave defense of the city of Vienna for nine weeks in 1683, against the Turkish army. The Emperor Leopold made him a field-marshal and a Minister of State. Three years afterwards he was wounded at Bude and forced to retire from active service. He settled in Vienna and became president of the Council of War. Consult Thurheim, *Feldmarschall Ernst Rüdiger, Graf Starhemberg* (Weimar, 1882).

STARK, JOHN (1728-1822). An American soldier, born at Londonderry, N. H. In early life he worked on his father's farm. During the French and Indian War he served with Rogers' Rangers first as a lieutenant, and later as a captain. Reporting at Cambridge early in 1775, he was commissioned colonel, and, with a regiment raised in one day by himself, took part in the battle of Bunker Hill. Later he served in the Canada expedition and then under Washington in New Jersey, distinguishing himself at Trenton and Princeton; but, resenting the promotion over himself of a number of officers, he resigned in April, 1777, and returned to his home. On the approach of Burgoyne, he accepted an independent command from New Hampshire, and defeated a force of Hessians in the battle of Bennington (q.v.), August 16, 1777. For this he was made a brigadier-general, and was formally thanked by Congress. With a force of New Hampshire recruits he took an active part in the Saratoga campaign, and in 1778 and again in 1781 he commanded the Northern Department. Consult his biography by Edward Everett in Sparks's *American Biography*, and his *Life and Official Correspondence* by Caleb Stark, his grandson.

STARLING (diminutive of *stare*, AS. *stœr*, OHG. *stara*, Ger. *Star, Staar, Stahr*, starling; connected with Lat. *sturnus*, starling). A European bird (*Sturnus vulgaris*) of the family Sturnidæ, famous for its song and powers of mimicry. It is rather smaller than the American meadowlark, its nearest analogue in the New World, and is brown finely glossed with black, with a pale tip to each feather. It has been introduced into America and seems to have become established in and around New York City.

The starling family is a large one, containing about 200 species, mostly living in the tropics of Africa and Asia. They fall between the Corvidæ and Icteridæ, and are divisible into two sections: one containing the more typical terrestrial starlings, the oxpeckers, the pastors, the mynas, pied starlings (Sturnopastor), and wattled starlings (Dilophus). In the second group, often regarded as a separate family (Eulabetidæ), distinguished by the absence of rictal bristles and by the fact that they lay spotted eggs, whereas the 'true' starlings lay blue unspotted eggs, are the African glossy starlings (Lamprotornis) with richly colored plumage and the grakles or hill-mynas. Consult writers upon African and East Indian ornithology, summarized in Lydekker, *Standard Natural History* (London, 1895). See Plate of Larks and Starlings.

STARNBERGER (stärn′bĕr-gĕr) **LAKE.** A lake south of Starnberg, in Southern Bavaria. Its length from south to north is about 18 miles; its altitude nearly 2000 feet. The Würm flows through the lake. The shores are picturesque and covered by lordly villas affording splendid views.

STARNINA, stär-nē′nȧ, Gherardo (c.1354-c.1410). A Tuscan painter, born at Florence. After painting the histories of Saint Nicholas and Saint Anthony on the ceiling of the Castellani Chapel in Santa Croce, he was involved in the Ciompi intriuges and fled in 1384 to Spain. There he enjoyed royal favor, which enabled him to return to Florence in 1387. Frescoes in Santo Maria del Carmine have been attributed to this period—scenes from the life of Saint Jerome, of which only the "Death" remains. Starnina was commissioned to paint a Saint Denis on the façade of the Guelph palace at Pisa, the city having surrendered on the day of that saint. The last work of the artist is to be seen in the right choir chapel of the Duome at Prato—the "Birth of the Virgin," the "Presentation of the Virgin," and the "Preaching of Saint Stephen." This series was finished by his pupil Antonio Vite, by whom and by his more famous pupils, Antonio da Pistoia, Masolino, and Masaccio, he is chiefly remembered.

STAR-NOSED MOLE. See Mole.

STAR OF BETHLEHEM (so called from its star-shaped flowers, which are white within), *Ornithogalum*. A genus of about seventy species of bulbous-rooted plants of the natural order Liliaceæ. The species are natives almost exclusively of the Eastern Hemisphere. Only a few species are grown in flower gardens. The common star of Bethlehem (*Ornithogalum umbellatum*), a native of France, Switzerland, Germany, the Levant, etc., has racemes of six to nine large white fragrant flowers, which open about eleven o'clock in the morning and close again about three or four in the afternoon. The plant is very hardy and may be grown three or four years without being disturbed. *Ornithogalum arabicum* is a tender species often grown in glasses like hyacinths. It produces large creamy white flowers, with a fragrance not agreeable to all persons. The hardy species flourish in ordinary well-drained garden soil. Propagation is effected by offsets from the bulbs, which are planted in the fall about nine inches deep in sheltered places.

STAR OF INDIA, Order of the. A British order with three classes founded by Queen Victoria in 1861, consisting of the sovereign, the Viceroy of India, and 246 members, in addition to an unrestricted honorary membership. The decoration is an oval medallion bearing a bust of Victoria in onyx, surrounded by a blue band with the device *Heaven's Light our Guide*, and surmounted by a diamond-studded crown.

STAROKONSTANTINOV, stä′rô-kŏn′stȧn-tyē′nôf. A district town in the Government of Volhynia, Russia, 86 miles southwest of Zhitomir. The chief manufactures are tobacco and soap; mineral waters are marketed. Population, in 1897, 16,527.

STARR, Eliza Allen (1824-1901). An American poet and lecturer on art. She was born of Puritan ancestry at Deerfield, Mass., and was educated at Deerfield Academy. In 1854 she left the Unitarian Church, in which she had been reared, and became a convert to Catholicism. In 1856 she settled in Chicago, where she became a teacher of drawing and painting. In 1877 she began the series of lectures on Christian art for which she is best known. She published *Poems* (1867); *Patron Saints* (1st series 1871, 2d series 1881); *Pilgrims and Shrines* (2 vols., 1883); *Isabella the Catholic* (1889); *Christian Art in Our Own Age* (1891); *Three Keys to the Camera della Signatura* (1895); and *The Seven Dolors of the Blessed Virgin Mary* (1898). Her works on Christian art are elaborately illustrated.

STARR, Frederick (1858—). An American anthropologist, born in Auburn, N. Y. He studied at the University of Rochester and at Lafayette, where he graduated in 1882. He was registrar of Chautauqua University in 1888-89, and after two years in charge of the American Museum of Natural History in New York City (1889-91) in 1893 became professor of anthropology in the University of Chicago. His publications include: a *Catalogue of Collections of Objects Illustrating Mexican Folklore* (1899); *Some First Steps in Human Progress* (1895); and *Indians of Southern Mexico* (1900).

STARR, Moses Allen (1854—). An American neurologist, born in Brooklyn, N. Y. He graduated from Princeton College in 1876; from the College of Physicians and Surgeons, New York City, 1880; served as interne in Bellevue Hospital, 1880-82; was professor of nervous diseases, New York Polyclinic, 1886-88; clinical professor of nervous diseases, College of Physicians and Surgeons, New York City, 1888-89; and professor of the same since 1889. He is the author of many articles contributed to medical journals, as well as of *Familiar Forms of Nervous Disease* (1891); *Brain Surgery* (1893); *Atlas of Nerve Cells*, with Dr. Strong (1899); *Organic Nervous Diseases* (1903); and other works.

STAR ROUTE FRAUDS. Certain frauds connected with the management of the star route postal service during the administration of President Hayes. The term 'star routes' was applied to those routes over which, owing to the lack of railroads and steamboats, the mail was carried on horseback or in wagons, such routes being commonly marked, in the books of the Post Office Department, with an asterisk or 'star.' A 'ring,' including Brady, the Second Assistant Postmaster-General, and Senator S. W. Dorsey, of Arkansas, on the one hand, and certain mail contractors on the other, was alleged to have been formed for the purpose of defrauding the Government by increasing unduly the remuneration of certain mail contractors. The sphere of operations of the combination included 135 mail routes on which the compensation for carrying the mail was increased from $143,169 to $622,808. This increase was accomplished by securing numerously signed petitions from the localities interested praying for an increase in the number of trips, after which the schedule time for each trip was shortened. Estimates from the contractors largely in excess of the actual cost were allowed, and the profits were alleged to have been divided between the contractors and the members of the ring at Washington. The frauds were brought to light early in Garfield's administration, and the chief participants were prosecuted. Dorsey was tried, but the jury failed to reach a decision. Upon a second trial in 1883 he was acquitted. Brady was also tried, but was not convicted. Of all those prosecuted only one was ever punished. The ring was eventually broken up, but not until a number of those interested had acquired fortunes.

STARS AND BARS. The popular name applied to the flag adopted by the Confederate States of America early in 1861. See FLAG.

STAR SPANGLED BANNER, THE. The national hymn of the United States, written by Francis Scott Key (q.v.) on board the frigate *Surprise* during the bombardment of Fort McHenry, Md., by the British, in 1814. He directed that the words should be sung to the tune of "Anacreon in Heaven," composed in England by John Stafford Smith between 1770 and 1775. "The Star Spangled Banner" was first sung in a tavern near the Holiday Street Theatre, Baltimore, by Ferdinand Durang. Consult Johnson, *Our Familiar Songs* (New York, 1881); FitzGerald, *Stories of Famous Songs* (London, 1898).

STARVATION (from *starve*, AS. *steorfan*, OHG. *sterban*, Ger. *sterben*, to die, Icel. *starf*, trouble, toil, work), or INANITION. Emaciation, enfeeblement, lowered vitality, and finally death, resulting from insufficiency of or total deprivation of food. The fact is stated, as quoted from Chossat, that death from starvation occurs after the loss of four-tenths of the body weight. The same observer recounts the most prominent phenomena during or after the death of animals who were starved, as follows: (1) Dropsical effusion. (2) Softening and destruction of the mucous membrane. (3) Blackening of the viscera, especially of the liver. (4) Bluish, livid, yellow, and reddish stains during life in the transparent parts of the skin. (5) Hectic fever, and a continuous decrease in the power of the body to resist cold. (6) At first a scanty excretion of dry, bilious, grass-green fæces, and afterwards diarrhœa of liquid saline matter. (7) Convulsions similar to those in death by hemorrhage. (8) Death by starvation seems to be in reality death by cold; since the temperature of the body is not much diminished until the fat is nearly consumed, when it rapidly falls, unless it be kept up by heat applied externally. (9) Young animals succumbed far sooner than adults. (10) The results of insufficient food were in the end the same as those of total deprivation, the total amount of loss being almost the same, but the rate being less, so that a longer time was required to produce it.

Chossat did not find that much influence was exerted on the duration of life by permitting or withdrawing the supply of water; but there is no doubt that in man, and probably in mammals generally, death supervenes much earlier when liquids as well as solid food are withheld. During the famine of 1847 in Ireland, the following were the most striking symptoms observed in the starving: Pain in the stomach, relieved by pressure; pallor and emaciation; bright and wild eyes; hot breath; parched mouth, thick and scanty saliva; intolerable thirst; fœtor from the skin, which becomes covered with a dark-brown secretion; tottering gait, weak and whining voice, the tears starting easily; imbecility.

The time during which life can be supported under entire abstinence from food and drink varies much. In one case, reported by Sloan, a healthy man, aged 65 years, survived 23 days' imprisonment without food in a coal mine, having impure water for the first ten days of this period. He died three days after rescue. The average healthy individual will survive a week or ten days of complete abstinence from food and water. Consult: Fernet, "Amaigrissement extrême et mort par inanition," in *Bulletin et mémoire, Société médicale de l'hôpital de Paris* (1901); Leeson, "Death from Starvation," in *Dublin Medical Press* (1847); Davies, "Starvation," in *Popular Science Monthly*, vol. xxvi. (New York, 1884-85).

STARWORT. See CHICKWEED.

STARY-OSKOL, stä′rê ŏs-kôl′. A district town in the Government of Kursk, Russia, on the river Oskol, 92 miles east-southeast of Kursk. It has tanneries and tobacco factories. Population, in 1897, 16,662.

STAS, stås, JEAN SERVAIS (1813-91). A Belgian chemist. He was born in Louvain, studied under and later assisted Dumas, and was for many years professor of the Military Academy in Brussels. He was one of the earliest investigators of the constitution of organic compounds, such as acetal. Subsequently he devoted a number of years to the determination of the atomic weights of the elements, and it is principally for these classic researches that he is celebrated in the history of science. The impulse to these researches was given by the discussion as to whether the atomic weights are or are not exact multiples of the atomic weight of hydrogen—a question connected with Prout's hypothesis, according to which the several chemical elements are derived from hydrogen and are not essentially different substances. But the results of Stas's work have been of much further-reaching importance, and its precision has hardly as yet been surpassed. His collected works appeared in three volumes (Brussels, 1894). Consult Spring, *Notice sur la vie et les traveaux de J. S. Stas* (Brussels, 1893).

STASSFURT, stäs′fo͞ort. A town in the Province of Saxony, Prussia, on the Bode River, 20 miles south of Magdeburg (Map: Prussia, D 3). There are iron mills, and the important royal salt works, which mine potash and rock salts. Extensive chemical works are also found here. Population, in 1900, 20,031. The town has been known since 806.

STATANT (heraldic Fr., standing). In heraldry, a term applied to an animal standing still, with all the feet touching the ground. If the face be turned to the spectator, it is said to be *statant gardant*, or in the case of a stag, *at gaze*. See HERALDRY.

STATE (OF. *estat*, Fr. *état*, from Lat. *status*, state, condition, from *stare*, to stand; connected with Gk. *ἱστάναι*, *histanai*, Skt. *sthā*, OChurch Slav. *stati*, OHG. *stān*, *stēn*, *stantan*, Ger. *stehen*, Goth., AS. *standan*, Eng. *stand*), THE. The theory of the State in its broadest sense may be taken to cover the whole field of political philosophy, involving the comprehensive examination of the laws underlying political phenomena. (See POLITICAL SCIENCE.) In a narrower sense, the theory of the State is concerned primarily with the essential nature of the State, its origin and basis, its various forms, and proper function or purpose.

The essential elements of the State, together distinguishing it from other social groups, are generally considered to be the following: a territorial basis serving as the physical foundation of the State, a population constituting its citizenship, and a more or less complete form of political organization exercising the power of life and death. Finally, the State is a sovereign body, being supreme over all persons on its territory and independent internationally. It is also held by some authorities that the State is an organism or a person.

The origin and basis of the State have been explained in various ways for the purpose of justifying or condemning various political systems. It has been held that the State owes its genesis and continuance to the will or command of God, a doctrine that has been used in the defense of all forms of government, including democracy. The origin of the State has been traced by others to the family, and explained as a development of the power of the early patriarchs. Others have maintained that the State was created by and exists in virtue of a voluntary contract to which the parties were either (1) the government on the one hand and the people on the other; or (2) separate individuals who agreed to form a political society and a government by a contractual process. Again it is argued that the foundation and support of the State is superior force, which in its first and last analysis is the essential fact in a political system. The modern theory is that the State owes its being to an historical process in which many or all of the foregoing factors may have played a part as the varying conditions required. The explanation of the present existence of a coercive power over individuals is generally found in a variety of motives for obedience. Of these the principal ones are custom or habit, fear, utility or the calculation of accruing advantages and disadvantages, and the element of conscious and rational consent. The general tendency of political development is toward a State based on general perception of its utility, and consequent consent to its laws. It may be added that the anarchistic school denies the existence of any rational justification for the State, demanding its complete abolition, and the substitution of some such principle as that of 'justice' or 'humanity' for that of coercive power.

The forms of the State are three, monarchy, aristocracy, and democracy, according as political power rests with one, the few, or the many. All other forms of government may be resolved into the three forms enumerated. Thus, theocracy is any one of these three forms in which the rulers are supposed to possess a special divine sanction for their government. The so-called federal State may be resolved either (1) into a union of many States for certain general purposes; or (2) one State with a dual form of government and with sovereignty vested in the group as a whole. Plutocracy and oligarchy are perverted forms of aristocracy. 'Constitutional,' 'despotic,' 'free,' when applied to States, have reference to the method in which the government is organized or administered, rather than to the form of the State, and might be applied to any of the three types. In recent years considerable attention has been given to the classification of various forms of State associations or groups. Of these the most important are the Personal-Union, the Real-Union, the Confederacy, the Protectorate, and the Federal or Composite State. (G. Jellinek, *Die Lehre von den Staatenverbindungen;* H. Rehm, *Allgemeine Staatslehre*).

The function or purpose of the State has been variously interpreted. It has been held that the proper function of the State is the development of the moral or religious nature of its subjects, and that this should be the controlling purpose of its activity. Again it has been maintained that the function of the State is merely to preserve order among its citizens and to protect them from external attack, leaving all else to the domain of individual initiative. It is also held that the function of the State is to further the general welfare of its subjects, including in this all sides of their life. In modern times the contest lies between the advocates of the 'legal' State and those of the 'paternal' State, holding respectively the individualistic and the socialistic conceptions of the function of organized political society. One of these theories has been carried to the extreme of a demand for anarchy, and the other to the opposite pole of a demand for the extension of the functions of government to the immediate control of industrial activity. At present the most widely accepted doctrine is that no general principle governing the activity of the State can be laid down, but that each case of proposed State action must be decided in accordance with what appears to be the greatest good to the greatest number.

The theory of the State has passed through several important stages in the course of the development that has brought it up to its present position. A philosophy of politics was first developed by the classical school of which Plato, Aristotle, and Cicero were the leading exponents. The most marked characteristics of the political thinking of this time were the development of political theory from the city as a basis—the city State—the complete subordination of the individual to the State in the discussion of political problems, and the constant confusion of political and ethical theory. In the next great period, that of the Middle Ages, political theory was interpreted in the light of Christian theology. A system of politics was deduced from the joint authority of the Scriptures, the writings of the Fathers, the philosophy of Aristotle, and the Roman law—all analyzed and presented with the subtlest refinement of which Scholasticism was capable. The point around which political speculation centred was the true and proper relation between Church and State. Thomas Aquinas (*Summa Theologica* and *De Regimine Principum*) was the most successful champion of the Church; Marsilius of Padua (*Defensor Pacis*) and Dante (*De Monarchia*) of the State. During the Renaissance and the Reformation political theory made important advances. By the work of Machiavelli (*Il principe, Discorsi*) politics was divorced from theology and ethics, and elevated to the position of an independent science. Jean Bodin, reviving the method and spirit of Aristotle, laid the foundations of modern systematic politics in his epoch-making treatise, *De Republica.* In the revolutionary period of the seventeenth and eighteenth centuries the so-called natural law philosophy was dominant. The fundamental premise of this system was the universal prevalence of an immutable law of natural justice, under which and independently of any government all men hold certain natural rights; e.g. life, liberty, and property. From this premise followed the theory of a contract as the basis of all legitimate government, the administration of government for the good of the parties to the contract, and the right of revolution whenever government is perverted to selfish ends by the rulers. Of these doctrines John Locke (*Two Treatises of Civil Government*) and Jean Jacques Rousseau (*Le contrat social*) were the most influential expounders. During the same period the opposing doctrines of the divine right of kings and governmental absolutism were developed by Robert Filmer (*Patriarcha*) and Bossuet (*Politique tirée de l'ecriture Sainte*), while Thomas Hobbes turned the natural law theory to the defense of absolutism (*The Leviathan*). As opposed to the *a priori* conception of these writers, Montesquieu (*Esprit des lois*) placed the study of political science upon an historical basis.

The modern theory of politics, dating from the reaction against the excesses of the French Revolution, is based on the historical-scientific premise that all institutions are the product of an evolutionary movement in which the conscious will of individuals plays a comparatively unimportant part. The method followed is historical and comparative, in contrast to the deductive style of the preceding school. The numerous problems arising out of the development of modern democracy, those involved in Nationalism, Federalism, and Imperialism, and the determination of the proper function of government, are the questions upon which general attention is fixed.

Bibliography. The most important works on the history of political theory are: Dunning, *A History of Political Theories* (New York, 1902); Janet, *Histoire de la science politique dans ses rapports avec la morale* (Paris, 1850, 1872); Bluntschli, *Geschichte der neueren Staatswissenschaft* (Munich, 1864); Mohl, *Geschichte und Litteratur der Staatswissenschaften* (Erlangen, 1855-58); Pollock, *Introduction to the Study of the Science of Politics* (London, 1890). Consult also: Lieber, *Manual of Political Ethics* (Boston, 1838-39); id., *Legal and Political Hermeneutics* (ib., 1839); Woolsey, *Political Science; or the State Theoretically and Practically Considered* (New York, 1877); Wilson, *The State* (Boston, 1889); Sidgwick, *Elements of Politics* (London, 1896); Willoughby, *The Nature of the State* (New York, 1896); Bosanquet, *The Philosophical Theory of the State* (London, 1899).

STATE, Department of. One of the nine executive departments of the Government of the United States, presided over by a Secretary who is a member of the Cabinet and first in the line of succession to the Presidency after the Vice-President. In rank the Department of State stands first among the other departments and is also the oldest in point of origin. It was in fact the logical successor of the old Department of Foreign Affairs created in 1781 and presided over first by Robert R. Livingston and afterwards by John Jay. The Department of State is the organ of communication between the Government of the United States and all foreign governments, as well as with the Governors of the individual States. The Secretary of State conducts all such correspondence; has charge of the negotiation of all treaties and conventions; he preserves the originals of all treaties, public documents, and correspondence with foreign governments as well as of the laws of the United States; he publishes all statutes and resolutions of Congress and proclamations of the President; he is the custodian of the great seal which is affixed to all commissions of appointment requiring the consent of the Senate, proclamations, warrants for extradition, pardons, etc., emanating from the President; he issues and keeps a record of passports granted to American citizens traveling abroad; issues warrants for the extradition of criminals to be delivered to foreign governments; presents foreign ministers to the President, etc. He makes an annual report of the conduct of foreign affairs for the year, publishes the consular reports and the 'foreign relations' of the United States, and performs such other duties relative to the conduct of foreign affairs as the President may direct.

To aid the Secretary of State, an Assistant Secretary was provided for in 1853; in 1866 a second assistant was created, and in 1874 a third, each charged with the supervision of a particular branch of the department. The business of the department is distributed among seven bureaus, namely, a diplomatic bureau, a consular bureau, a bureau of indexes and archives, a bureau of accounts, a bureau of rolls and library, a bureau of foreign commerce, created in 1897 (formerly the bureau of statistics), and a bureau of appointments, created in 1898. The name of each bureau indicates broadly the nature of the business assigned to it. Besides the Secretary and the three assistant secretaries there is a solicitor, detailed from the Department of Justice, an assistant solicitor, created in 1900, seven chiefs of bureaus, two translators, sixty-three clerks, and a number of messengers, making a total force of about one hundred employees.

The following is a list of the Secretaries of State from the organization of the department in 1789 to the present, with the dates of their appointment: Thomas Jefferson, September, 1789; Edmund Randolph, January, 1794; Timothy Pickering, December, 1795; John Marshall, May, 1800; James Madison, March, 1801; Robert Smith, March, 1809; James Monroe, April, 1811; John Q. Adams, March, 1817; Henry Clay, March, 1825; Martin Van Buren, March, 1829; Edward Livingstone, May, 1831; Louis McLane, May, 1833; John Forsyth, June, 1834; Daniel Webster, March, 1841; Hugh Legaré, May, 1843; Abel Upshur, July, 1843; John Nelson, February, 1844; John C. Calhoun, March, 1844; James Buchanan, March, 1845; John M. Clayton, March, 1849; Daniel Webster, July, 1850; Edward Everett, November, 1852; William L. Marcy, March, 1853; Lewis Cass, March, 1857; Jeremiah Black, December, 1860; William H. Seward, March, 1861; Elihu Washburne, March, 1869; Hamilton Fish, March, 1869; William M. Evarts, March, 1877; James G. Blaine, March, 1881; Frederick T. Frelinghuysen, December, 1881; Thomas F. Bayard, March, 1885; James G. Blaine, March, 1889; John W. Foster, June, 1892; Walter Q. Gresham, March, 1893; Richard Olney, June, 1895; John Sherman, March, 1897; William R. Day, April 1898; John Hay, September, 1898. Consult: *History of the Department of State* (Washington, 1901); Schuyler, *American Diplomacy* (New York, 1886).

STATEN (stăt′*e*n) **ISLAND.** An island of New York constituting Richmond County, and since 1898 the Borough of Richmond, New York City (q.v.). It is distant a little more than five miles from the southern extremity of Manhattan Island, and is separated from Long Island on the east by the Narrows, which connect the Upper New York Bay with the Lower Bay.

STATE PUBLIC SCHOOL. A model institution at Coldwater, Mich., for the education and support of dependent and ill-treated children of the State. It was established by an act of the State Legislature in 1871, but was not formally opened until 1874. It is the object of this institution to receive, care for, educate, and place whenever possible in family homes all the dependent children of the State of sound mind and body between the ages of two and twelve. The board of control, however, has the discretionary power vested in it of admitting children under two, where circumstances warrant such an exception. Since its foundation it has received over 5000 children, and in 1902 there were in the school 155 inmates. The school is located on a farm of 160 acres, covered partly by orchards, ornamental trees, and gardens. The buildings consist of an administration building, school house proper, and nine cottages among which the inmates are distributed. This system of cottages, under the superintendence of matrons who are specially qualified for that work, has the tendency to foster a love for home life. The State of Michigan was first in establishing this type of school. Similar institutions have since been established in Iowa, Minnesota, Kansas, Montana, Colorado, Wisconsin, Texas, Nebraska, Alabama, Rhode Island, and Nevada.

STATES, Popular Names of.

Badger State. Wisconsin, from the animal.

Bay, or Old Bay, State. Massachusetts. The name Massachusetts Bay, though later used in a more extended sense, was originally restricted to Boston Harbor, and as early as 1622 persons from Plymouth spoke of 'the Bay.' Under the first charter, the government was called the Colony of the Massachusetts Bay; and under the second charter, the Province of the Massachusetts Bay. Hence the nicknames Bay Colony, Bay Province, and Bay, or Old Bay, State.

Bayou State. Mississippi, from the number of its bayous, a word derived from the Indian *bayouc*(*k*), meaning a rivulet.

Bear State. Arkansas, from the animal.

Blackwater State. Nebraska, from the dark color of its rivers, owing to the black vegetable mold which covers large areas.

Blizzard State. South Dakota. The word 'blizzard,' of obscure origin, was used as early as 1829 in the sense of a blow or a discharge from a gun. In its present sense the word was recorded in 1876, and is said to have been current in Dakota for a decade previous.

Blue Grass State. Kentucky, from its celebrated blue grass.

Blue Hen State. Delaware. The term is said to have originated in the Revolutionary War, when an officer in a Delaware regiment raised famous gamecocks from a breed of blue hens; hence the members of his regiment were called 'Blue Hen's Chickens,' and so the name came to be applied to the State; but the story lacks proof.

Blue Law State. Connecticut. See Blue Laws.

Bread and Butter State. Minnesota, from its wheat and dairy products.

Buckeye State. Ohio, because of the horse chestnut, which grows there in great profusion and which for more than a century has been popularly called *buckeye*.

Bullion State. Missouri, from the sobriquet 'Old Bullion,' applied to Senator Thomas Hart Benton of that State on account of his advocacy of gold and silver currency.

Centennial State. Colorado, because it was admitted into the Union in the Centennial year, 1876.

Central State. Kansas, from its location with reference to the other States of the Union.

Corn Cracker State. Kentucky, perhaps because the poor whites subsist chiefly on corn.

Cotton State. Alabama, because the central State of the cotton belt.

Cracker State. Georgia, from the poor whites, who for more than a century have been called Crackers.

Creole State. Louisiana, from its many inhabitants descended from the French and Spanish settlers.

Dark and Bloody Ground. Kentucky, because in its early days it was the scene of frequent Indian wars. The name has been known for more than a century.

Diamond State. Delaware, from its diminutive size.

Dominion, Ancient or Old. Virginia. In early documents we read of 'the Colony' or 'the Plantation' or 'the Colony and Plantation' of Virginia; while later, about 1674, there are allusions to 'the Colony and Dominion' of Virginia, about 1682 to 'the Dominion' of Virginia, and about 1697 to 'the Ancient Colony and Dominion' of Virginia. Hence, in time, came the nicknames Ancient Dominion and Old Dominion merely. According to some, the name is due to Virginia's loyalty to the Stuarts during the Civil War.

Egypt. Southern Illinois, either from its alleged intellectual darkness or from the fertility of its soil.

El Dorado. California. El Dorado (q.v.) was the name of a fictitious region or city, abounding in gold, supposed to exist in South America. Hence it was sometimes, after the discovery of gold in California in 1849, applied to that State.

Empire State. New York, from its size, wealth, and number of its inhabitants.

Empire State of the South. Georgia, from its enterprise.

Evergreen State. Washington.

Excelsior State. New York, from the motto on its seal (adopted 1778).

Freestone State. Connecticut, from its freestone quarries.

Golden State. California, from its gold mines.

Gopher State. Minnesota, from the animal.

Granite State. New Hampshire, from its granite hills.

Green Mountain State. Vermont, from the Green Mountains.

Hawkeye State. Iowa. The name arose about 1839, apparently in allusion to J. G. Edwards, familiarly known as 'Old Hawkeye,' editor of the Burlington *Patriot*, the name of which paper was changed September 5, 1839, to the *Hawkeye and Patriot*.

Hoosier. Indiana. In use as early as 1833, but its origin is obscure.

Jayhawker State. Kansas. The word, of obscure derivation, appears to have originated with a party on its way to California in 1849, but no instance of its use is recorded prior to 1858, when it was used in Kansas, where it was derisively applied to James Montgomery and his men, who, in retaliation for the atrocities committed on Free-State settlers by the 'border ruffians,' raided the pro-slavery settlers and their abettors from Missouri. Later it was applied to marauders on both sides during the Civil War, and finally was applied to the people of Kansas.

Keystone State. Pennsylvania, probably because it was the central State of the Union at the time of the formation of the Constitution.

Lake State. Michigan.

Land of Steady Habits. Connecticut. See Blue Laws.

Little Rhody. Rhode Island, from its diminutive size.

Lone Star State. Texas, from the single star in the flag of the Texas Republic (1836-1845).

Lumber State. Maine.

Mormon State. Utah.

Mother of Presidents. Virginia, because the birthplace of six Presidents.

Mother of States. Virginia, because the first settled of the States.

New England of the West. Minnesota.

Nutmeg State. Connecticut, in allusion to the alleged manufacture of wooden nutmegs in that State.

Old Colony. That part of Massachusetts which from 1620 to 1692 was the Plymouth Colony.

Old Line State. Maryland, probably from the 'Maryland Line' which won distinction in the Revolutionary War.

Old North State. North Carolina.

Palmetto State. South Carolina, from the device on its seal.

Panhandle State. West Virginia, from the irregular section of the State projecting northward between Pennsylvania and Ohio.

Pelican State. Louisiana, from the device on its seal.

Peninsula State. Florida, from its location.

Pine Tree State. Maine, from the device on its seal, adopted in 1820.

Prairie State. Illinois, from its prairies.

Sage-Brush State. Nevada, from the plant.

Silver State. Nevada, from its silver mines.

Sucker State. Illinois, probably from the fish of that name, because in the early days the men went up the Illinois River to the mines and returned at the season when the sucker made its migrations. The term was first used about 1833.

Turpentine State. North Carolina, from the turpentine produced in it.

Web-Foot State. Oregon, from the quantity of rain which falls there.

Wolverine State. Michigan, from the animal.

STATE'S EVIDENCE (or, in England, King's or Queen's Evidence). A popular phrase used to denote the testimony given by an accomplice in the commission of a crime against the other accomplices on their trial, under an agreement or understanding with the prosecuting officer that the witness shall not be brought to trial for his part in the crime, in consideration of his aid to the State. Such an agreement or understanding on the part of the prosecution is not valid and enforceable as a matter of law, but in practice such agreements are usually adhered to by the prosecutor as a matter of good faith and are countenanced by courts as a justifiable and proper means of securing convictions for crime. In several States there are statutes providing that there shall be no conviction for crime upon the uncorroborated testimony of an accomplice. In applying this statute, whether a witness is an accomplice whose testimony requires corroboration is a question for the jury, unless the facts are undisputed or the question rests upon some rule of law, where it must be passed upon by the court. See Accomplice; Principal; Accessory.

STATES-GENERAL (Fr. *états généraux*). The name given to the convocation of the representative body of the three orders of the French kingdom, representing the nobility, clergy, and bourgeoisie or *tiers état* (Third Estate). As far back as the time of Charlemagne, there were assemblies of clergy and nobles held twice a year to deliberate on matters of public importance, and in these assemblies the extensive body of laws bearing the name of the Capitularies of Charlemagne was enacted. These national convocations seem to have ceased to be held at the time of the final disruption of the Carlovingian realm, about seventy years after Charlemagne's death. From that time forward there is no trace of any national assembly in France till 1302, when the *états généraux*, including the three orders of clergy, nobles, and citizens, were convoked by Philip the Fair, with the view of giving greater weight to the course adopted by the King in his quarrel with Pope Boniface VIII. In 1308 Philip obtained from the states-general a condemnation of the Knights Templars. During the period of the Hundred Years' War (1337-1453) the states-general were frequently convoked, and the exigencies of the Court enabled them to play an important rôle in connection with the revenue and taxation. But they were not a law-making body, although they enabled the voice of the nation to assert itself against abuses of the royal power. As the royal authority became more and more absolute, and a standing army made the sovereign less dependent upon financial grants made by his subjects, the summoning of the states-general gradually ceased to be regarded as indispensable. The advisers of Louis XIII. convoked the states-general, after a long interval, in 1614, but the body was soon dismissed for looking too closely into the finances;. and from that time there was no convocation of the states-general till the memorable meeting in 1789, which initiated the French Revolution. The states-general voted by orders, but in 1789 the Third Estate refused to abide by a regulation which enabled the other two orders to combine against it and to thwart its purposes. They insisted that the vote should be by members in a single body (with the Third Estate as numerous as the other two orders combined), and they achieved their object by constituting themselves the National Assembly. See French Revolution.

The name States-General is also applied to the existing legislative body of the Kingdom of the Netherlands (q.v.), as was formerly the case in the Republic of the Netherlands from 1593 to 1795.

STATES OF THE CHURCH. The territory in Central Italy formerly under the temporal sovereignty of the Holy See. For their history, see Papal States; and for the theory involved, Temporal Sovereignty.

STATES' RIGHTS. A political term having reference to the rights of the individual States as compared with the central Government in countries having a federal form of government. In the history of the United States, the term is used to denote the view prevailing in the South prior to the Civil War with regard to the nature of the Union. According to this view the Union was a compact of sovereign and independent States; the central or Federal Government was the mere agent of the States, which were regarded as the principals; and the primary allegiance of the individual was to his State rather than to the United States. In effect this view upheld the right of a State to interpose its authority when the central Government enacted oppressive or unconstitutional laws. (See Nullification.) Southern statesmen and political leaders contended for this view with particular insistence in connection with the long controversy over slavery. Prior to the Civil War, a large proportion of the people of the Southern States held to the States' rights view of the Constitution, although many of them were not nullifiers. In the early part of the nineteenth century, particularly at the time of the War of 1812, the States' rights view was also strong in the North and East, and was not abandoned until it became the view and support of the slavery interest. The Civil War settled the issue adversely to the States' rights view, and it is no longer a constitutional question in the old sense of the term. In the German Empire, States' Rights, or Particularism, as the Germans call it, is very strong, and has been at the bottom of many great constitutional struggles in that country. The Imperial Constitution recognizes a large sphere of autonomy of the individual States, and some of those in South Germany enjoy rights which are survivals of the Confederation.

STATESVILLE. The county-seat of Iredell County, N. C., 156 miles west of Raleigh, on the Southern Railway (Map: North Carolina, B 2). It is in the centre of a rich grain and tobacco growing section, with some mineral deposits. One of the State experiment farms is just outside the city limits. There are furniture factories, flour mills, cotton mills, tanneries, foundries, and iron works. The water works and the electric light plant are owned by the municipality. Population, in 1900, 3141.

STATE TRIALS. In English law, a phrase employed to denote trials involving offenses against the State, or which determine questions concerning the duties and privileges, etc., of important officers of the Crown. The first collection of State Trials appeared in 1719; a second in 1730; a third in 1742; *Hargrave's* edition in ten volumes in 1776-81; and between 1809 and 1826, the fifth edition in thirty-three volumes was published. This edition is the one now used, and is known as "Howells' State Trials," after the real editor, Thomas Bayley Howell, who compiled the work, although the name of one Cobbett appears as editor on the title page of volume i. These reports contain much learning in criminal and constitutional law. A new series is being prepared under the supervision of a Parliamentary Committee, and all important cases in constitutional and international law will be included.

STATIC ELECTRICITY. See Electricity.

STATICS (from Gk. *στατικός*, *statikos*, relating to standing, from *στατός*, *statos*, placed, standing, from *ἱστάναι*, *histanai*, to stand). That branch of dynamics which treats of the properties of material bodies when, under the action of forces, their motion is not changing. They are then said to be in equilibrium. See Mechanics and Equilibrium.

STATIC SENSE. In close anatomical connection with the cochlea of the inner ear there are in man and most other vertebrates, three bent tubes of bone inclosing three membranous tubes, filled with and floating in a fluid, the endolymph and perilymph. These tubes, known as the semicircular canals, lie approximately in the three planes of space. At the termination of each canal is a flask-like swelling (ampulla), within which are to be found certain specialized nervous end-organs. The ingoing fibres from the three ampullæ constitute the main portion of the vestibular branch of the eighth or auditory nerve. Arguing from these anatomical features, it was long supposed that the canals served some auditory function such as the sensation of noise or the perception of localization of sounds. But we now have abundant evidence for regarding them as the organ of the 'static sense'—by which is meant (1) that they constitute a *physiological* apparatus for the maintenance of equilibrium (and some would add, for the maintenance of muscular tonicity); (2) that any irregularity in their operation makes itself felt *mentally* as giddiness or dizziness; and more doubtfully (3) that an acceleration or a diminution of the rate of movement of the body as a whole so affects them as to set up sensations which are interpreted as what has very loosely been termed a 'sense of translation.'

STATIONERS' HALL. The guildhouse of the 'Master and Keepers or Wardens and Commonalty of the Mystery or Art of Stationers of the City of London,' now situated near Ludgate Hill in London. This company, which had been preceded by a voluntary association as early as 1403, was incorporated in 1556. For nearly three hundred years it regulated the publication of all books in England. Since the passage of the copyright law (1842), registration is no longer compulsory, but it is necessary for securing copyright. For a history of the company, consult the first volume of E. A. Arber's valuable *Transcript of the Stationers' Registers, 1554-1640* (5 vols., London, 1875-94).

STATIONS (Lat. *statio*, from *stare*, to stand). A name applied in the Roman Catholic Church to certain places reputed of special sanctity, which are appointed to be visited as places of prayer. The name is particularly applied in this sense to certain churches in the city of Rome. The word is employed in reference to a popular devotional practice of the Roman Catholic Church, known as that of 'the stations of the cross.' Carved or painted representations, the subjects of which are supplied by scenes from the passion of Christ, are called stations of the cross, and are found in every church. The origin of this devotional exercise, like that of local pilgrimages, is traceable to the difficulty of access to the holy places of Palestine, consequent on the Turkish occupation of that country; the number of the stations is commonly fourteen; the subject of all is a sort of pictorial narrative of the passion. The devotional exercise is performed by kneeling at the several stations in succession, and reciting certain prayers at each, or joining in their recitation by the priest.

STATISTICAL CONGRESS, INTERNATIONAL. An organization of the most eminent statisticians of all countries, which convenes from time to time to define and systematize investigations. The first meeting was held at Brussels in 1853.

STATISTICS. Etymologically, the science of States. The word seems to have been introduced into England about the beginning of the nineteenth century. It came into use in Germany about half a century earlier and was there applied to lectures or books upon descriptive political science, of which the *Statesman's Year Book* and the *Almanach de Gotha* are typical modern representatives. If either of these annual publications be imagined stripped of the numerical statements so frequent in them, a very fair notion is left of Achenwall's *Outlines of Modern Political Science* ("Abriss der neuesten Staatswissenschaft," etc., 1749), which opens with the statement: "The notion of statistics so called, that is, the political science of the several kingdoms, is very differently understood, and among the many books on the subject it is not easy to find any one that agrees with the rest in the number and the arrangement of its parts," a complaint which might be made to-day with almost equal correctness. The title Statistics thus adopted by Achenwall established itself as the prevailing name for a sort of descriptive political science, which had existed long before as the Elzevir *Republics* and the writings of Conring illustrate, and which maintained itself at the universities and before the public in Germany until into the nineteenth century.

Meantime in England a different line of work had begun about the middle of the seventeenth century, after the recurrent and disastrous visitations of the plague had roused interest enough in the mortality it did so much to swell to cause weekly reports of the burials and later of the christenings in London to be made and published. The keen interest in the methods of observation and measurement which culminated in and were reinforced by the Royal Society, chartered in 1662, induced Captain John Graunt to apply methods of observation, induction, and measurement to the births and deaths of London. He presented to the Royal Society in 1662 his "Observations on the Bills of Mortality," the foundation of statistics as that word is now understood. But at that time the new study was baptized by his friend and collaborator, Sir William Petty, 'Political Arithmetic.' Interest in this line of work grew and spread gradually to the Continent, where Achenwall's contemporary Süssmilch in 1741 hailed Graunt as a scientific Columbus who had discovered a new continent and confessed himself Graunt's disciple, but showed no knowledge of Achenwall's work and made no use of the name statistics. Gradually the word statistics spread to Great Britain, where, in 1798, Sir John Sinclair published his *Statistical Account of Scotland.* The word was taken up by Malthus in editions of his *Principle of Population* after the first, and in such connection as to indicate that he borrowed it from Sinclair. Malthus's subject-matter was in the line of previous writers on political arithmetic, and his adoption of the term statistics may have been instrumental in leading to its gradual displacement of the lengthier phrase in English writing. Meantime the study of political arithmetic, born in England, extended to the Continent, gradually displacing the older statistics of Achenwall, sometimes called 'university statistics,' from its prevalence as a subject of university lectures, and, to add insult to injury, usurped its name. Perhaps the most striking difference between the two notions of statistics, the older and the newer, is that the former is purely descriptive and takes no account of the underlying notion of modern science, the notion of causation, while the latter subordinates description to explanation, or an attempt at explanation. At the same time it would be inconsistent with present usage to limit the word statistics any further than to say that it refers to the results obtained in any field of reality by methods of counting and that these methods are mainly employed in the study of societies politically organized into States.

Methods of counting apply especially to the study of human societies, because in them the individual units are widely different, and it is with the differences almost as much as with the resemblances between individuals that science is concerned. In the inorganic sciences and to a less extent in the sciences of plant and animal life, the units taken for purposes of investigation resemble one another far more closely than human individuals do, or at least their resemblances are far more obvious and for man's purposes more important than their differences. In other than the social sciences, therefore, the observation of one or a few units may serve as a basis for general statements about the group, but in human societies it is frequently necessary to ascertain the existence, or non-existence, of a particular characteristic in every member of the group. This involves counting, and results in a statement in some numerical form, as a percentage, an average, or a series of figures showing the distribution of the characteristic among the members of the group. This indicates a fundamental reason for the imperfect development of methods of measurement in the social sciences and a reason that statistics or the science of measuring aggregates of units, as distinct from individual units, is more necessary and has a wider range of applications in the study of social sciences than it has in the study of natural sciences. There is, therefore, much ground for the opinion of those who define statistics as the numerical study of social facts, or the numerical investigation of man's social life. But it seems more correct to hold that, for example, an enumeration through the century of the number of auroras observed each year and an observation through the same period of the extent of spots on the sun, and an arrangement of these two measurements in such a way as to show that they have fluctuated in close conformity, is to be included in statistics.

Theory. The United States Census reported in 1890 22,329,990 persons in the country over 15 years of age and married; in 1900 this class of the population numbered 27,765,707. On computing the ratios it is found that among each 1000 adults 553 were married in 1890 and 557 in 1900. The same authority reported at the Eleventh Census 875,521 deaths during the preceding year, of which 6756 were caused by railroad accidents, and at the Twelfth Census 1,039,094 deaths, of which 6930 were due to the same cause, so that railroad accidents caused in 1890 657 deaths and in 1900 667 deaths out of each 100,000 reported. The foregoing will serve to illustrate a regularity or uniformity often, but not always, traceable in the distribution of conditions or the recurrence of events in society. Upon this uniformity in the characteristics of, and this regularity in the events occurring in, social groups, which has been not very felicitously called 'the law of large numbers,' the statistical method rests. These uniformities and regularities do not exist in the individual or even in the small group, and if they could not be traced in the large group the laborious and uninviting statistical method would add nothing to the information obtainable from examination of a few individuals or instances, and therefore, however important for political ends, would have no significance for science. It is this 'law of large numbers,' or the permanence of numerical relations in social life, that makes it possible to describe human societies with accuracy in quantitative terms, to frame inductions from their past, which are found to hold for their future, to forecast the influence of a given change upon their life and so in multitudinous ways to control that life. Perhaps the best illustration of the importance of the 'law of large numbers' is found in the business of insurance, which could not exist were it not for that law as a foundation. This principle stands in somewhat the same relation to the possibility of a science of society that the principle of the uniformity of nature does to the possibility of natural science. In social phenomena it is seldom if ever possible to carry the isolation of causes to the degree of perfection it has reached in the natural world. The presence of a few drops of hydrochloric acid is practically the only difference between a transparent solution of nitrate of silver and a turbid white fluid, so the acid is said to cause the precipitate. But the marriage of an individual man or woman is influenced by so many complex considerations that it is impossible to perceive in the vast majority of marriages taken separately any effect of so subsidiary a cause as the price of bread or the spread of business depression. What this subsidiary cause loses, however, in power over each individual instance it gains by the number of individuals it reaches and the fact that its effect is uniformly in the same direction, while the influence of age, of example, of personal affection, of gain or loss of property, etc., though in many individual cases far more powerful, is felt sometimes in one direction and sometimes in another. Such causes, therefore, are as powerless on the aggregate as they are potent on the individual, and, on the contrary, the society as a whole betrays the undeniable effects of slight causes, which perhaps few individuals therein would admit to have swayed their action. The 'law of large numbers' thus assumes that the causes of any social phenomenon may be divided into two groups, the individual, accidental, or disturbing causes, and the essential or primary causes, and that causes of the former sort have no constant tendency to act in one direction rather than another, and, accordingly, no tendency to move the group as a whole in any one direction. If a sufficiently large number of instances be taken, the disturbing or individual causes cancel and allow the influence of the essential or group causes to be traced. How large a number of instances must be enumerated to eliminate these individual causes with any specified degree of completeness is a mathematical problem dealt with by the calculus of probabilities.

Bibliography. For the only survey of the history in English, see Falkner's translation of Meitzen's *Geschichte, Theorie und Technik der Statistik*, published by the American Academy of Political and Social Science in 1891. For the theory of the subject, see the latter part of the foregoing book; Bowley, *Elements of Statistics* (London, 1901), strong in English methods, in wage statistics, and in the mathematical basis of the subject; and Westergaard, *Theorie der Statistik* (Jena, 1890). See also Mayo-Smith, *Statistics and Sociology* and *Statistics and Economics.*

STATIUS, stā′shĭ-ŭs, Publius Papinius (c.40-c.96 A.D.). A Roman poet, born at Naples. He became famous for his poetic gifts, especially for his skill in extemporaneous verse, and three times gained the prize in the Alban contests. But finally, having been vanquished in the quinquennial games, he retired with his wife, Claudia, to his birthplace, Naples, where he died about A.D. 96. He is polished and correct, but one often feels the note of artificiality in his verse. He wrote a very dull and laborious epic entitled *Thebais;* the *Silvæ*, five books of miscellaneous poems; and an epic of the Trojan cycle, *Achilleid*, of which only a portion has survived. The best modern editions are: of the *Silvæ*, by Baehrens (Leipzig, 1876), Vollmer (with extensive German commentary, Leipzig, 1898), and Klotz (Leipzig, 1900); of the *Achilleis* and *Thebais*, by Kohlmann (Leipzig, 1879). There are English translations, in whole or in part, by Pope, Howard, Stephens, and Lewis.

STATUTE (Lat. *statutum*, statute, neu. sg. of *statutus*, p.p. of *statuere*, to set up, establish, from *statum*, supine of *stare*, to stand). A law enacted or promulgated in writing by the supreme legislative body of a government, or by its authority. Statute law is sometimes spoken of as written law to distinguish it from the common or unwritten law, which is established exclusively by judicial decision. All statutes have their source in the official action of the legislative body, the form of which may vary according to the particular form of government under which it acts. The validity of a statute in any given case depends not only upon the legislative body's being lawfully constituted, but upon its constitutional authority to act. (See CONSTITUTIONAL LAW.) Statutes may be enacted by indirect legislation, that is, by some subordinate legislative body whose acts derive their validity from the sanction of the supreme legislative body. Thus, in England Orders in Council and the various rules of court adopted under the judicature acts, and in the United States the ordinances of Boards of Aldermen, and the ordinances of Boards of Health under the various public health acts, are examples of statutes enacted by indirect legislation.

The procedure by which statutes are created by legislative enactment has been fully discussed under the topics PARLIAMENT; CONGRESS; LEGISLATION, etc., to which reference is here made. In England the acts of Parliament have the full force of statutory law without the approval of the sovereign, although it is the established custom for the sovereign to promulgate all statutes "by and with the advice and consent of the Lords Spiritual and Temporal in this present Parliament assembled." In the United States the acts of Congress require the assent of the President of the United States, and the acts of the various legislatures require the assent of the Governors of their respective States to give them validity as statutes. See VETO.

Statute laws may be classified with reference to the purpose for which they are enacted, with reference to the subject matter of the statutes, and with reference to the compliance with the statute required. With reference to their purpose, statutes are said to be (a) Declaratory, when passed for the purpose of affirming a rule of the common law which is uncertain or indefinite, or a statute of doubtful meaning; (b) Remedial, when passed for the purpose of remedying defects or supplying omissions in the statute or common law; (c) Penal, when passed for the purpose of prohibiting acts specified in the statute and imposing a penalty for its violation; and with reference to their subject matter, they are said to be (a) Public, when applicable to the entire community, and (b) Private (see the explanation of these terms under the titles LAW; LEGISLATION; PUBLIC LAW, ETC.), as distinguished from public when applicable to a single individual or corporation, or to a limited number of individuals. The distinction between public and private statutes, first made as early as the reign of Richard II., now has considerable importance, owing to various statutory and constitutional provisions requiring the publication of public and private statutes separately. Statutes have also been classified with reference to the extent of territory in which they are applicable. Those statutes are said to be (a) General, when they apply to the entire territory subject to the legislative jurisdiction of the law-making body, and (b) Local, when they extend only to a single or limited political division of such territory, as statutes enacted by State legislatures which apply only to a single town, city, or county.

With reference to the subject matter also, statutes are classified as Enabling acts, which confer rights or privileges, as the Married Women's Enabling Acts; and Disabling acts, which take away rights or privileges hitherto enjoyed, as statutes requiring legal voters to have new or additional qualifications.

With reference to the compliance required statutes are said to be (a) Mandatory, when they direct an act to be done with the consequence that if it is not done all acts or proceedings taken under the statute are invalid. Thus statutes formulating the procedure for organizing corporations, or authorizing civil arrest, are mandatory, since they must be strictly complied with, or all acts done under them have no validity.

(b) Directory, when failure to comply with the statute does not affect the validity of acts done under it or entail the imposition of any penalty for failure to comply with the statute. Thus many statutes specifying the time and manner of filing official reports are directory only. There is no penalty for failure to comply with the statute, and compliance with it can be compelled only by mandamus (q.v.).

(c) Prohibitory, when they forbid the doing of any act either with or without penalty for failure to comply with the statute.

(d) Permissive, when they allow acts to be done not before permitted, or give to them some additional legal effect, although such acts are not required to be done, as the various statutes permitting the disposition of property by will.

A statute may contain four distinct parts—the title, the preamble, the enacting clause, and the purview. The title is a short form of description of the statute, as for example, 'An Act Prohibiting Sabbath-Breaking.' In some States the title is of great importance, because of constitutional provisions requiring statutes to have titles descriptive of the subject matter of the statute. In the absence of such provision, it is now the usual practice to omit the title.

The preamble is an introductory and explanatory statement setting forth the reason and purpose of the statute. It is of service only as an aid in interpreting the purview of the statute which follows. All the early English statutes included the preamble, but it is now seldom used.

The enacting clause is a brief direction that the statute be enacted by the legislative body; as, "Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled."

The purview is that portion of the statute following the enacting clause, and is the only part of the statute which has the effect of law. It may contain various subdivisions or clauses known as provisos, exceptions, the saving clause, the repealing clause, terms which are self-explanatory.

At common law a statute was deemed to take effect as upon the first day of the session in which it was enacted. This was modified by

Statute 33, Geo. III., c. 13, which provided that all statutes should become operative from the date of their receiving the royal assent. It is now generally the rule in the United States that statutes shall become operative from the date of their receiving the assent of the Executive, unless a different date is otherwise specified in the statute itself.

Courts will take judicial notice of all public statutes operative within their jurisdiction, and it is therefore not necessary generally to plead a public statute upon which a litigant founds an action or defense. Some rule of public policy may, however, require a public statute to be pleaded in special cases, as the Statute of Limitations (q.v.) and Statute of Frauds (q.v.). Private statutes, however, are required to be pleaded, and the statutes of foreign States and countries, being regarded as matters of fact, are required to be pleaded and proved like other matters of fact.

For discussion of the *amendment* and *repeal* of statutes, consult those topics respectively; and for a discussion of the interpretation of statutes, see Interpretation; Constitutional Law; Law, etc.

Consult the authorities referred to under Legislation; Law.

STATUTE OF FRAUDS. See Frauds, Statute of.

STATUTE OF LIMITATIONS. See Limitation of Action.

STATUTE OF PARLIAMENT. See Act of Parliament.

STATUTES OF JECFAILS. English statutes permitting amendments to pleadings or curing certain mistakes or omissions in the proceedings in an action. The name was derived from the old phrase *jeo faile* (I have failed), by which the pleader acknowledged an error in his pleadings or proceeding, after which he could take advantage of the provisions of these statutes. The procedure acts in practically all of the United States provide for the amendment of pleadings and the arbitrary waiver of defects and irregularities in certain cases, but the term *jeofails* is not commonly applied to such acts. Consult Chitty on *Pleading;* Stevens on *Pleading.*

STAUBBACH, stou′bäG. A celebrated waterfall in the southern part of the Canton of Bern, Switzerland, 8 miles south of Interlaken. It is one of the highest in Europe, having a descent of between 800 and 900 feet. Long before it reaches the bottom it is blown into a dust of spray, whence its name *staubbach* (dust-stream).

STAUNTON, sta̤n′ton. The county-seat of Augusta County, Va., 135 miles northwest of Richmond, on the Baltimore and Ohio and the Chesapeake and Ohio railroads (Map: Virginia, E 3). It is the seat of the Western State Hospital for the Insane, and of the State Deaf, Dumb, and Blind Institution: and has the Mary Baldwin Seminary, Virginia Female Institute, and Kable's Military Academy. Other prominent features are the City Hall, Court House, Masonic Temple, Columbian Hall, and Gypsy Hill and Highland Parks. Staunton manufactures organs, flour, overalls, wagons, machine-shop products, and agricultural implements. The government, under the revised charter of 1879, is vested in a mayor, chosen biennially, and a unicameral council. The waterworks and the electric-light plant are owned and operated by the municipality. Population, in 1890, 6975; in 1900, 7289.

STAUNTON, Sir George Thomas (1781-1859). An English traveler and Orientalist, born at Salisbury. In 1792 he went with his father, Sir George Leonard Staunton (1737-1801), to China, where he learned to speak and write the language. After two terms at Cambridge he was appointed writer in Canton for the East India Company's factory. He introduced vaccination into China in 1804, by translating George Pearson's treatise. He translated from Chinese: *La Tsing lew lee, being the Fundamental Laws of China* (1810), the first book translated from Chinese into English; the *Narrative of the Chinese Embassy to the Khan of the Tourgouth Tartars* (1821), and wrote *Miscellaneous Notices Relating to China* (1822), *Notes of Proceedings and Occurrences During the British Embassy to Peking* (1824), *Observations on Our Chinese Commerce* (1850), and *Memoir of Sir J. Barrow, Bart.* (1852).

STAUNTON, Howard (1810-74). An English chess master and Shakespearean scholar. In 1843 he defeated St. Amant, then the chess champion of Europe, and three years afterwards won from the German experts Harrwitz and Horwitz. His plans at all times displayed great originality in attack, fertility in defense, and untiring patience. He founded the *Chess Player's Chronicle* in 1840, which he edited until 1854, and from 1844 until his death conducted the chess column of the *Illustrated London News.* His Shakespearean researches resulted in an edition of the plays and poems (1857-60), edited and analyzed with shrewdness and good taste, a facsimile of the 1623 folio, and a series of articles contributed to the *Athenæum,* on "Unsuspected Corruptions of Shakespeare's Text" (1872). His other writings include: *Chess Player's Hand-Book* (1847); *Chess Player's Companion* (1849); *Chess Praxis* (1860); *Great Schools of England* (1865).

STAUPITZ, stou′pĭts, Johann von. A friend and spiritual guide of Martin Luther (q.v.).

STAUROLITE (from Gk. *σταυρός, stauros,* cross + *λίθος, lithos,* stone), or Fairy Stone. A mineral hydrated iron-aluminum silicate crystallized in the orthorhombic system. It has a sub-vitreous to resinous lustre and is dark brown to black in color. The crystalline varieties are frequently cruciform, owing to twinning. On account of their resemblance to a cross these forms are popularly believed to have fallen from heaven, and are used to some extent not only as ornaments, but also as charms. They occur in crystalline schists, and are usually associated with garnet, syenite, and tourmaline. Staurolite is found in Switzerland, the Tyrol, Moravia, Ireland, and in the United States at various localities in New England, New York, North Carolina, Georgia, and elsewhere along the Appalachian range of mountains.

STAUROSCOPE (from Gk. *σταυρός, stauros,* cross + *σκοπεῖν, skopein,* to view). A variety of polariscope (q.v.) adapted to the study of crystals, and consisting essentially of a mirror, two Nicol's prisms, and a revolving stage. By it sections cut from crystals along any desired direction are examined by use of parallel rays of plane polarized light. See CONOSCOPE; CRYSTALLOGRAPHY.

STAVANGER, stä′våŋg-ēr. A seaport of Southwestern Norway, on the south shore of the wide entrance to the Stavanger or Bukken Fiord, 190 miles southwest of Christiania (Map: Norway, A 7). It has a Gothic cathedral, one of the finest in Norway. The town produces woolen, linen, and cotton goods, soap, preserves, oleomargarine, hardware, pottery, and bricks. There are iron foundries, and the harbor is provided with shipyards. Fisheries and the curing of fish are important industries. The shipping at the harbor amounts to about 325,000 tons annually, and the trade in 1899 was valued at $3,867,100, the principal exports being fish, preserved foods, butter and margarine, marble, and manure. Population, in 1891, 23,899; in 1901, 30,541.

STAVROPOL, stäv′rô-pôl-y′. A government of Ciscaucasia, bounded by the Province of the Don Cossacks and the Government of Astrakhan on the north, the Territory of Terek on the east and south, and the Territory of Kuban on the west (Map: Russia, F 5). Area, 23,430 square miles. The surface is largely steppe-like in character, and only the southwestern part is mountainous, the highest point being about 2200 feet. The principal rivers are the Kuma and the Great Egorlyk. Agriculture and stock-raising are the principal occupations. The chief cereals are wheat, oats, and barley. In 1898 there were in the government over 3,800,000 head of live stock, including over 2,600,000 sheep. Population, in 1898, 912,639, of whom the Russians constituted 90 per cent.

STAVROPOL. The capital of the Russian government of the same name, situated about 700 miles south-southeast of Moscow (Map: Russia, F 5). Farming and gardening are the main occupations. Population, in 1897, 41,621, chiefly Russians.

STAWELL, stą′el. A town of Borung County, Victoria, Australia, 179 miles northwest of Melbourne, in the centre of the richest gold-mining region of the province (Map: Victoria, B 4). There are important freestone quarries. Population, in 1901, 5296.

STAY (OF. *estaie*, *estaye*, Fr. *étai*, from MDutch *staeye*, a stay). In law, a suspension of legal proceedings by order of a court. A stay is usually granted by the court in which an action or proceedings are pending, and is commonly ordered for the purpose of compelling a party to an action to comply with some condition or order of the court, as to pay costs on some interlocutory motion, or to give security for costs, etc. In a few instances the courts may grant absolute stays, as, for example, where an unfounded action is commenced merely to harass or annoy the defendant. It is customary for the United States courts to stay the proceedings in all actions pending against a bankrupt in State courts during the pendency of the bankruptcy proceedings. A temporary stay of execution may usually be obtained, especially where the defeated party desires to appeal. No rights are destroyed by a stay, as it only operates to suspend proceedings and does not involve their merits. See Chitty, *On Pleading; New York Code of Civil Procedure.*

STEAD, WILLIAM THOMAS (1849—). An English journalist, born at Embleton, Northumberland. After a brief schooling he went into business, but in 1891 was appointed editor of the *Northern Echo* (Darlington). Here he remained until 1880, when he was called to be assistant editor, under John Morley, of the *Pall Mall Gazette*. He was editor of this paper from 1883 to 1889 and in the next year founded the *Review of Reviews* (monthly). He established similar publications in the United States (1891) and Australia (1894). As editor of the *Pall Mall Gazette*, a daily, he introduced American journalism into England, in the way of the interview, illustrations, and 'extras.' Though regarded as thoroughly sincere and intensely earnest in his treatment of public affairs, he aroused criticism by these methods and by injudicious conclusions. He became known as a vigorous opponent of social evils, a steadfast advocate of international peace, and, though patriotic, an apologist of Russia. His *The Truth About the Navy* (1884) led to the laying down of more ships in the following year. In 1885 his *The Maiden Tribute of Modern Babylon*, an exposure of legally permissible outrages upon women and children, landed him for a three months' term in Holloway Gaol, but it was followed by the enactment of the Criminal Law Amendment Bill. In 1898 he started *War Against War*, a weekly devoted to the opposition of the Anglo-Boer War. His publications include: *The Truth About Russia* (1888); *The Pope and the New Era* (1889); *The Story that Transformed the World* (1890); *If Christ Came to Chicago* (1893); *The Labor War in the United States* (1894); *Satan's Invisible World: A Study of Despairing Democracy* (1897); *Mr. Carnegie's Conundrum* (1900); *The Americanization of the World* (1902); *The Last Will and Testament of Cecil John Rhodes* (1902).

STEALING. See LARCENY.

STEAM (AS. *stēam*, Fris. *stoame*, Dutch *stoom*, steam; of unknown etymology). Water in a gaseous condition. It is a dry, colorless gas with a specific gravity of 0.625 as compared with air at the same pressure. The white cloud of vapor which rises from boiling water and which is commonly called steam is a vapor composed of minute particles of water suspended in the air and formed by the condensation of the steam coming in contact with the cool air. When water is subjected to the action of heat, it is converted into steam. Though a change takes place in the physical condition of the substance, the chemical composition of the steam is in no way different from that of the water from which it was generated. If heat be applied to the bottom of a vessel containing water, the air contained in the water will first appear as little bubbles which rise to the surface. Then the water in immediate contact with the heated portion of the vessel will be converted into steam, which will form as bubbles on the bottom of the vessel and these will rise through the liquid, but at the commencement of the operation they will be at once condensed by the cold upper layers of water. Finally, however, the water becomes heated through when the bubbles rise to the surface and the steam exudes upon the air, and we have the phenomenon known as boiling. As the steam passes into the air, it is cooled and collects into small particles of water which are visible as a white cloud above the surface, and the phenomenon is called condensation. If all the particles of this white cloud were collected into one mass, there would be a volume of water equal to the volume of water in the original vessel which had been converted into the steam forming the cloud. Boiling occurs only when the water in the vessel has reached a certain temperature. This temperature varies with the pressure. ·At the atmospheric pressure of 14.7 pounds at mean sea level, it is 212° F., but it would be somewhat less on the top of a high mountain and somewhat greater at the bottom of a deep mine. See HYPSOMETER; HYPSOMETRY.

The boiling temperature or boiling point of water thus varies with the pressure upon it. At a pressure of 5 pounds per square inch, it is as low as 162.3° F., and at a pressure of 100 pounds per square inch, it is as high as 327.58° F. Condensation takes place at any temperature lower than the boiling temperature.

To explain more fully the action of heat in the formation of steam, reference will be made to the accompanying diagrams. In Fig. 1, let the cylinder contain one pound of water at 32° F., and let the pressure of the atmosphere be represented by the weighted piston. Then if heat be applied to the bottom of the cylinder, the temperature of the water will rise higher and higher until it reaches 212° F.; the piston will up to this point remain stationary except for the small expansion of the water. On continuing the heat, the water shows no further rise in temperature, but steam begins to form and to force the piston upward as shown by Fig. 2, and this continues until the last drop of water is converted into steam and we have the condition illustrated by Fig. 3.

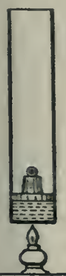


Fig. 1.

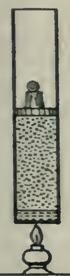


Fig. 2.

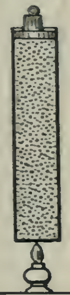


Fig. 3.

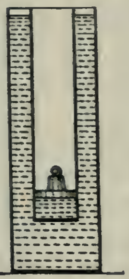


Fig. 4.

Before proceeding further, we must note first that no steam began to form until the water reached a temperature of 212° F., hence this is evidently the lowest temperature at which steam will form under normal atmospheric pressure. Second, we must note that in the condition illustrated by Fig. 3 we have one pound of steam occupying the least possible volume at atmospheric pressure. In actual figures this volume is 26.36 cubic feet. Steam in this condition is known as *saturated steam*. If now we continue to heat the steam in the cylinder Fig. 3, its temperature will rise above that of saturated steam, and the piston will move upward, and we will have *superheated steam*. If now we take the cylinder Fig. 3 and plunge it into a vessel of cold water, as shown by Fig. 4, the heat will be taken away from the steam and it will condense to water. When this water has cooled to 32° F., the whole heat taken away is exactly equal to the whole heat added during the operations illustrated by Figs. 1, 2, and 3.

The amount of this added and abstracted heat may now be considered. First, let us assume that the cylinder Fig. 1 has an area of 1 square foot and that it contains 1 pound of water. The height to which the water rises in the cylinder is 0.016 foot. The pressure on the piston from the air is 14.7 pounds × 144 square inches = 2116.8 pounds. Now on applying heat to the water it will at first gradually rise in temperature from 32° F. to 212° F. before evaporation commences. Then 212° — 32° = 180 are the number of heat units required to raise water from 32° F. to the boiling point at atmospheric pressure. Steam now begins to form and the piston to rise until all the water is converted into steam at a temperature of 212° F. This steam, as before stated, occupies a space of 26.36 cubic feet. The heat required to perform this operation is 966 units. Hence the total heat required first to raise the water from 32° F. to 212° F. and then to convert it into steam is 180 + 966 = 1146 units. It is quite clear how the heat required to raise the water from 32° F. to 212° F. has been expended, but it is not so clear how the 966° F. required to convert the water at 212° F. into steam at 212° F. has been expended. It will be observed that two things have happened in this last operation. First, the water has been converted into steam, which occupies 1644 times the space occupied by the water from which it was generated. Second, the piston has been raised from the surface of the water in Fig. 1 to the surface of the steam in Fig. 3. Therefore, the heat has been expended in two ways: First, in overcoming the internal molecular resistance of the water in changing its condition from water to steam, and, second, in overcoming the external resistance of the piston to the increasing volume of the steam during formation. The first task performed is called the internal work of the steam and the second task is called the external work. Now the share of the heat expended in each operation may be calculated as follows: The total heat expended is, as already stated, 1146 units. To raise the piston with a pressure on it of 2116.8 pounds through a height of 26.36 feet requires 55,799 foot-pounds of energy. As the energy of one heat unit is 772 foot-pounds, then 55,799 ÷ 772 = 72.3 heat units expended in raising the piston. Adding this to 180, the number of heat units required to raise water from 32° F. to 212° F., we have 252.3 units consumed in heating the water and raising the piston. This amount subtracted from the total heat expended gives 1146 — 252.3 = 893.7, which is the number of heat units expended in internal work. We can now summarize the distribution of the heat as follows:

In raising temperature of water	180 units
In doing internal work	893.7 units
In doing external work	72.3 units
Total	1146.0 units

Having gone through the phenomenon of steam generation in detail, we can summarize some of the general facts that have been brought out. The temperature of the water gradually rises until it reaches the temperature at which steam is formed. This temperature will depend upon the pressure or the load on the piston. If this pressure is the normal atmospheric pressure of 14.7 pounds per square inch, steam begins to form at a temperature of 212° F.

As soon as 212° F. is reached, steam will begin to form and the piston will steadily rise, but no matter how hot the fire may be, the temperature of both water and steam will remain at 212° F. until all the water is evaporated. We had one pound of water at 32° F. and at 14.7 pounds absolute pressure, and found that steam formed at a temperature of 212° F. and remained at that temperature. We added 180.9 B. T. U. (British Thermal Units), the heat of the liquid, to bring the water from 32° to the boiling point. To convert water at 212° into steam at 212°, we added 965.7 B. T. U. more. This quantity, known as the latent heat, or heat of vaporization, makes the total heat 1146.6 B. T. U. If we should measure the volume carefully after all the water was evaporated, we should find that there was just 26.36 cubic feet of dry saturated steam. We had one pound of water, and therefore must have one pound of steam, for none of it could escape; hence one cubic foot will weigh $\frac{1}{26.36} = 0.03794$ pound, which is known as the density of steam at 14.7 pounds absolute pressure or 212° F. In the table of properties of saturated steam all these quantities are found in the order given and at the pressure of 14.7 pounds above vacuum.

Suppose now we place a weight of 85.3 pounds on the piston. The pressure is 85.3 pounds plus 14.7 pounds, or 100 pounds absolute. We shall now find that no steam will form until a temperature of 327.58° is reached. Starting with water at 32°, it will be necessary to add 297.9 B. T. U. before a temperature of 327.58° is reached, and also we must add 884 B. T. U. more to vaporize it, making a total heat of 1181.9 B. T. U. Under this greater pressure the steam occupies a volume of only 4.403 cubic feet, or one cubic foot of it weighs $\frac{1}{4.403} = 0.2271$ pound.

We have already seen that any change in the temperature of saturated steam produces a change of pressure, and that every change of pressure corresponds to a certain change in temperature. There are several properties of saturated steam that depend upon the temperature and pressure; and the values of all these different properties when arranged for all temperatures and pressures are called steam tables. The

TABLE OF PROPERTIES OF SATURATED STEAM

PRESSURE IN POUNDS PER SQUARE INCH ABOVE VACUUM	Temperature in degrees, Fahrenheit	Total heat in heat units from water at 32°	Heat in liquid from 32° in units	Heat of vaporization, or latent heat in heat units	Density or weight of cubic foot in pounds	Volume of 1 pound in cubic feet	Factor of equivalent evaporation at 212°	Total pressure above vacuum
1	101.99	1113.1	70.0	1043.0	0.00299	334.5	.9661	1
2	126.27	1120.5	94.4	1026.1	0.00576	173.6	.9738	2
3	141.62	1125.1	109.8	1015.3	0.00844	118.5	.9786	3
4	153.09	1128.6	121.4	1007.2	0.01107	90.33	.9822	4
5	162.34	1131.5	130.7	1000.8	0.01366	73.21	.9852	5
6	170.14	1133.8	138.6	995.2	0.01622	61.65	.9876	6
7	176.90	1135.9	145.4	990.5	0.01874	53.39	.9897	7
8	182.92	1137.7	151.5	986.2	0.02125	47.06	.9916	8
9	188.33	1139.4	156.9	982.5	0.02374	42.12	.9934	9
10	193.25	1140.9	161.9	979.0	0.02621	38.15	.9949	10
15	213.03	1146.9	181.8	965.1	0.03826	26.14	1.0003	15
20	227.95	1151.5	196.9	954.6	0.05023	19.91	1.0051	20
25	240.04	1155.1	209.1	946.0	0.06199	16.13	1.0099	25
30	250.27	1158.3	219.4	938.9	0.07360	13.59	1.0129	30
35	259.19	1161.0	228.4	932.6	0.08508	11.75	1.0157	35
40	267.13	1163.4	236.4	927.0	0.09644	10.37	1.0182	40
45	274.29	1165.6	243.6	922.0	0.1077	9.285	1.0205	45
50	280.85	1167.6	250.2	917.4	0.1188	8.418	1.0225	50
55	286.89	1169.4	256.3	913.1	0.1299	7.698	1.0245	55
60	292.51	1171.2	261.9	909.3	0.1409	7.097	1.0263	60
65	297.77	1172.7	267.2	905.5	0.1519	6.583	1.0280	65
70	302.71	1174.3	272.2	902.1	0.1628	6.143	1.0295	70
75	307.38	1175.7	276.9	898.8	0.1736	5.760	1.0309	75
80	311.80	1177.0	281.4	895.6	0.1843	5.426	1.0323	80
85	316.02	1178.3	285.8	892.5	0.1951	5.126	1.0337	85
90	320.04	1179.6	290.0	889.6	0.2058	4.859	1.0350	90
95	323.89	1180.7	294.0	886.7	0.2165	4.619	1.0362	95
100	327.58	1181.9	297.9	884.0	0.2271	4.403	1.0374	100
105	331.13	1182.9	301.6	881.3	0.2378	4.205	1.0385	105
110	334.56	1174.0	305.2	878.8	0.2484	4.026	1.0396	110
115	337.86	1185.0	308.7	876.3	0.2589	3.862	1.0406	115
120	341.05	1186.0	312.0	874.0	0.2695	3.711	1.0416	120
125	344.13	1186.9	315.2	871.7	0.2800	3.571	1.0426	125
130	347.12	1187.8	318.4	869.4	0.2904	3.444	1.0435	130
140	352.85	1189.5	324.4	865.1	0.3113	3.212	1.0453	140
150	358.26	1191.2	330.0	861.2	0.3321	3.011	1.0470	150
160	363.40	1192.8	335.4	857.4	0.3530	2.833	1.0486	160
170	368.29	1194.3	340.5	853.8	0.3737	2.676	1.0502	170
180	372.97	1195.7	345.4	850.3	0.3945	2.535	1.0517	180
190	377.44	1197.1	350.1	847.0	0.4153	2.408	1.0531	190
200	381.73	1198.4	354.6	843.8	0.4359	2.294	1.0545	200
225	391.79	1201.4	365.1	836.3	0.4876	2.051	1.0576	225
250	400.99	1204.2	374.7	829.5	0.5393	1.854	1.0605	250
275	409.50	1206.8	383.6	823.2	0.5913	1.691	1.0632	275
300	417.42	1209.3	391.9	817.4	0.644	1.553	1.0657	300
325	424.82	1211.5	399.6	811.9	0.696	1.437	1.0680	325
350	431.90	1213.7	406.9	806.8	0.748	1.337	1.0703	350
375	438.40	1215.7	414.2	801.5	0.800	1.250	1.0724	375
400	445.15	1217.7	421.4	796.3	0.853	1.172	1.0745	400
500	466.57	1224.2	444.3	779.9	1.065	.939	1.0812	500

following are the principal items that are found in the tables:

(1) The absolute pressure in pounds per square inch; it is equal to the gauge pressure plus the atmospheric pressure of 14.7 pounds.

(2) The temperature of the steam, or boiling water, at the corresponding pressure.

(3) The heat of the liquid; or the number of B. T. U. necessary to raise one pound of water from 32° F. to the boiling point corresponding to the given pressure.

(4) The heat of vaporization, or the latent heat; this is the number of B. T. U. necessary to change one pound of water, at the boiling point, into dry saturated steam at the same temperature and pressure.

(5) The total heat; or the number of B. T. U. necessary to change one pound of water from 32° F. into steam at the given temperature or pressure. The total heat is evidently equal to the sum of the heat of the liquid and the heat of vaporization.

(6) The density of the steam; that is, the weight in pounds of one cubic foot of steam at the given temperature or pressure.

(7) The specific volume; or volume in cubic feet of one pound of steam at the required temperature or pressure. Evidently the specific volume is equal to $\frac{1}{\text{density}}$.

All these properties have been calculated by means of various formulas which have been deduced from the results of actual experiment.

We have seen that a saturated vapor contains just enough heat to keep it in the form of a vapor; if it loses heat it will condense. A superheated vapor is one that has been heated after vaporization; it can lose this extra heat before any condensation will take place. A vapor in contact with its liquid is saturated; one heated after removal from the liquid is superheated.

For saturated steam there is a fixed temperature for every pressure. If we know either the pressure or the temperature, we can find the other in the steam tables. For instance, if the gauge pressure of a boiler is 60.3 pounds and we wish to know the temperature, we simply add atmospheric pressure and turn to our tables and find it to be 307° (approximately).

With superheated steam the case is entirely different, for there is no longer the same direct relation between the temperature and pressure. In fact, the relation between temperature and pressure of superheated steam depends upon the amount of superheating. Superheated steam at 60.3 pounds gauge pressure may have a temperature considerably above 307° F. At a given pressure the temperature and volume of a given weight of superheated steam are always greater than the temperature and volume of the same weight of saturated steam. The properties of superheated steam at given pressure are not constant as is the case with saturated steam.

If superheated steam were a perfect gas, we could determine the relation of p, v, and t by the equation $pv = ct$; but superheated steam is not a perfect gas, hence we must modify our equation. By experiment it has been determined that the following equation is nearly correct:

$$pv = 93.5\ t - 971\ p\,\tfrac{1}{4},$$

in which p = absolute pressure in pounds per square inch,
t = absolute temperature, and
v = volume of 1 pound in cubic feet.

STEAM CARRIAGE. See AUTOMOBILE.

STEAM ENGINE. A motor in which the expansive force of steam is employed as the medium for transforming the energy of heat into useful work. Ordinarily the steam acts upon a piston inclosed within a cylinder in such a manner as to be capable only of *reciprocating* motion, but in certain rare forms of engines it acts upon an inclosed piston or vane, which *rotates* around an axis. The rotary engine has the advantages of compactness and of being capable of applying its power directly, while the reciprocating engine has to have the rectilinear motion of the piston transformed into the rotary motion of a fly wheel or shaft by a cumbersome intermediate mechanism. These advantages of the rotary engine are, however, more than counterbalanced by its decided lack of economy in steam consumption, which prevents it from successfully competing commercially with the reciprocating engine. Only the latter is here treated.

EARLY HISTORY. The first instance of the use of steam as a motive power is generally assumed to have been the æolipile of Hero of Alexandria (q.v.). As early as 1543 a Spanish captain, named Blasco de Garay, is reputed to have shown in the harbor of Barcelona a steamboat of his own invention. A French engineer, Salomon de Caus, describes in 1615 a steam machine, which was merely a contrivance for forcing the water contained in a copper ball through a tube by applying heat. An Italian engineer, Giovanni Branca, invented, in 1629, a sort of steam windmill; the steam, being generated in a boiler, was directed by a spout against the flat vanes of a wheel, which was thus set in motion. See STEAM TURBINE.

In England the first successful effort was that of the Marquis of Worcester, who, in 1663, describes a steam apparatus by which he raised a column of water to the height of 40 feet. The first patent for the application of steam power to various kinds of machines was taken out in 1698 by Thomas Savery. His engines were the first used and seem to have been employed for some years in the drainage of mines in Cornwall and Devonshire. The essential improvement in them over the older ones was the use of a boiler separate from the vessel in which the steam did its work.

To Denis Papin, a celebrated Frenchman, is due the idea of the *piston.*

The next great step in advance was made about 1705 in the 'atmospheric' engine, conjointly invented by Newcomen, Calley, and Savery. In this engine, which is shown in Fig. 1, the previous inventions of the separate boiler and of the cylinder with its movable steam-tight piston are utilized, although in a new form. The 'beam,' which has ever since been in use in pumping engines, was used for the first time, and for the first time also the condensation of the steam was made an instantaneous process, instead of a slow and gradual one. To one end of a beam moving on an axis, I, was attached the rod, N, of the pump to be worked; to the other, the rod, M, of a piston moving in a cylinder, C, below.

The cylinder was placed over a boiler, B, and was connected with it by a pipe provided with a stop-cock, V, to cut off or admit the steam. Suppose the pump-rod depressed, and the piston raised to the top of the cylinder—which was effected by weights suspended at the pump end of the beam—the steam cock was then turned to cut off the steam, and a dash of cold water was thrown into the cylinder by turning a cock, R, on a water pipe, A, connected with a cistern, C′. This condensed the steam in the cylinder, and caused a vacuum below the piston, which was then forced down by the pressure of the atmosphere, bringing with it the end of the beam to which it was attached, and raising the other along with the pump-rod. The cock was then turned to admit fresh steam below the piston, which was raised by the counterpoise; and thus the motion began anew. The opening and shutting of the cocks was at first performed by an attendant, but in 1713 a boy named Humphrey Potter devised a system of strings and levers by which the engine was made to work its own valves. In 1717 Henry Beighton invented a simpler and more scientific system of 'hand-gear,' which rendered the engine completely *self-acting*.

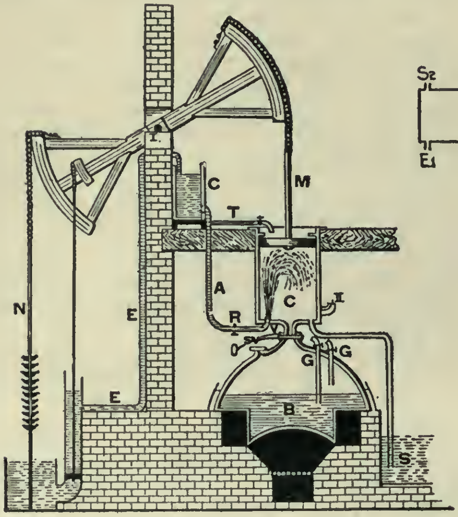


Fig. 1. NEWCOMEN'S ENGINE.

The next essential improvements on the steam engine were those of Watt. The first and most important improvement made by Watt was the separate condenser, patented in 1769. He had observed that the jet of cold water thrown into the cylinder to condense the steam necessarily reduced the temperature of the cylinder so much that a great deal of the steam flowing in at each upward stroke of the piston was condensed before the cylinder got back the heat abstracted from it by the spurt of cold water used for condensing the steam in the cylinder. The loss of steam arising from this was so great that only about one-fourth of what was admitted into the cylinder was actually available as motive power. Watt, therefore, provided a separate vessel in which to condense the steam, and which could be kept constantly in a state of vacuum, without the loss which arose when the cylinder itself was used as a condenser. The principal improvements since have been either in matters relating to the boiler or in details of construction consequent on increased facilities, improved machinery, and greater knowledge of the strength of materials.

Analysis. The motor element of the engine is the cylinder and piston (Fig. 2). The cylinder, C, is a hollow cylinder of metal closed at both ends, except for small openings for the entrance and escape of steam and for the passage of the piston rod. Inside the cylinder is the piston, P, a circular disk of metal fitting steam-tight and capable of movement lengthwise of the cylinder. The openings S_1 and S_2 provide for the admission of steam into the cylinder, and the openings E_1 and E_2 provide for the exhaust of steam from the cylinder. These passages are opened and closed by valves. These valves operate in pairs; when valves S_1 and E_1 are open valves S_2 and E_2 are closed and vice versa. If steam be admitted by opening valve S_1 its pressure forces the piston P to the opposite end of the cylinder. Valves S_1 and E_1 now close and valves S_2 and E_2 open, and steam entering at S_2 forces the piston to return and press, as it advances, the previous cylinderful of steam out of the exhaust port E_2. The repeated and alternate opening and closing of the two pairs of valves, as described, causes the piston to reciprocate back and forth in the cylinder. This motion is carried outside of the cylinder by means of the piston rod R. This is a cylindrical rod attached rigidly to the piston and passing out of the cylinder through a steam-tight orifice in the cylinder head. At its outer end the piston rod is attached to a rectangular piece H, called the crosshead, which slides between two guides GG. To the opposite end of the crosshead is hinged the rod S, called the connecting rod, the forward end of which is journaled to a crank K, which operates the fly-wheel W.

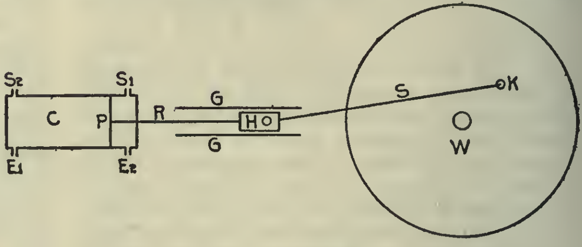


Fig. 2.

In the steam engine, as actually constructed, these different parts and their movements are variously modified, but the essential operating parts of all reciprocating steam engines are: The cylinder and piston; the valves and valve gear; the piston rod; the crosshead and guides; the connecting rod; the crank and crank-shaft or fly-wheel.

The ordinary unit of measure of the work done by a steam engine is the horse power, and it was originated by Watt. As defined by Watt a horse power is the work done in lifting 33,000 pounds one foot high in one minute. Now if the area of the piston P, Fig. 2, is *w* square inches and the pressure of the steam admitted to the cylinder is *y* pounds per square inch, then the pressure exerted by the steam against the piston is $w \times y$. If now the total travel or stroke of the piston is s feet, then the foot pounds of work for such stroke is represented by $w \times y \times s$, and if the piston makes n strokes per minute, the foot pounds of work of the piston per minute are represented by $w \times y \times s \times n$. This amount, divided by 33,000, gives the horse power of the engine. Assuming all of the other factors to remain the same or to be constant, the horse power of an engine may be varied by varying either the area of the piston, the length of the stroke, the pressure of the steam, or the number of strokes per minute. The whole of the theoretical horse power, however, is never available for useful work, owing to the friction of the moving parts and other causes.

CLASSIFICATION. Steam engines may be classified (I.) according to the nature of their mechanism, (II.) according to the manner in which the steam is used, and (III.) according to the use to which the engine is put.

I. Reciprocating engines may be grouped according to the position of the axis of the piston into horizontal engines, vertical engines, and inclined or diagonal engines. Fig. 2 shows the position of the parts of a *horizontal engine*, that is, an engine with the axis of the cylinder and piston horizontal. The advantages of such an engine are convenient access from the ground to all parts of the mechanism, distribution of the weight over a large area, and the location of the centre of gravity of the machine close to the foundation; its disadvantages are greater friction and wear of the cylinder owing to the fact that the piston is supported upon the bottom of the cylinder.

In the *vertical engine* the axis of the cylinder and piston is vertical; if the cylinder is carried by a frame above the crank shaft so that the piston rod extends downward, the engine is called an *inverted vertical engine;* and if the cylinder is below, with the piston rod extending upward to a crank shaft above, the engine is called a *direct vertical engine.* The advantages of the vertical engine are that the cylinder friction and consequent cylinder wear of the horizontal engine are largely avoided and that a comparatively small area of ground is occupied by the engine. Its disadvantages are that the weight of the piston, piston rod, crosshead, and connecting rod acts with the steam in one direction and against the steam in the other direction, thus producing unequal effort on the crank on alternate strokes, which has to be counteracted by special constructions; that the different parts of the mechanism are at different heights, requiring more attendants; that the centre of gravity of the machine is high, reducing its stability. The limited foundation area required for the vertical engine especially adapts it to places where room is scarce or expensive, as in steamships and city power houses. See STEAM NAVIGATION.

Inclined engines possess in a measure the advantages and disadvantages of both the horizontal and the vertical engine. In such engines the axis of the cylinder is at an inclination between the vertical and horizontal, and the cylinder is usually set below with the piston rod projecting diagonally upward to the crank shaft. They are used chiefly in side-wheel steamboats of shallow draught and in ferry-boats.

An engine in which the motion of the piston is transmitted by a connecting rod direct to the crank, as shown by Fig. 2, is called a *direct-acting engine.* As applied to pumps this term has a somewhat different meaning. (See PUMPS AND PUMPING MACHINERY.) In contradistinction to direct-acting engines we have *beam engines*, of which the engine shown by Fig. 1 is an early example. In the beam engine the connecting rod is journaled to one end of a beam rocking on a horizontal axis. To the other end of the beam is journaled a pitman rod which connects with the crank shaft. The engines for side-wheel steamboats are usually beam engines; and they are also used for pumping engines.

Besides the forms of engines mentioned there are various special forms, a few of which are sufficiently important to merit mention. The *oscillating engine* dispenses with the connecting rod, the piston rod connecting directly to the crank, and the cylinder is mounted upon suitable trunions so that it can oscillate in conformation to the swaying of the piston rod in operating the crank. The *trunk engine* dispenses with the piston rod, the connecting rod being attached direct to the piston, which takes the form of a hollow cylinder closed at one end. The *back-acting engine* has the connecting rod extending back from the crosshead to a crank shaft back of the engine instead of extending forward as shown by Fig. 2.

II. The method in which the steam is used in the engine is also a basis for a scheme of classification. The fact that the same number of foot pounds of energy per minute may be secured by a small piston working at high speed or a larger piston working at a slower speed gives us our first classification, viz., *high-speed* and *low-speed* engines. The high-speed engine has the advantage of small dimensions and small weight for a given power, and, because the strokes are so frequent, of meeting variations in resistance more quickly than a slow-speed engine. Its disadvantages are its comparatively greater waste of steam, the greater wear of the moving parts, the greater danger of heating, and consequently the higher cost of construction and operation. Altogether, experience shows the slow or moderate speed engine to be superior to the high-speed engine where circumstances permit its use. Between 600 and 800 feet per minute is regarded as a moderate piston speed, and over 900 feet per minute as a high piston speed. Referring to Fig. 2, it will be observed that the steam acts first against one side of the piston and then against the other side. Such an engine is called a *double-acting engine.* When the pressure of the steam is exerted against one side of the piston only the engine is called a *single-acting engine.* The single-acting principle is utilized in the well-known Cornish engine for pumping and in certain high-speed rotative engines for electric light and power service. In the latter form of engine two cylinders are used which are coupled to separate cranks on the same shaft in order to secure continuous action. Two familiar forms are the Westinghouse and the Winans, and both are inverted vertical trunk engines. Owing to their single action and the omission of the connecting rod, these engines escape many of the disadvantages of the double-acting high-speed engine.

The Cornish single-acting pumping engine deserves particular notice because of its essentially peculiar steam-cylinder mechanism. It appears in two forms, the beam form and the direct-acting form. The beam Cornish engine has a vertical cylinder from whose top the piston rod extends, and has the usual connecting-rod connection with one end of a beam pivoted at the centre, to whose other end are attached the pump rods. The direct-acting Cornish engine has the cylinder located directly over the mouth of the shaft and the piston rod passing out of its bottom connects directly with the pump rods. This form of Cornish engine is usually called the Bull Cornish, from the name of its first adopter. In both forms of Cornish engine the action of the steam is simply to raise the heavy pump rods, whose weight in falling displaces the water to be pumped. The cylinder of the Cornish engine has three valves, one for the admission of steam, one for the exhaust of the steam, and an equilibrium valve, these being shown in Fig. 3 at S, D, and E, respectively.

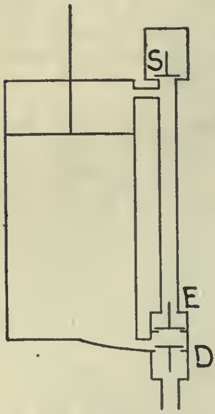


Fig. 3.

The cycle of operations is as follows: The pump rods being at the bottom of their stroke, the piston P of a beam Cornish engine will be at the top of the cylinder. The steam valve S and the exhaust valve D will be opened and the equilibrium valve E will be closed. The pressure of the steam drives the piston to the bottom of the cylinder, lifting the pump rods. When this operation has been completed, valves S and D are closed and valve E is opened. The opening of valve E permits the steam above the piston to flow freely beneath it, equalizing the pressure on the two sides of the piston and leaving it free to return to the top of the cylinder under the pull of the heavy pump rods. The valves of the Cornish engine are worked by a special device called a *cataract*. This consists of a weighted piston working in a cylinder, having a large intake valve and a small discharge valve, whose opening can be adjusted to various dimensions. During the working stroke of the pump this weighted plunger is lifted, drawing water into its cylinder through the large inlet valve. When the pump makes its return stroke the weighted plunger is released and gradually descends as its weight presses the water out of its cylinder through the small discharge valve. The return stroke of the weighted plunger actuates the valves of the steam cylinder of the pump so as to cause another working stroke.

The third subdivision of engines according to the method of using the steam comprises expansive and non-expansive working engines. To understand the nature of this subdivision it will be found convenient to refer to the diagram Fig. 4. In this diagram the full lines represent the cylinder, piston, and piston rod. Now if steam be admitted behind the piston it will force it forward to the position which it occupies in the diagram. The steam may be made to perform this operation in two ways, non-expansively and expansively. When used non-expansively the steam enters the steam port at boiler pressure, and as this port remains open until the piston has completed its stroke, boiler pressure is maintained behind the piston during the whole stroke. If we assume the broken line *ad* to represent the steam pressure and the broken line *dc* to represent the stroke, then the work done by the steam is represented by the dotted rectangle *abcd;* the pressure *bc* at the end of the stroke is the same as the pressure *ad* at the beginning of the stroke and a cylinderful of steam at full pressure has to be exhausted in order to make the return stroke. When using the steam expansively the steam valve is closed when the piston has reached some intermediate point, as *e*, called the point of cut-off, in its forward stroke, and no more steam is admitted into the cylinder. Full steam pressure is, therefore, maintained against the piston for the portion *ae* of its stroke, but afterwards this pressure gradually decreases as the steam expands until at the end of the stroke it is represented by the line *cf*. The work done by the steam is represented by the area *aefcd*, which, as will be readily seen, is less than the area *abcd*, representing the work done when using the steam non-expansively. In using the steam expansively, however, the amount at boiler pressure which is consumed at each stroke is represented by the rectangle whose base is *ae*, and whose height is *ad*, as compared with the rectangle *abcd*, representing the amount of steam at boiler pressure consumed at each stroke in non-expansive working. Evidently from the diagram, the amount of steam used in proportion to the work done is less in expansive working than in non-expansive working. This advantage has made the expansive working engine practically universal where circumstances will permit.

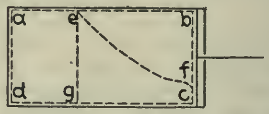


Fig. 4.

The fourth subdivision of steam engines, according to the method of using the steam, comprises condensing and non-condensing engines. In a non-condensing engine the waste steam from the cylinder is exhausted into the air at air pressure, or 14.7 pounds per square inch. In the condensing engine it exhausts into a vacuum and is condensed into water. Thus, in a non-condensing engine the steam has to force the piston against a back pressure of 14.7 pounds per square inch, while in a condensing engine this back pressure is obliterated, with a consequent gain of 14.7 pounds per square inch in the effective working pressure of the steam. The practical advantage of the condensing engine may, therefore, be expressed by saying that it will receive the same power with a smaller cylinder and greater power with the same cylinder, as compared with a non-condensing engine. (See Condenser.) A fifth subdivision of steam engines according to the method in which steam is used comprises simple engines, compound engines, and multiple expansion engines. In a simple engine the steam, after having done its work in forcing the piston through its stroke, is exhausted into the air or into a condenser. In a compound or multiple-expansion engine the steam, after having done its work in one cylinder, is exhausted into a succeeding cylinder of larger size, where it continues to perform work. The operation may be explained by the diagram Fig. 5. Steam enters the cylinder HP, which is connected with cylinder LP by two passages *a* and *b* closed by valves, and here performs the work of driving piston P_1 to the front end of the cylinder. This steam, instead of being exhausted into the air or into a condenser to allow the return stroke of the piston P_1, is exhausted through the passage *a* into cylinder LP, where it acts to drive forward piston P_2. Were the size of the cylinder LP the same as that of the cylinder HP, it is evident that the propulsive effect of the steam on piston P_2 would be exactly counterbalanced by the back pressure on piston P_1. and, therefore, that there would be no increase, but rather a loss, in the work done. If, however, cylinder LP is made twice the diameter of cylinder HP, then the forward pressure on piston P_2 is greater than the back pressure on piston P, and a position or working effect is obtained by the second use of the steam. A two-cylinder engine like Fig. 5 using steam as described is called a *compound* engine. Were the exhaust steam from the second cylinder to enter a third and larger cylinder and continue working we should have a *triple expansion engine*. If a fourth cylinder were added to the set we should have a *quadruple expansion engine*. The expansive working of steam has not been successfully carried beyond four expansions. The cylinders of compound engines are generally arranged parallel to each other or side by side, or else one behind the other, or tandem. A tandem compound with the cylinders set vertical is called a *steeple engine*. When the cylinders are placed side by side, but some distance apart so as to allow space for a fly wheel between them, the engine is commonly called a *cross-compound engine*. Modern marine engines for screw vessels are nearly always inverted vertical compound or multiple expansion engines. (See Plates under STEAM NAVIGATION.) The arrangement of the cylinders of triple and quadruple expansion engines varies considerably. The great practical advantage of the compound or multiple expansion engine is the economy resulting from the expansive use of steam, as indicated in discussing expansive and non-expansive working engines. It is obviously possible to use the steam according to any of the methods discussed with any of the arrangements of mechanism previously discussed and thus make a great number of combinations.

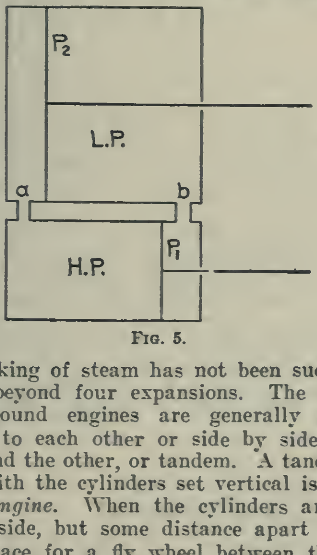


FIG. 5.

III. A very usual classification of steam engines is based upon the service or use to which the engine is to be put. It includes the following groups: *Stationary engines, locomotive engines,* and *portable engines*. The first group or stationary engines include mill engines, power-house engines, pumping engines, blowing engines, air compressors, hoisting engines, and others. Locomotive engines include locomotives, marine engines, traction engines, steam road rollers, self-propelled fire engines, and others. Portable engines include a wide variety of engines, such as agricultural engines, so designed that the engine and boiler are self-contained and do not require a foundation or permanent structure of any kind.

STRUCTURAL DETAILS. Structurally the steam engine consists of the working parts and the fixed structure or frame by which the working parts are supported and maintained in their relative positions. The supporting frame is usually a structure of cast or forged iron or steel varying in shape to suit the form of engine of which it is a part. The working parts of an engine comprise the cylinder and piston, the valves and valve gear, the governor, the piston rod, crosshead, and connecting rod, and the crank shaft and fly wheel. The function of the engine frame is to constitute a fixed link in a kinetic chain, and to perform this function it must be essentially rigid and strong. In a horizontal engine, as shown in Fig. 2, it will be evident that the duties of the frame are to support the cylinder C at one end, and the fly wheel W at the other end, and to steady and align the transforming mechanism connecting these two parts. The frame of a vertical engine performs an exactly similar duty, but of course differs in construction to suit the different arrangement of the moving parts. Thus in an inverted vertical engine there is a broad base plate, on which the crank shaft is directly supported. From this base plate rises a columnar structure supporting the cylinders and guiding the reciprocating parts. Cast iron and cast steel are particularly adapted to furnish the rigidity and massiveness desired and are, therefore, the materials commonly employed for engine frames. In certain classes of engines, such as the locomotive and the marine engine, where lightness combined with great strength is an essential, forged steel frames are used.

Turning now to the working parts, the cylinder and piston as the motor elements naturally call first for consideration. The engine *cylinder* is a barrel-shaped or box-shaped casting, with its interior bored out into the form of a perfect cylinder. The ends of this cylinder are closed by cover-like castings fastened by studs or bolts to the body. The front head has a circular orifice at the centre to allow for the exit of the piston rod, and where a tail rod is used a similar orifice is necessary in the back head. The barrel or body of the piston has one or more orifices for the admission and exhaust of the steam, and these orifices are covered by a box-like chamber called the *steam chest,* inside of which works the *valves,* as will be described immediately. The body and often the ends of the cylinder casting are usually covered with a *lagging* or envelope of some material which is a poor conductor of heat and whose purpose is to prevent the condensation of steam in the cylinder by the loss of heat due to radiation from its outer walls. The *piston* is a circular disk of metal of sufficient strength to resist distortion by the steam pressure. In the edge of this disk are set rings of metal so arranged that they are constantly pressed outward against the walls of the cylinder, either by their own elasticity or by the elasticity of springs pressing against them from behind. These rings are called *packing rings,* and their function is to make the piston fit steam-tight in the cylinder and at the same time render its movement as free from friction as possible.

The function of the valves and valve gear is to control the admission and exhaust of the steam. The functions of the *valve* are both primary and secondary. The primary function is to admit the steam from the boiler to one side of the piston, while the exhaust steam filling the other end of the cylinder is permitted to escape with the least possible resistance. The secondary functions are to close the admission of steam at the point necessary to give the expansion desired and to close the exhaust orifice at such a point in the return stroke that a certain volume of steam shall be caught and compressed behind the piston to serve as an elastic cushion. It is necessary also that the opening of the inlets and outlets of the cylinder should be so timed with respect to the stroke of the piston that pressure may not be brought too soon against the piston head, nor the exhaust opened until the expanding steam has done its entire work for that stroke. The valves for admitting and distributing steam in an engine cylinder may open the parts which they control, either by lifting from their seats or by sliding upon their seats. When the engine is a double-acting one there must be provision to connect each end of the cylinder with the boiler and each end with the exhaust pipe. When the engine is single-acting it is only necessary to connect one end to the boiler and exhaust pipe alternately. Apparently the simplest arrangement would be to have four valves, as shown by Fig. 2, one at each end for steam, and one at each end for exhaust. This is the arrangement in the *Corliss engine.* An important type of engines makes use of a separate valve for admitting steam at each end, while the exhaust is controlled by a single valve for both ends. Such engines are called *three-valve engines.* Another arrangement is to have one valve for admitting steam to both ends and another controlling the exhaust for both ends. Such engines are called *two-valve engines.* A fourth class has one *single valve,* so designed as to perform the inlet and outlet functions for both ends. Such are the great majority of stationary engines and all locomotive and marine engines.

The simplest form and also the most common form of single valve is the D-shaped *slide valve.* In the diagram, Fig. 6, W represents a portion of the top wall of the cylinder, S and S_1 being the steam ports to the two ends of the cylinder. At the top these steam ports open into the inclosed space A, B, C, D, which represents the steam chest. The valve proper is represented by V, which is operated by the rod R passing out through a suitable orifice in the forward end of the steam chest. The steam from the boiler is admitted into the space above the valve VS. It will be observed that in the position shown the valve exactly covers the ports S and S_1, and steam from the steam chest cannot enter the cylinder, nor can any steam contained in the cylinder escape. If the valve is moved either to the right or left of the position shown, both ports are immediately uncovered. If the movement be toward the right, port S_1 is opened to the live steam space above valve V, and port S is opened to the exhaust space E, beneath the valve V. A reverse movement of the valve opens port S to the live steam space, and port S_1 to the exhaust space. The movement of the valve from 'centre' to the right and back again to 'centre' accomplishes the right-hand stroke of the piston; its movement from 'centre' to the left and back again to 'centre' accomplishes the left-hand stroke of the piston. These alternate right and left movements of the valve are accomplished by means of the rod R, and are eccentric. (See ECCENTRIC.) When the valve is at 'centre' the axis of the eccentric is at right angles to the fly-wheel crank, providing the valve is constructed, as shown, to cover exactly the steam ports, which is the construction for non-expansive working of the steam. This is the simplest form of slide valve. To provide for the expansive working of the steam, its use as a compression cushion and other desirable variations in admission and exhaust, the construction of the valve and the position of the eccentric have to be modified in various ways, an analysis of which is a matter of considerable mechanical intricacy.

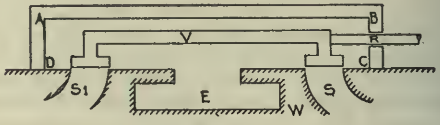


FIG. 6.

The train of mechanism by which the opening and closing movements of the valves are effected is called the *valve gear.* This varies in construction and operation. The precise character of the gear adopted in any case is determined partly by the form of valve and partly by the nature of the general problem presented for solution. In some cases it is merely required that a fairly good steam distribution shall be secured; in other instances a good method of expansion must be obtained; in still other cases the system must be capable of adjustment with a view to wise regulation of speed, and in all locomotive and marine engines easy and prompt reversal of the direction of motion is required. Different inventors have invented different forms

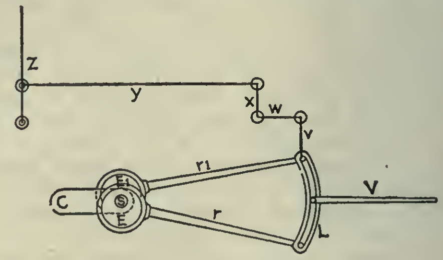


FIG. 7.

of valve gear designed particularly to meet one or the other of these conditions. Of these the link motion invented by Howe in 1843, and first used on Stephenson's engines, is perhaps the most familiar, it being the gear very generally used, either as originally designed or in some modified form, on locomotives and marine engines. Fig. 7 shows the Howe link, or, as it is more commonly called, the Stephenson reversing link valve gear. The two eccentrics E and E_1 are set on the crank shaft, S, at right angles to the crank, C. These eccentrics carry two rods r and r_1 diverging from each other at a slight angle and with their forward ends connected by the slotted, curved link, L. The valve stem, V, has a block or pin which connects it to the link by means of a sliding fit in the slot. If the link be lifted so that the rod r lies nearly in line with V, then the valve receives its motion merely as if driven directly by the single eccentric E; if the link be lowered so that rod r_1 lies nearly in line with V, then the valve acts practically as if driven by the single eccentric E_1. Now eccentric E_1 being set for forward motion of the engine and eccentric E being set for backward motion, it will be seen that the movement of the link gives a ready means for reversing the engine. It does more than this, however, since by putting the link in intermediate positions between full forward and full backward gear the cut-off of the valve can be adjusted for expansive working of the steam. The train of levers v, w, x, y, and z in Fig. 7 shows the means of operating this link in an ordinary locomotive engine.

The *governor* of a steam engine is a device whose function is to regulate the energy developed in accordance with the load propelled. If the admission and pressure of the steam be constant, the speed will vary as the load varies; with a light load the speed will be high and with a heavy load it will be slow. These fluctuations in speed are always undesirable and may easily become dangerous, as, for example, when the engine 'races' or 'runs away,' causing the fly wheel to burst from centrifugal force. Governors act to regulate the energy in two ways, first by cutting off steam from the boiler as the speed increases, which amounts to a reduction in boiler pressure, and second by reducing the quantity of steam admitted into the cylinder. The first are called *throttling governors* and the second are called *cut-off governors*. Governors are also classified according to their method of action and according to their form. The most common form of governor is the fly-ball or pendulum governor, which may operate either by throttling or by cut-off action. The diagram (Fig. 8) shows a form of pendulum governor. The stem or shaft, S, is given rotary motion by means of a belt embracing the pulley, P. Keyed to the top of the shaft is the plate a, carrying, by means of the arms b and b_1, the heavy balls c and c_1, and hung to the arms b and b_1 are the arms d and d_1 which connect with the plate e, which is free to slide up and down the shaft S. The balls and their connecting arms revolve with the shaft, and because of the familiar law of centrifugal force they tend to fly apart as the speed of rotation increases and to come closer together as this speed decreases. As the balls fly apart, due to increased speed, they lift the plate e, and this operates the train of levers x, y, and z in such a way as either to shut off steam from the boiler or from the cylinders. That is, as the speed increases the energy is decreased, and conversely as the speed decreases the energy is increased. In this way the energy is proportioned to the load at every instant, the exactness with which this proportion is maintained depending upon the sensitiveness of the governor.

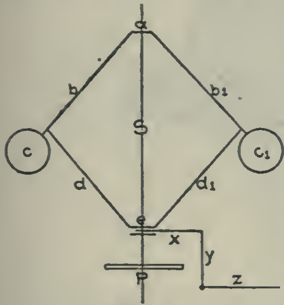


Fig. 8.

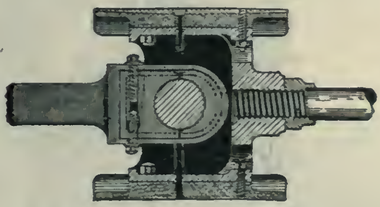


Fig. 9. SECTION OF CROSSHEAD.

The *transmission mechanism* of a steam engine consists of the piston rod, the crosshead, and the connecting rod. The duty of the *piston rod* is to convey the energy developed by the piston outside of the cylinder so that it may be transmitted to the crank shaft or fly wheel. At its inner end the piston rod is attached rigidly to the piston at its centre and at its outer end it is rigidly attached to the crosshead. The rod passes out of the cylinder through an orifice in its front end, this orifice being so constructed that it is steam-tight. It is due largely to the fact that a circular orifice is more easily made steam-tight than any other form that the piston rod is universally cylindrical in form. The *crosshead* is the connecting link which permits the rectilinear motion of the piston rod to be transformed into the swaying motion of the connecting rod. The manner in which it accomplishes this is clearly shown by Fig. 9, which is a section through a familiar make of crosshead. The piston rod coming from the right is rigidly attached to the crosshead by a threaded connection, while the connecting rod is connected by means of a horizontal pin, so that it can swing up and down. The top and bottom of the crosshead are planed smooth and fit a groove or track in the upper and lower guides. These guides are a part of the engine frame, and serve to prevent any vibration of the outer end of the piston rod due to the swaying motion of the connecting rod. The connecting rod is commonly a rectangular or cylindrical bar having at each end a circular bearing, one to embrace the crosshead pin and the other to embrace the crank pin. Fig. 10 shows the construction described. The articles CRANK and FLY WHEEL describe the construction and functions of these parts of the engine's mechanism, and they will not be mentioned further. In concluding this section reference may be made to Fig. 11 as showing in a very plain manner the character and relation of the several structural details which have been described individually. In this engraving the different parts are designated by letters as follows: The engine frame, A; the cylinder, B; the piston rod, C; the crosshead, D; the connecting rod, S; the crank, F; the fly wheel, G; and the governor, H.

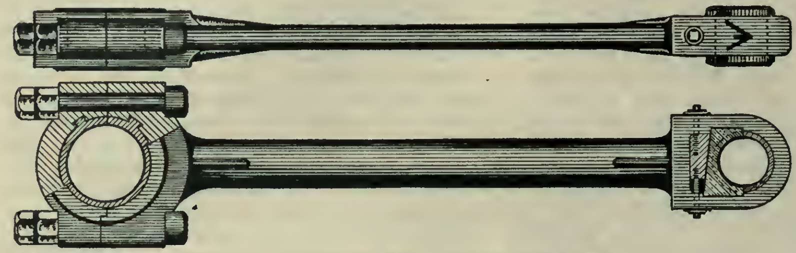
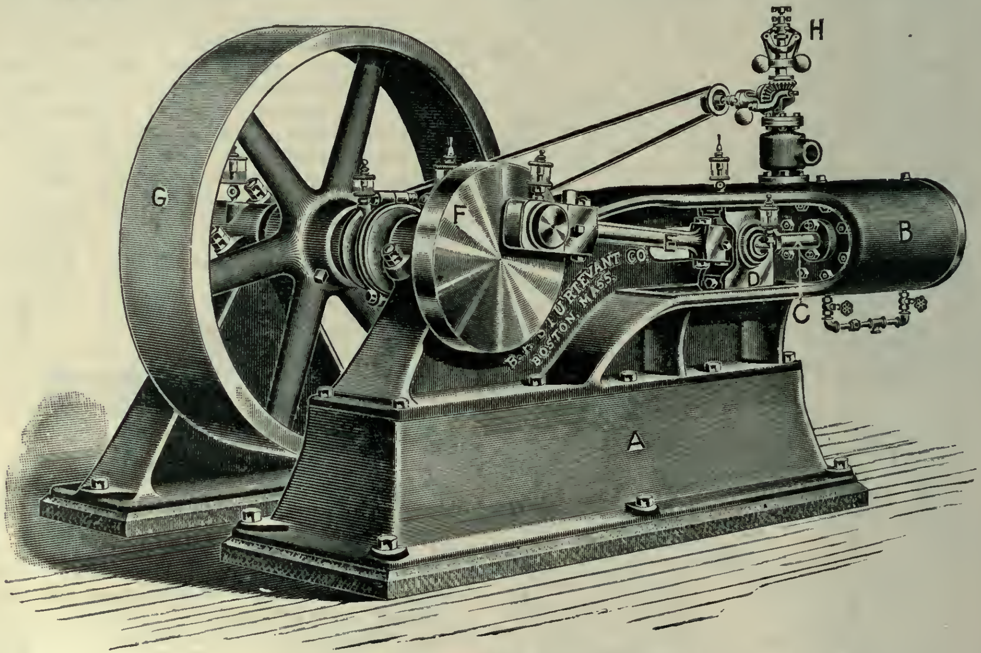
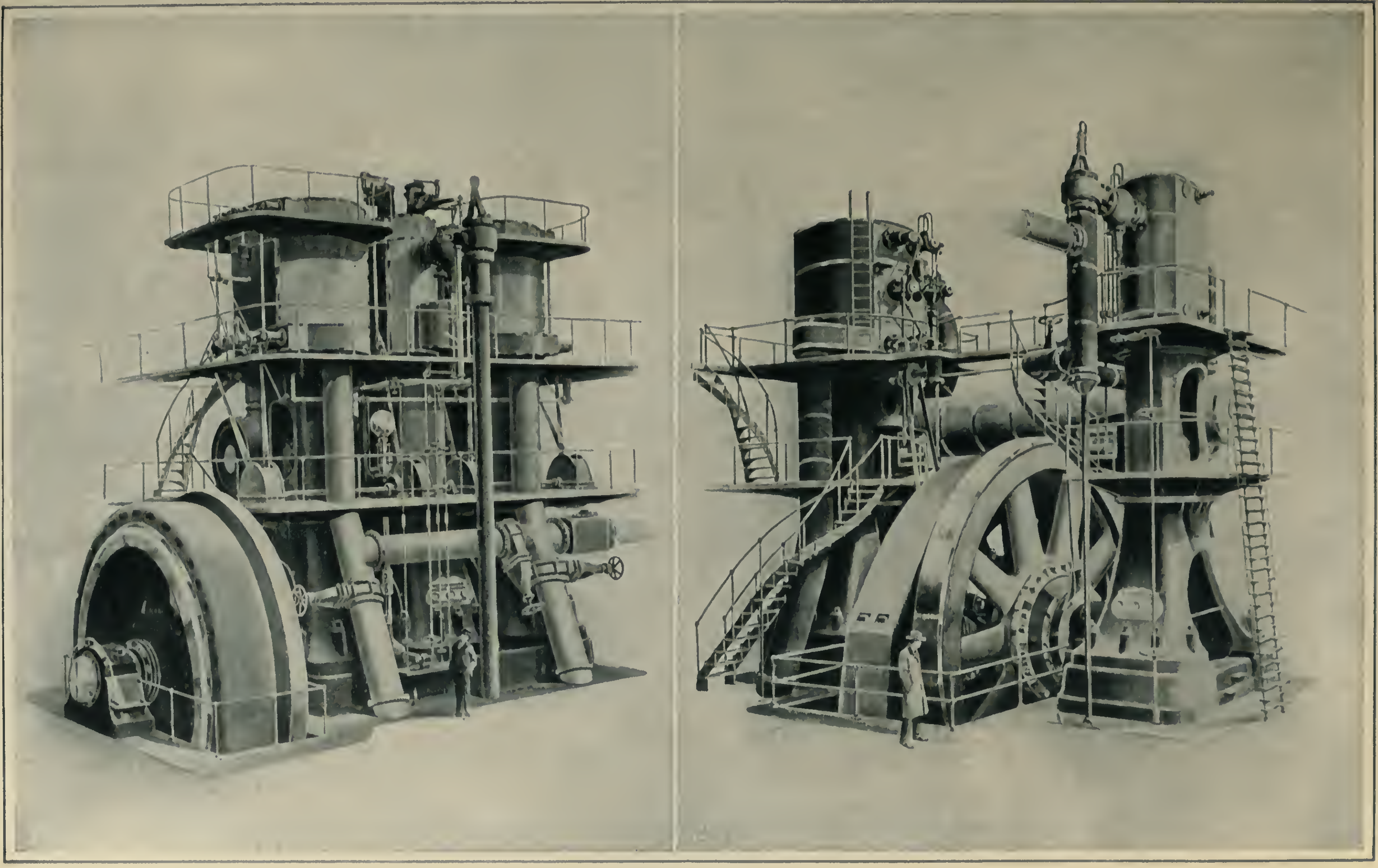


Fig. 10. CONNECTING ROD. Top and side views.


H
G
F
B
D
C
A
B. F. STURTEVANT CO. BOSTON, MASS.
Fig. 11. SMALL HIGH-SPEED HORIZONTAL ENGINE.

The first practical use of importance to which steam engines were put was the pumping of water, and the *pumping engine* still remains one of the principal forms of the steam engine. The various types of pumping engines are described in the article of Pumps and Pumping Machinery. The next important use of the stationary steam engine was for driving the machinery of factories, mills, and workshops, and such establishments still consume an enormous aggregate of steam-engine power. The modern form of *mill engine* is the horizontal direct-acting fly wheel engine, in which the power is taken from the fly wheel and transmitted to shafting by means of belts. (See Belts and Power Transmission.) For mill engines of large size present practice favors compound engines; simple engines are used when the unit of power which is required is small. Generally tandem compound and cross compound engines are preferred to engines using steam with three or four expansions, although multiple-expansion mill engines are not infrequent. A horizontal simple engine of comparatively small size which can be used for dynamo driving or other high-speed work, is shown by Fig 11. A third type of stationary engine is the *hoisting engine,* which in its smaller sizes combines a vertical steam boiler and a duplex horizontal or vertical engine in one machine. Such engines do not have a fly wheel, but connect directly with a crank shaft which drives the drum upon which the hoisting rope is wound. Hoisting engines of larger size have separate boilers and often operate as many as eight separate drums. The largest sizes of hoisting engines are those used in raising ore from deep mine shafts. These mine hoists have capacities of from 2000 to 5000 horse power. Like the smaller sizes, they are either duplex vertical or duplex horizontal engines. A duplex engine consists of a right-hand and a left-hand engine, both of which couple to the same crank shaft. They are to be distinguished from cross-compound engines, which have a similar appearance structurally, by the important fact that each half of the machine is distinct from the other half so far as the use of the steam is concerned. In direct-acting mine hoists the drum or drums are mounted directly on the crank shaft; in general hoists the crank shaft drives a separate drum shaft by means of gearing. A fourth form of stationary engine is the *rolling-mill engine,* used for driving the trains of rolls in rolling mills. (See Rolling Mill.) This is usually a horizontal simple engine of



VERTICAL STEAM ENGINES DIRECT CONNECTED TO ELECTRIC GENERATORS

1. 6,000 Horse-power Poppet Valve Westinghouse Cross-compound Engine. 2. 5,000 Horse-power Westinghouse-Corliss Cross-compound Engine.

large size and especially sturdy construction. The largest stationary steam engines now used in any form are those employed for driving the generators of electric power plants. These large machines are almost universally of the inverted vertical direct-acting type, illustrated in the accompanying plate. A sixth important form of steam engine is the steam-driven air compressor described in the article AIR COMPRESSORS.

Engines other than stationary fall into one of two great classes, viz., locomotive engines for railways and marine engines for ship propulsion. The *traction engine* is essentially a locomotive engine designed to run on common roads, and the *portable engine* is practically a stationary engine and boiler plant of small size mounted on wheels so that it may be hauled from place to place. The growth and construction of the *locomotive engine* are described in the article LOCOMOTIVE. *Marine engines* fall into two separate classes. For paddle-wheel boats the beam engine and the inclined engine are universally employed. For screw-propelled vessels the inverted vertical direct-acting engine is almost universal. (See STEAM NAVIGATION.) For a discussion of the theory of steam engines and heat engines in general, see STEAM and THERMODYNAMICS. For descriptions of special applications of steam engines, see AUTOMOBILES; FIRE ENGINES; BLOWING MACHINES.

BIBLIOGRAPHY. For an account of the development of the steam engine, see Thurston, *Growth of the Steam Engine* (New York, 1879). Among the best theoretical and descriptive works are: Clark, *The Steam Engine* (London, 1890); Thurston, *Manual of the Steam Engine* (New York, 1892); Hutton, *The Mechanical Engineering of Power Plants* (ib., 1897); Seaton, *A Manual of Marine Engineering* (ib., 1895); Peabody, *Valve Gears for Steam Engines* (ib., 1892).

STEAMER DUCK, LOGGERHEAD, or RACEHORSE. A very large duck (*Tachyeres cinerus*), numerous about the southern extremity of South America, so called on account of its peculiarity of rowing itself along the surface of the water at great speed. This is said to be due to the remarkable fact that this bird loses its power of flight when it reaches maturity.

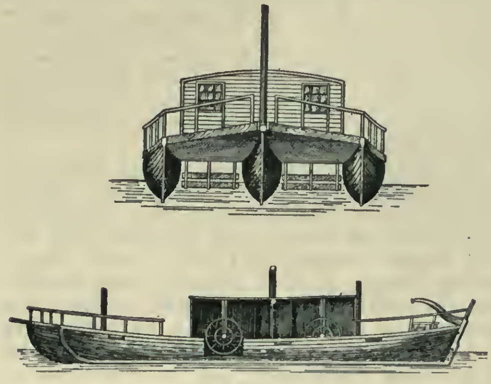
STEAM HAMMER. See HAMMER.

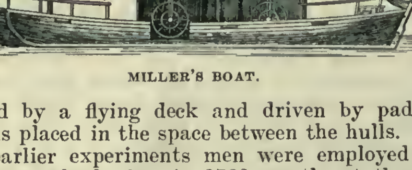
STEAM HEATING. See HEATING AND VENTILATION.

STEAM NAVIGATION. The Spaniards assert that as early as 1543 Blasco de Garay made an attempt to propel a vessel by steam in the harbor of Barcelona. In the absence of direct proof of the fact this may well be doubted. At the time mentioned the most advanced scientists in Europe had not yet begun seriously to consider steam as a source of power. The assertion is also made that Denis Papin (q.v.) in 1707 propelled a boat by steam on the River Fulda. Papin invented the safety valve and a single-acting steam cylinder pump, and made various improvements in steam pumps, but it does not appear that he ever built what might be called a steam engine. The boat which has been mentioned and which is frequently referred to had some sort of paddle wheels, but they were operated by the crew and not driven by steam power. In 1729 Dr. John Allen took out a patent in England for a method of propelling a boat by means of forcing water out of the stern with steam or other pressure. In 1736 the rather vague ideas of Allen were improved upon by Jonathan Hulls, a clockmaker of Campden, England, and he was granted a patent for mechanism to propel a boat by steam power. Like Allen, he apparently made no serious attempts to put his ideas into practice. In 1752 the French Academy of Sciences awarded a prize to the distinguished physicist Daniel Bernoulli for an essay on the manner of propelling boats without wind. In addition to other suggestions he proposed the use of the screw propeller.

HULLS' BOAT
(From an old drawing).

Up to this time successful steam navigation was impossible because a practical steam engine did not exist. This deficiency was supplied by Watt, who took out his first patent in 1769, but the engines contemplated were really single-acting pumps. In 1782, however, Watt brought out the double-acting engine, and developed the principle of expansive working by cutting off the steam at a suitable point instead of allowing it to follow full stroke. All the conditions for the propulsion of vessels by steam were now in existence and experimental boats rapidly appeared. In 1783 the Marquis de Jouffroy built one which was tried at Lyons, and it is said to have been successful; but before it could be developed into a form for practical use the Revolution overtook and ruined him. At the same time John Fitch, James Rumsey, and Oliver Evans were experimenting in America. Rumsey's boats, like the proposed vessel of Dr. Allen, were fitted with jet propellers, whereby a stream of water was discharged by a steam-driven pump. His first boat was tried in Virginia in 1784 and a second, which attained a speed of 4 knots, was completed in 1786. He died in London in 1792, just previous to the trial of a new boat built from his plans. Fitch's boats were fitted with various types of propelling machinery—with paddle wheels in 1785 and afterwards with long paddles which were given motion similar to that of the paddle of an Indian canoe. In 1790 one of Fitch's boats attained a speed of 7 knots, and afterwards was used on the Delaware to carry passengers. In 1793 Fitch went to France; in 1796, after returning to America, he built a small screw steamboat, but the exact measure of success that he attained is uncertain. Evans experimented with various peculiar types of steamboats, one of which was fitted with a rude screw and wheels with which to run on shore. In England Joseph Bramah obtained a patent in 1785 for propelling vessels by means of "a wheel with inclined Fans or Wings similar to the fly of a Smoke-jack or the vertical sails of a windmill." A patent for a similar invention was issued to William Lyttleton in 1784 and to Edward Shorter in 1800. In 1791 John Stevens of Hoboken, N. J., patented a multitubular steam boiler, and he soon after began experiments with steam propulsion of boats, in which he was assisted by the celebrated engineer Mark Isambard Brunel, then an exile. Brunel left the United States in 1799, however, and it was not till three years later that Stevens completed a small screw-propelled boat which he used for his own pleasure. This little boat, only twenty-five feet in length, was the first successful screw-propelled craft built. Engines suitable for large screw steamboats were not yet invented, so that commercial success in this direction was not yet aimed at. Patrick Miller, a retired banker of Edinburgh, for several years experimented with boats of various types in a lake on his estate of Dalswinton in Dumfriesshire. These boats had two or three hulls connected by a flying deck and driven by paddle wheels placed in the space between the hulls. In the earlier experiments men were employed to turn the wheels, but in 1788, partly at the instance of James Taylor, a tutor in his family, Miller engaged a Scotch engineer by the name of Symmington to fit the boats with steam power. A small boat was tried and gave such promises of success that a larger one was built in 1789. In October of that year this boat obtained a speed of seven miles an hour on the Forth and Clyde Canal. Either because of lack of interest or of means, Miller ceased thereafter to interest himself in the matter and nothing further was attempted. But in 1801 Symmington was commissioned by Lord Dundas of Kerse to build a steamer for towing barges on the Forth and Clyde Canal. This was the celebrated *Charlotte Dundas.* She was a success in all essential respects, but the proprietors of the canal refused to use her because they feared the effect of the wash from her paddles on the banks of the canal. She was therefore broken up and her disappointed designer turned his attention to land machinery.

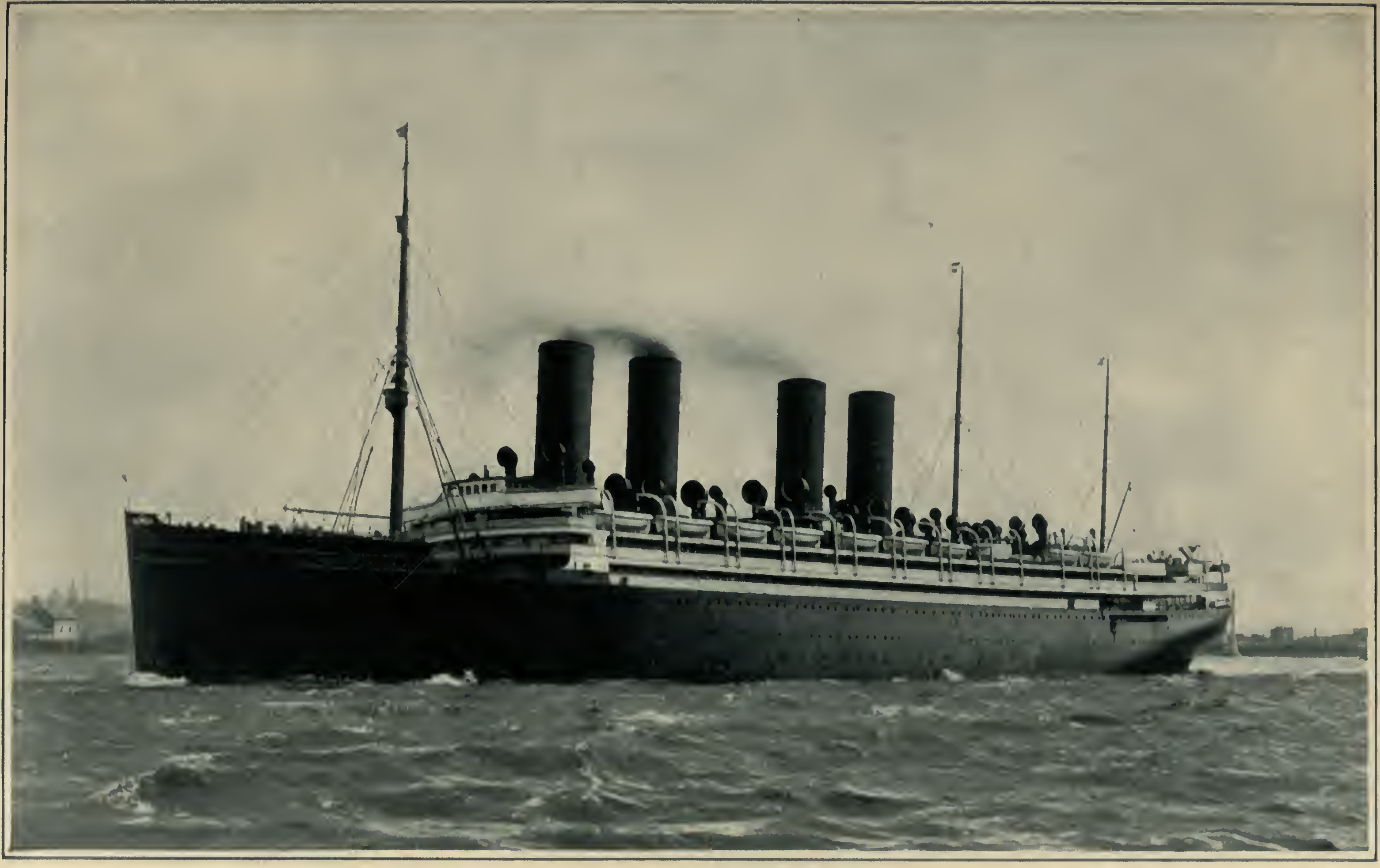

MILLER'S BOAT.


CHARLOTTE DUNDAS.

The next development was Robert Fulton's *Clermont,* and her advent marks the beginning of steam navigation as a commercial success. In 1797 Fulton (q.v.) went to Paris from England and soon afterwards began experiments with submarine torpedoes and torpedo boats. About the year 1801 he secured the assistance of Robert Livingston, then the United States Minister to France, and they built a small steamboat. Her engines proved to be too heavy for the poorly constructed hull, which collapsed and sank. The engines were recovered, however, and placed in a larger boat 66 feet long and 8 feet broad, and on August 9, 1803, this boat was tried on the Seine, but the speed obtained was unsatisfactory. In 1804, as the agent of Livingston, Fulton went to England, where he ordered of Boulton and Watt the machinery for a much larger vessel which was to be built in the United States. In the autumn of 1806 Fulton returned to America, and the new engine followed him almost immediately. A hull, built in New York, was launched early in 1807, the engines were placed on board, and on August 7, 1807, the *Clermont* started on her trial trip. She proceeded without stopping to Clermont, the home of Livingston, on the Hudson, 110 miles away, and twenty hours later went on to Albany. The next day she started to New York and made the trip in thirty hours at an average speed of 5 miles an hour. Within a month she began to run regularly between Albany and New York.

The success of paddle steamers for sheltered waters was now assured, and they multiplied rapidly, particularly in the United States, where the conditions were particularly suitable. In Great Britain the use of steamers was less immediate. The first commercially successful one to be completed there was the *Comet,* built by Henry Bell in 1811-12. She went into service on the Clyde and was soon followed by others. In the meantime the use of steamers for ocean navigation was being tried. In 1813 Fulton began the war steamer *Demologos* (see UNITED STATES, section on *Navy*), which was the first steam war vessel as well as the first ocean-going steamer. Several steamers began to make regular trips along the British coast in 1818-19, but the voyages were all short. In 1819 a vessel fitted with steam power crossed the Atlantic. This was the *Savannah,* of 350 tons, with a length of 100 feet, which crossed from Savannah to Liverpool in 25 days. In her, however, the engines were purely auxiliary; she was fitted with full sail power, and when the wind was fair or the seas too boisterous for steaming the paddle wheels were unrigged and taken in on deck. The beginning of real transatlantic voyages under steam was made by the *Sirius* and the *Great Western.* The latter was built for transatlantic service and was the larger and more powerful, while the former was taken from the London and Cork line. The *Sirius* started on April 4, 1838, and the *Great Western* four days later. They arrived in New York within twenty-four hours of each other, the *Sirius* at 10 P. M. on the evening of April 22d and the *Great Western* the next afternoon at three o'clock. The average speed of the *Sirius* was 161 miles per day—the highest 220 miles and the lowest 85 (half day only); the amount of coal consumed was 450 tons. The *Great Western* averaged 208 miles per day and her highest run was 247 miles. Neither vessel carried much sail.

For two or three years the transatlantic



A TRANSATLANTIC LINER—NORTH GERMAN LLOYD STEAMSHIP KAISER WILHELM II."

steamer service was rather irregular. The *Sirius* was withdrawn after making a few trips, and though the *Great Western* continued running, she lost money for the company that owned her. Other steamers made a few trips, but they also, like the *Sirius*, were withdrawn. In 1839 Samuel Cunard, of Halifax, N. S., went to England and succeeded in forming the celebrated Cunard Company. Assisted by a liberal Government mail subsidy, it was commercially successful from the start. The first vessels put in service were the paddle steamers *Britannia, Acadia, Columbia,* and *Caledonia*. They were of 1154 tons burden and their machinery was of 740 horse power. The *Britannia*, the first to sail, left Liverpool on July 4, 1840, and made the passage to Halifax in 12 days 10 hours; on her return voyage she did better, the time being but little over ten days. The Cunard Company enjoyed a practical monopoly of the transatlantic service until 1850, when the Collins (American) and Inman lines were started. The Collins Line lost two of its four steamers and was discontinued in 1858. Two other American steamship lines were started in 1850, the New York and Havre Steamship Company and the Vanderbilt Line. Both ceased running at the beginning of the Civil War.

The Inman Line was more successful. It began its career with steamers built of iron and propelled by screws. Though no faster than the wooden paddle-wheel Cunarders, they were cheaper to operate. The screw propeller (q.v.) now began rapidly to displace the paddle wheel, though the Cunard Company launched the *Scotia*, their last and finest paddle steamer, in 1861. The rapid increase in size of ocean steamships led to the production of the *Great Eastern* (q.v.), but she was half a century ahead of the demands of ocean traffic and the adequate development of marine steam engineering. She was fitted with both screw and paddle engines, as it was thought impossible for either separately to deliver sufficient propulsive effect. The combination was not an economical one, and was a leading cause of her failure as a commercial venture. By 1860, in the fight for supremacy, the screw had become the unquestioned victor over the paddle wheel so far as ocean navigation was concerned, both in the merchant marine and in naval construction. Its advantages for war vessels were numerous, but the greatest of these was the possibility of placing all the propelling machinery of a screw steamer below the water line; and this alone was decisive. In merchant steamers the advantages of the screw were of a different kind. The efficiency of the paddle wheel depends upon the depth of immersion of the paddles; if too great or too little, the losses from slip, drag, and churning of the water are serious. The variation of draught consistent with economical propulsion was therefore very small—too small to admit of heavy loading. Very large wheels and feathering wheels reduced the losses somewhat, but introduced troubles of another type, while the rolling of paddle steamers in heavy seas greatly interfered with their speed and economy no matter what the character of the wheels. The draught and condition of lading of screw steamers was of much less importance and could be varied within much wider limits without perceptible loss of efficiency; rolling produced little effect, and though pitching might be serious in short vessels in which the screw was not deeply immersed, yet, owing to the small ordinary angle of pitch, the screw rarely rose high enough above the surface to give trouble.

Up to this time boilers were of the box type and the pressure of steam carried rarely exceeded 25 pounds per square inch—in many of the early steamers 10 pounds or less was the common practice. But the displacing of box boilers by cylindrical permitted a higher steam pressure, and this in turn demanded another form of engine to utilize it economically. The compound engine, which was built and patented by Hornblower in 1781 and revived by Woolf in 1804, had not been much used, because the conditions had not demanded it; but now it became a necessity. It consisted at first of two cylinders—and many compound engines are still so built—in which the steam was expanded in two stages, the first expansion taking place in the high-pressure cylinder, by which the pressure was reduced one-half, more or less, and the second expansion in the low-pressure cylinder, where the pressure was carried down to the atmospheric line or below it.

The demand for increased speed led to higher steam pressure and greater engine speed. The range of economical expansion in one cylinder being limited, the tri-compound or triple-expansion engine was designed to utilize the increased boiler pressures. The gain was twofold. The new engines, using a higher pressure of steam, were lighter than their predecessors of equal power and they were also more economical. The first large vessel to be fitted with them was probably the *Propontis*, which, in 1874, was supplied with engines designed by Mr. A. C. Kirk. By 1880 the use of triple-expansion engines became common, though compound engines were largely used for another decade and they are still fitted in certain steamers where the conditions favor their economical working.

The continued demand for increased power, particularly in small vessels (torpedo boats and the like), naturally pushed up the steam pressure again, and, although the locomotive boiler was used to some extent, the advantages of the water-tube boiler soon became apparent. (See section on *Boilers* below.) Its capability to furnish very high pressure steam reacted upon engine design and produced the quadruple-expansion engine. The water-tube boiler is not yet much used in the mercantile marine, but is rapidly displacing the cylindrical boiler in naval construction. It has not yet brought about the extended use of quadruple-expansion engines in large vessels, but this may follow in the course of time.

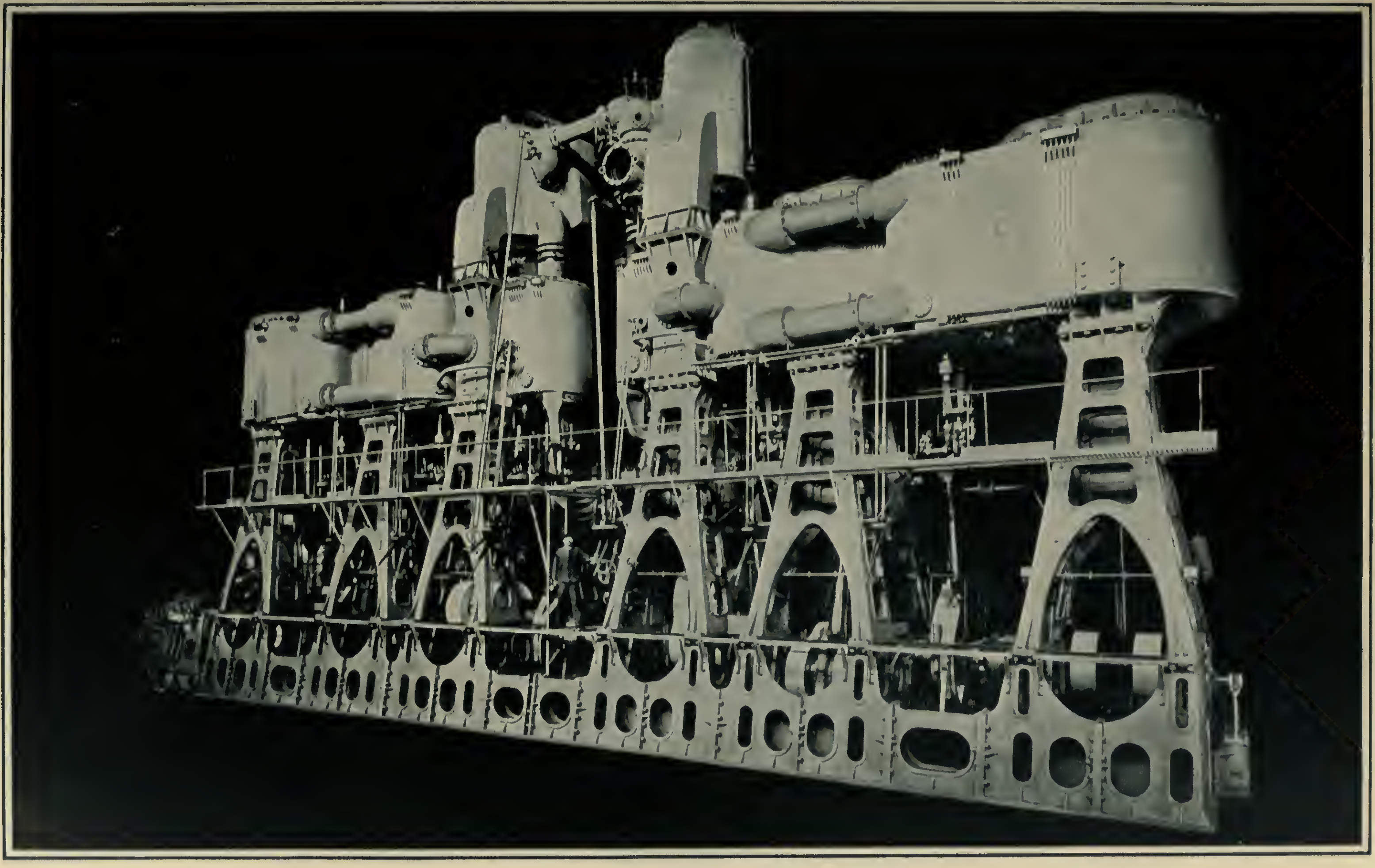
The length of the voyage and the vast amount of traffic has caused the transatlantic trade to be the principal field of steamship development. While the gain in size and speed of the vessels in this trade has been continuous from the start, a great impulse was given by the building of the *Britannic* and *Germanic* for the White Star Line in 1874. They at once reduced the average passage from Queenstown to New York to about eight days. They were followed in 1879 by the *Arizona* of the Guion Line, confessedly built to outstrip all competitors, and her success was the beginning of a race for speed supremacy that has brought out a new 'record-breaker' almost every year since. As the vessels are increased in size it takes less horse power per ton to drive them at a given speed, and this has tended to augment the tonnage of the great liners so that the dimensions of the *Great Eastern* are now exceeded by nearly a dozen vessels, built and building. The accompanying table gives the principal features of the largest ships belonging to the great steamship companies, transatlantic and transpacific.

MARINE ENGINES. Marine engines have during recent years tended to one general type. For special services on inland waters a great num-

TABLE GIVING PARTICULARS OF THE LARGEST AND MOST IMPORTANT STEAMERS IN THE WORLD

NAMES OF VESSELS AND OF OWNERS	When completed	Net tonnage	Gross tonnage	Displacement tonnage at full load	Length between perpendiculars feet	Length over all, feet	Beam, feet	Depth of hold, feet	Draught at full load, feet	Indicated horse power of engines	Mean ocean speed, knots
AMERICAN LINE:											
St. Paul	1895	5,874	11,629	16,000	535.8	554.2	63.0	42.0	26.0	20,000	21
St. Louis	1895	5,894	11,629	16,600	535.8	554.2	63.0	42.0	26.0	20,000	21
New York	1888	6,318	10,675	....	....	560.0	63.3	42.0	......	20,000	21
Philadelphia (Built, 1888; rebuilt, 1901)	1901	6,289	10,787	....	....	560.0	63.3	42.0	......	20,000	21
ANCHOR LINE:											
Columbia	1901	....	8,900	....	....	503.0	56.0	......	......	....	......
ATLANTIC TRANSPORT LINE:											
Minneapolis	1900	....	13,401	....	....	600.7	65.5	39.7	......	....	14
Minnesota	1900	....	13,403	....	....	600.7	65.5	39.5	......	....	14
Minnetonka	1902	....	13,398	....	....	600.7	65.5	39.7	......	....	14
New ship	b'ld'g 1903	....	13,400	....	....	615.0	65.0	51.0	......	12,000	15
New ship	b.ld'g 1903	....	13,400	....	....	615.0	65.0	51.0	......	12,000	15
Missouri	b'ld'g 1903	....	10,425	....	....	490.0	58.0	43.0	......	....	15
Maine	b'ld'g 1903	....	10,425	....	....	490.0	58.0	43.0	......	....	15
CUNARD LINE:											
Campania	1892	5,000	12,950	....	600	622.0	65.3	41.5	25.0	30,000	22
Lucania	1892	5,000	12,950	....	600	622.0	65.3	41.5	25.0	30,000	22
New ship	b'ld'g 1903	....	....	....	....	760.0	78.0	......	29.0	60,000	25
New ship	b'ld'g 1903	....	....	....	....	760.0	78.0	......	29.0	60,000	25
COMPAGNIE GENERALE TRANSATLANTIQUE:											
Touraine	1890	....	9,778	13,000	....	536.0	55.0	38.0	......	....	......
Aquitaine	1890	....	10,000	13,000	....	520.0	58.0	38.0	......	....	......
Lorraine	1899	....	11,869	15,400	557.7	582.3	60.5	39.4	25.5	22,000	21.5
Savoie	1900	....	11,869	15,400	557.7	582.3	60.5	39.4	25.5	22,000	21.5
HAMBURG-AMERICAN LINE:											
Deutschland	1900	....	16,502	23,620	662.8	686.6	67.0	44.0	29.0	36,000	23.5
Fürst Bismarck	1890	....	8,430	....	520.0	....	58.0	40.0	......	18,000	......
Augusta Victoria	1889	....	8,470	....	520.0	....	56.0	38.0	......	15,000	......
Columbia	1889	....	7,241	....	....	465.0	56.0	38.0	......	15,000	......
NORTH GERMAN LLOYD LINE:											
Kaiser Wilhelm der Grosse	1898	5,521	14,349	20,880	625.0	648.6	66.0	43.0	28.0	30,000	23.0
Kaiserin Maria Theresa	1899	3,769	7,800	....	....	546.0	52.0	37.0	......	17,000	21.0
Kronprinz Wilhelm	1901	....	15,000	21,300	....	663.0	66.0	43.0	28.5	36,000	23.5
Kaiser Wilhelm II	1902	....	19,500	26,000	....	706.5	72.0	52.5	29.0	39,000	23.5
Grosser Kurfürst	1900	....	12,200	22,000	....	581.5	62.0	39.0	......	16,000	20.0
RED STAR LINE:											
Vaderland	1900	7,490	11,899	....	560.0	580.0	60.0	42.0	27.9	12,000	17.5
Zeeland	1901	7,511	11,905	....	560.0	580.0	60.0	42.0	27.9	12,000	17.5
Finland	1902	....	12,300	....	560.0	580.7	60.0	42.0	28.0	10,400	17.0
Kroonland	1902	....	12,300	....	560.0	580.7	60.0	42.0	28.0	10,400	17.0
WHITE STAR LINE:											
Teutonic	1889	4,269	9,984	....	....	585.0	57.0	42.0	......	16,000	20.5
Majestic	1890	4,269	9,965	....	....	585.0	57.0	42.0	......	16,000	20.5
Oceanic	1899	6,917	17,274	28,500	685.0	704.0	68.4	49.0	32.5	27,000	20.7
Celtic	1901	13,449	20,880	37,770	680.8	699.0	75.4	49.3	36.5	13,000	17.0
Cedric	1902	13,500	20,970	37,870	680.8	699.0	75.4	49.3	36.5	13,000	17.0
GREAT NORTHERN RAILWAY COMPANY (Transpacific):											
Dakota	1903	....	21,000	33,000	....	630.0	73.5	55.7	33.0	9,600	14.0
Minnesota	1903	....	21,000	33,000	....	630.0	73.5	55.7	33.0	9,600	14.0
PACIFIC MAIL COMPANY (Transpacific):											
Korea	1902	....	11,300	18,400	550.0	572.4	63.0	40.7	29.0	17,900	18.0
Siberia	1902	....	11,300	18,400	550.0	572.4	63.0	40.7	29.0	17,900	18.0

N.B.—The names of vessels which fly the American flag are printed in italics.



ONE OF THE TWO SETS OF MAIN ENGINES OF THE "KAISER WILHELM II."

Each set of engines develops 20,000 horse-power, and consists of two four-cylinder, three-crank, quadruple-expansion engines.

ber of various specialties are found, but in seagoing steamers the type in almost universal use is the vertical (i.e., the piston moves vertically), inverted (i.e. the cylinder is above the crank), direct-acting (i.e. the connecting rod joins the crosshead directly to the crank), triple (or quadruple) expansion engine. Engines differ as regards fittings and attachments, length of stroke and revolutions, weight, speed, etc., but a description of the general type will give the essential features of all.

Naval engines are built lighter, have a shorter stroke, and run at higher speeds than those in the merchant service. In a triple-expansion engine the steam works expansively in three successive stages, in a quadruple in four. The reason for the introduction of the multiple-expansion engine is the greater economy obtained when steam is used expansively over a greater range. This cannot be efficiently accomplished in a single cylinder owing to various causes chiefly due to liquefaction, hence compound (two stage) engines were introduced, then the triple and quadruple. The economy gained by the compound over the simple is about 50 per cent., by triple over compound about 25 per cent., and by quadruple over triple about 10 per cent. In the quadruple the gain in economy is obtained by considerable increase in weight, so that for most services the real gain of the quadruple is questionable. The type of engines will depend largely on the steam pressure employed. For a pressure of 40 to 90 pounds a compound; up to 190 pounds the triple; above 190, the quadruple may be used if space and weight are not very important. At present the pressure used is ordinarily between 140 and 250 pounds per square inch above the atmosphere. A great advantage of multiple-expansion engines, and a cause for their adoption, is the more even turning effect and better balancing obtained. The triple-expansion engine has either three or four cylinders, more often three, arranged in successive order, H.P. (high pressure), I.P. (intermediate pressure), L.P. (low pressure), each cylinder being attached by means of its piston and connecting rod to its own crank on the crank shaft, which is usually made in interchangeable sections, one for each crank. Cranks are usually set at 120° from each other to obtain even turning effect. Four cylinders are used when the L. P. cylinder would be too large to be conveniently fitted or built, or to obtain a better balancing of the engine and reduce vibrations. The sequence of the cylinders is then high pressure, intermediate pressure, low pressure, low pressure; or, on what is known as the Yarrow-Schlick-Tweedy system, low pressure, high pressure, intermediate pressure, low pressure, with cranks set at right angles. Here the crank shaft is generally in two sections.

The course of steam in a triple-expansion engine would be as follows: Leaves main steam pipe, passes through separator, then throttle, and into high-pressure valve chest. The movement of the valve opens and closes the steam ports at pressure cylinder for 0.6 to 0.75 of the stroke and then cuts off. The steam in the cylinder then expands, continuing to move the piston. Just before the end of the stroke the valve opens to exhaust and at about the same time begins to allow steam to enter on the other side of the piston; this results in cushioning at the end of the stroke. The steam having been reduced about 50 to 60 per cent. in pressure and correspondingly in temperature, leaves the high pressure cylinder, and passes to the intermediate pressure receiver, which is really the intermediate pressure valve chest. From here it enters through the intermediate pressure valve and does its work in the intermediate pressure cylinder, being again reduced in temperature and pressure. On leaving the intermediate pressure cylinder the steam is generally at about atmospheric pressure. Then it is conducted to the low pressure receiver and goes through its third stage of working and expansion. On leaving the low pressure it goes through the exhaust pipe to the main condenser where it is condensed, and then as water and vapor it is pumped by the air pump to the hot well or feed tank, and thence to the boiler, where it is reëvaporated.

A plate illustrating a four-cylinder triple-expansion engine of a modern second-class cruiser for the United States Navy is shown with various parts indicated. The engine framing is supported on a *bed plate* made in sections and bolted by *holding-down bolts* to structural parts of the vessel. The engine framing is made of *steel columns* braced by various *cross rods.* A more general practice is to have cast or wrought steel inverted Y frames on one side which support the guides, and in the merchant service the condenser is generally cast in one piece with lower portions of the Y frames. The *cylinders* are supported on top of framing and bolted to it by various fastenings. In large engines each cylinder is a separate casting; generally the valve chest is cast with the cylinder, making the whole a rather intricate casting. Cast iron is generally used for cylinders. Cylinders are fitted with liners, *a*, which form the bearing surface for the piston. The liners are bolted at the lower end to the bottom of the cylinder and the joint at the top is packed. Liners are of cast steel or cast iron; steel is stronger, but cast iron gives a better wearing surface. The space between the cylinder and liner is commonly used as a steam jacket. Lately the economy of steam jacketing, especially for fast-moving engines, has been questioned. All cylinders are fitted with covers, *c*, of cast iron or steel, and these are secured to the cylinders by bolts and nuts and the joints packed by gaskets. For large cylinders, smaller openings called bull's-eyes, *d*, are fitted for purposes of examination. The pistons are cone-shaped, made of forged or cast steel or cast iron, and fitted with cast iron spring packing rings, *e*. The piston rod is secured to the piston by its taper and the piston rod nut, *f*, on top. The opening in the bottom of the cylinder for the piston rod is fitted with a stuffing box, *g*, supplied with some form of metallic packing. The lower end of the piston is secured to the crosshead *h*, made of forged steel, which has a slipper, *i*, sliding on the crosshead guide, *j*. The crosshead also has journals, *k*, for the upper end of the connecting rod. The lower end of the connecting rod is attached to the crank pin, *l*, by means of the crank pin brasses, *m*. The crank shaft is supported by the main bearings, *n*, which are supported by a bed-plate. All large bearings are lined with anti-friction metal.

The valves *o* for the H. P. and I. P. cylinders are piston valves, either single or double ported, hollow or solid. For the L. P., the double-ported flat slide valve, *p*, fitted with a relief ring is used. Piston valves are employed with high pressure because in them the pressure is on all sides and there is no force holding the valve against its seat. They are fitted with spring rings to make them tight. Valves are made of cast iron, cast steel, or forged steel. The valve seats are generally liners of cast iron. The valve stem is secured to the valve by its taper or shoulder and the nut *q* and the upper end *r* of the rod is fitted as a guide. The lower end of the valve rod is connected by means of a bearing to the link block *s*, which works in the link *t*. To the ends of the link are attached the eccentric rod *u*, and the lower ends of these rods are bolted to the eccentric straps *v*, which move around eccentrics *w*. The eccentrics are secured to the shaft and fitted so that the position can be slightly changed. There are two eccentrics, one to give go-ahead motion and the other backing. The link is moved by an arm attached to the reversing shaft *x*, which is operated by the reversing engine *y*, and this engine is controlled by the reversing lever. The link arm is attached to the adjustable cut-off block, by means of which the cut-off can be varied from .5 to .75 of stroke. This is the Stephenson gear, which is most generally used; others are Marshall's, Joy's, Morton's, etc.

In the cut shown, the air pump A is operated by a cross beam B attached to the L. P. crosshead. In many merchant vessels the circulating, bilge, and feed pumps are operated from such a beam. For large installments these pumps are as a rule independent and of the Blake, Worthington, Snow, or other patent type. The office of the air pump is to pump the condensed water and vapor from the condenser to the feed tank and produce a vacuum. Surface condensers are now always fitted, and the steam and condensed fresh water are kept separate from the circulating sea water. This keeps salt out of the system. The condenser consists of an approximately cylindrical vessel, having a water chamber and a tube sheet at each end. Brass tubes connect the two tube sheets and cold sea water is pumped through the tubes by means of the circulating pump, thus cooling and condensing the exhaust steam surrounding the tubes. Condensers are made of bronze or cast steel and the tubes of brass. Circulating pumps are centrifugal and operated by a vertical simple or compound engine.

The feed tank is generally fitted with a filter chamber for purifying the water. Feed heaters, using auxiliary exhaust steam to heat the water before reaching the boilers, are fitted for purposes of economy and make the service less hard on boilers. The feed pumps are vertical, single, or duplex plunger pumps. Cylinders are lagged (i.e. covered with non-heat-conducting material) to prevent loss of heat. All cylinders are fitted with relief valves set at appropriate pressures, drains for conducting off any water that may accumulate, and indicator pipes, cocks, and reducing motion for taking indicator cards. Pressure gauges are supplied to indicate the pressure in the steam pipe, the various receivers, and the vacuum in the condenser. Revolution counters are attached, which automatically record the number of revolutions of the engines. A water service is supplied, consisting of a system of piping by means of which sea water can be circulated through such parts as the thrust bearing and crosshead guides, or sprayed on various other bearings where heating is likely.

The oil services on a modern engine are very elaborate, as all working bearings must be supplied with a lubricant. The best practice is the manifold system, where each bearing has a small pipe leading up to one of the several manifolds where it is fed by means of a wick. The manifold can be filled from a reservoir placed above the level of the engine. Besides oil, graphite and various preparations of tallow and grease are used for lubrication.

The steam pressures now used are 150-300 pounds. It is not likely that much higher pressures than 250 will be soon used, on account of the great strength of parts necessary to withstand the pressure, the difficulty of keeping tight joints, and the high temperature of steam, which heats the working surfaces and prevents proper lubrication.

Steam is expanded in triple-expansion engines 6 to 9 times; in quadruple, 8 to 12 times. The ratio of the area of the H. P. to that of L. P. cylinder varies from 1 to 5 to 1 to 10, there being a greater ratio with increased pressures.

The revolutions vary from 80 or 100 per minute in very long stroke engines to 400 to 500 in high-speed torpedo boats. The piston speed is limited to about 1000 feet per minute. The length of stroke for large merchant vessels is four to six feet; for naval engines not over four feet; with smaller engines the stroke is less. A relatively long stroke results in greater economy.

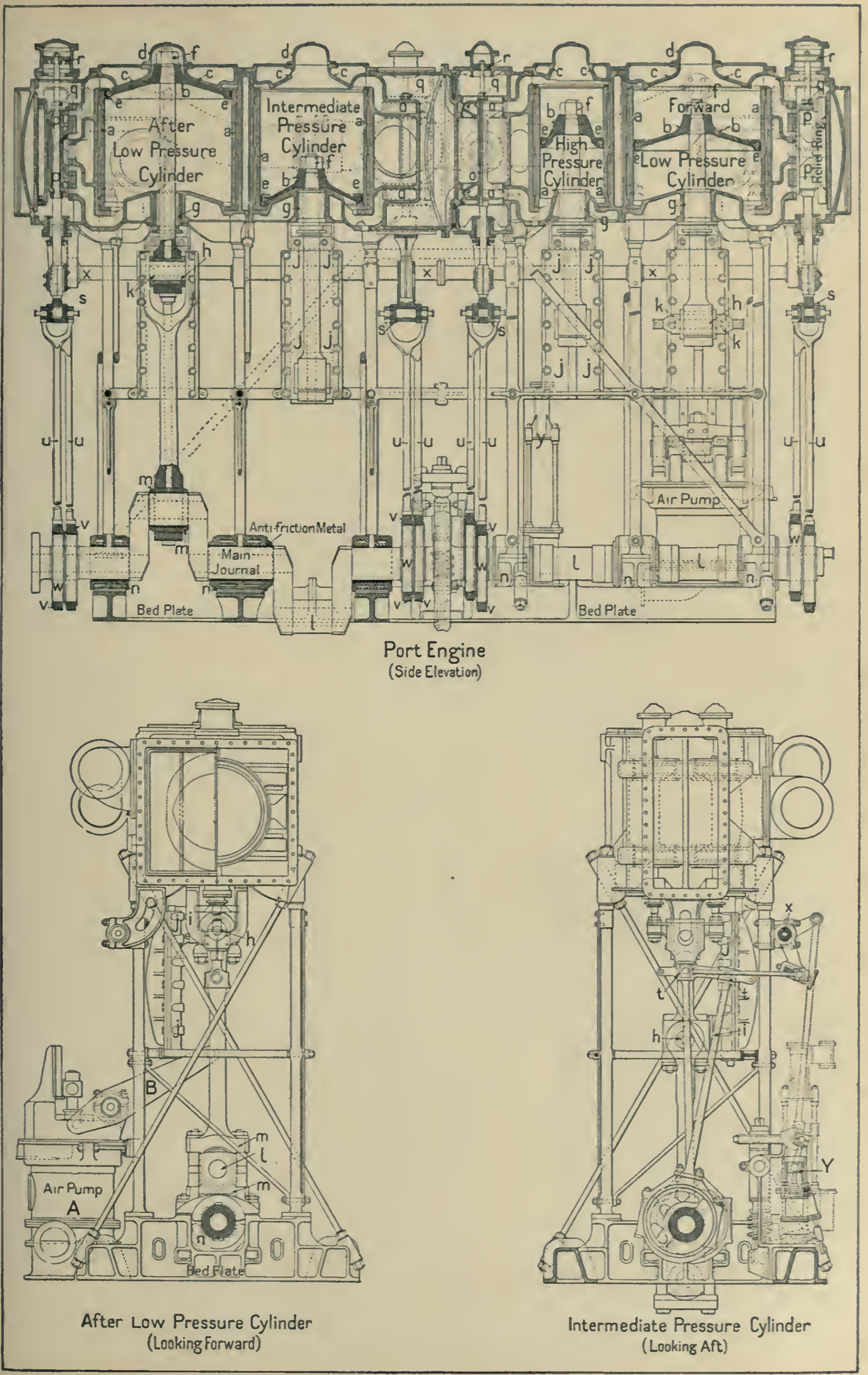
Of late the steam turbine is beginning to be introduced in place of the reciprocating engine for fast vessels. See STEAM TURBINE.

BOILERS. Modern marine practice is either to use the cylindrical fire-tube boiler carrying pressures of 150 to 200 pounds per square inch, or some form of water-tube boiler using pressures of 160 to 300 pounds. W.T. (water-tube) boilers are more largely used for naval purposes and fast passenger vessels and cargo vessels in fresh water, cylindrical boilers for general merchant service.

The substantial advantages of the cylindrical boiler are: reliability, simplicity; it is well made and generally understood; it can use salty or dirty water, and it will stand hard usage without serious loss or injury. The disadvantages are: great weight; steam cannot be gotten up or taken off quickly; it does not readily adjust itself to change of output; and heavy forced draught cannot be used.

The advantages of the water-tube boiler are: lightness; adaptability to high pressure; rapidity of raising steam or taking it off; it is readily adjusted to sudden change of output; heavy forced draught can be used (in nearly all types); repairs or removals are more easily made. Its disadvantages: it requires great care and attention; it cannot use salty or dirty water or experience hard usage; corrosion takes place very readily; it is complicated and many types require a large number of mechanical attachments; and being new, it is not well understood by men who handle it and best results are not obtained. The economy of fuel is about the same in the best of each type. For average running the cylindrical is probably the most economical.

The general form of a cylindrical boiler is the



Port Engine
(Side Elevation)

After Low Pressure Cylinder
(Looking Forward)

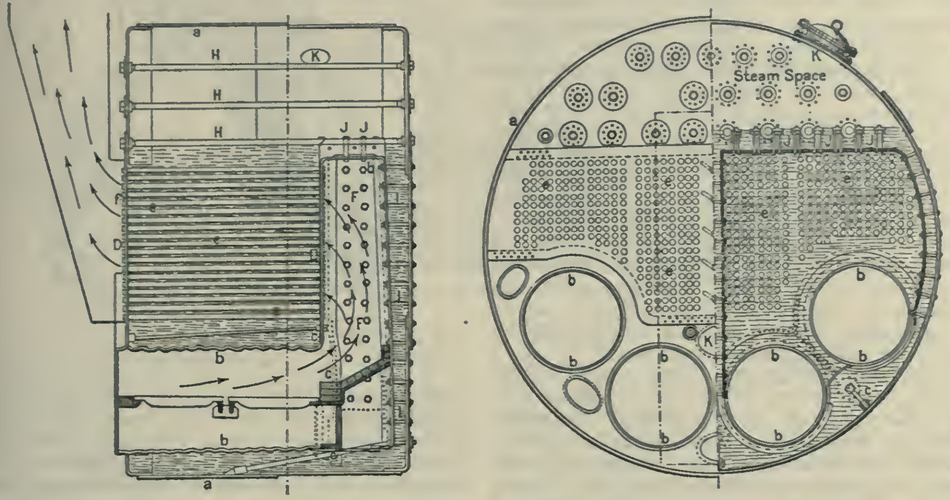
Intermediate Pressure Cylinder
(Looking Aft)

SECTIONS OF ENGINE OF UNITED STATES TWIN-SCREW PROTECTED CRUISER.

Displacement of Vessel, 3200 tons.
Indicated Horse-power, 4500.

Diameter of cylinders, 18, 29, and (2) 35 1-2 inches.
Stroke, 30 inches.

single or double ended return-tube boiler fitted with two, three, or four corrugated furnaces. Boilers vary from 9 to 20 feet in diameter, and 9 to 18 feet in length for single-ended, and 17 to 21 feet for double-ended. A cut of a single-ended boiler is shown; *aa* are the shell plates, made in two courses of three sections each, with butt joints; *bb*, corrugated furnaces, either of Fox, Purves, or Morrison patent, into which the grate and bridge wall are fitted; *c*, stays supporting boiler front and combustion chamber; DD, tube sheets with tubes, *e*, expanded into them; some of these are stay tubes screwed into tube sheets which they help to support. F is the combustion chamber where the gases of combustion are finally mixed and burnt. The products of combustion pass through the tubes to the uptake and then to the smoke pipe. The heating surface is composed of the crown sheets (top of furnaces), top and sides of combustion chamber, and tube surface, the tube surface being by far the larger portion. H, H, H are steam space stays supporting the boiler ends. The back and sides of the combustion chamber are supported by short stay bolts, I, and the top by girder stays, J. The steam space is fitted with a dry pipe which collects the steam and discharges through the stop valve to the steam pipe.



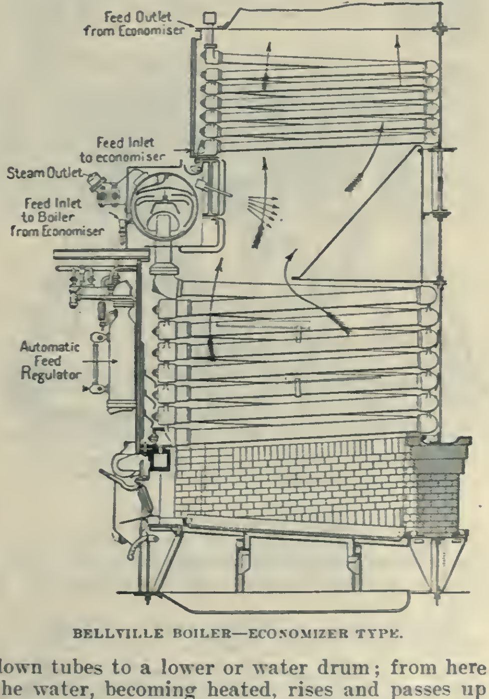
SINGLE-ENDED CYLINDRICAL BOILER.

The furnace front is fitted with furnace and ash-pit doors, the ash pit being the part of the furnace below the grate. Manholes, K, are fitted to obtain access to boiler for cleaning, etc. The coverings for manholes are called manhole plates. Practically all parts of a boiler, except the grate, furnace doors, and bridge wall, are built of mild steel.

The attachments of a boiler like the one shown are: main and auxiliary stop valves in the steam pipe; check valves through which feed water enters; surface and bottom blow valves, by means of which boiler is blown down or pumped out; two water columns to show the height of the water; pressure gauge; spring safety valve; and circulating apparatus (generally a hydrokineter).

The grate surface of such a boiler develops 13 to 16 indicated horse power per square foot. Ratio of heating to grate surface, 30-35 to 1. Weight per I. H. P. including water, 90 to 120 pounds. Maximum coal burnt per square foot grate to smoke stack is rather short, most types narily 15 to 20 pounds. The efficiency of the boiler is about 70 to 75 per cent. in best condition.

In water-tube boilers the water is contained within the tubes, and as these are relatively small great pressures can be carried and the boiler may be considerably lighter. Most types of water-tube boilers have a number of steam and water chambers connected by a system of tubes either straight or bent. The feed water usually enters the upper or steam drum and is conducted by down tubes to a lower or water drum; from here the water, becoming heated, rises and passes up through steam-collecting tubes to the steam


Feed Outlet from Economiser
Feed Inlet to economiser
Steam Outlet
Feed Inlet to Boiler from Economiser
Automatic Feed Regulator

BELLVILLE BOILER—ECONOMIZER TYPE.

drum. Thus a circulation is set up. The efficiency of a water-tube boiler depends in a large measure on proper circulation. As the distance of grate to smoke stack is rather short, most types of water-tube boilers have a system of baffle plates for conducting the gases among the tubes to increase the distance of travel. The economy depends in large measure on efficient baffling.

The boilers are fitted with a casing made of fire brick, asbestos, or other non-conducting material held in place by thin sheet metal.

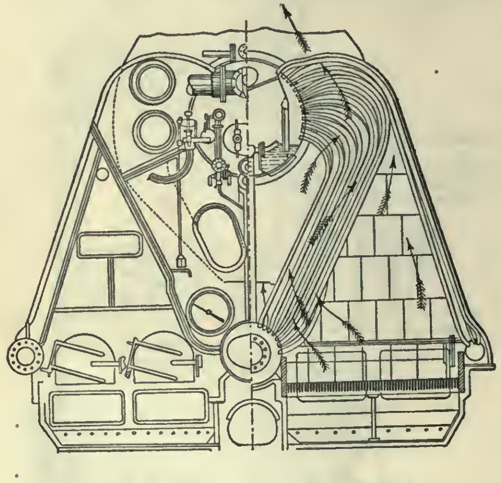
Water-tube boilers have all the attachments enumerated for the cylindrical fire-tube boiler. In addition nearly all except Babcock & Wilcox boilers have automatic feeding apparatus. Bellville boilers are fitted with reducing valves. Some types, especially Bellville, are fitted with feed heaters or economizers placed above the boiler proper, where the feed water is heated before entering the boiler. Others are fitted with superheaters. Most types have an arrangement of steam or air service for the removal of soot.

Down-tube boilers are those in which the steam-generating tubes discharge into a steam drum below the water line. Priming boilers are those where these tubes discharge at or above the water line. Such a boiler as the Schultz appears to be neither one nor the other.

Large-tube boilers use tubes varying from three to five inches in diameter. Small-tube boilers use tubes one to two inches in diameter.

Express boiler is a term applied to rapid steaming small-tube boilers, capable of large power on small weight and using heavy forced draught. This type is rather less economical and is chiefly used for very fast vessels such as torpedo boats.

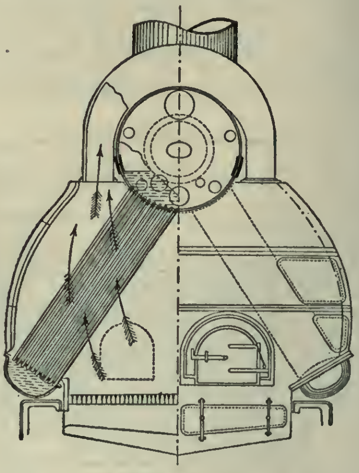
Up to the present time the Babcock & Wilcox and Dürr of large-tube type, and the Thorneycroft, Yarrow, and Normand of express type, have given the greatest satisfaction in service.



THORNEYCROFT BOILER—DARING TYPE.

The Niclausse and Bellville appear to give satisfaction in some services and dissatisfaction in others.

The Babcock & Wilcox and Bellville are straight-tube priming boilers. The former is shown in section on the plate accompanying the article on BOILERS (q.v.). The Niclausse, Dür, Yarrow, and D'Allest are straight-tube 'drowned' tube boilers. The Thorneycroft and the Schultz are express bent-tube priming boilers. The Norman is an express bent-tube 'drowned' tube boiler. Of these the Yarrow, D'Allest, and Babcock & Wilcox are simplest and the Bellville most complicated.



YARROW BOILER.

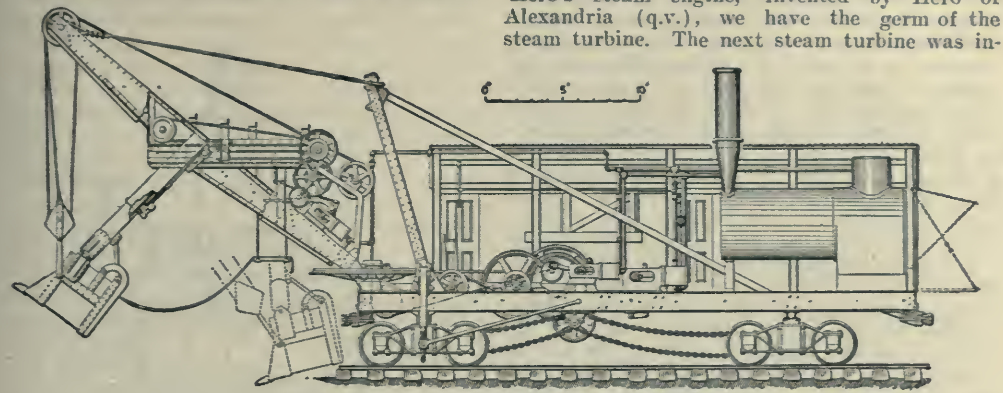
The systems of forced draught in use are the closed ash pit and closed fire room. Of induced systems generally fitted with air heaters we have various patent forms. Superheating is somewhat used, but does not meet with great satisfaction, owing to increased cost and weight and the rapid deterioration of such attachments.

The economic results and other data of water-tube boilers varies so much with different types and conditions that no average results can fairly be taken. As a rule there is a larger ratio of heating surface than in Scotch and a decrease in weight, so that among some of the best types the weight per indicated horse power, including water, is 50 to 90 pounds. See SHIPBUILDING; STEAM; STEAM ENGINE; SHIP, ARMORED; NAVIES; TRANSPORTATION.

STEAM PUMP. See PUMPS AND PUMPING MACHINERY.

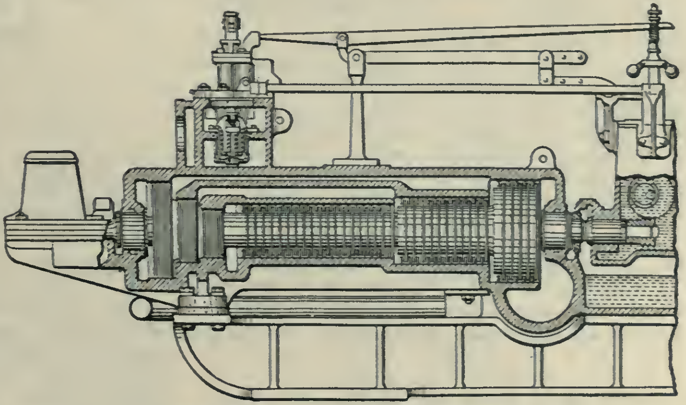
STEAMSHIP. See STEAM NAVIGATION.

STEAM SHOVEL. A modified form of dredge adapted for excavating material on dry land. The steam shovel was invented in 1840 by an American named Otis, but it did not come into general use until about 1865. The large increase in railway construction in the United States created an active demand for a rapid excavating machine. As will be seen from the accompanying outline drawing, the steam shovel consists essentially of a strong frame mounted on wheels to form a base to which the working parts are attached. The digging mechanism consists of a crane hinged to a mast or support at the front end of the car, and a dipper handle and dipper carried by the crane. The operating machinery consists of a main engine, which hoists the dipper and swings the crane, and of a thrusting mechanism for forcing the dipper into the earth. The operation begins with the dipper at the position shown by the dotted lines in the illustration. The engine man begins to hoist and thus swing the dipper upward along a curved path; at the same time the crane man by means of the thrusting mechanism forces the dipper into the earth so that a layer is scooped off the face of the bank and falls into the dipper. The depth of the cut is so regulated by the crane man that the dipper is just filled when at its topmost position. The dipper is then hauled back and the crane is swung so as to carry the dipper over the car set alongside the shovel, and the latch is pulled, setting free the swinging bottom of the dipper, which falls open and permits the contents of the dipper to fall into the car. In actual operation these several movements are combined to a greater or less extent, and are accomplished by various devices which will be found described in Hermann, *Steam Shovels and Steam Shovel Work* (New York, 1894). The various parts of the shovel, body, mast, crane, and dipper handles, are constructed either of wood or steel, the latter material being most generally used for the heavier types of shovels. The dipper is always made of steel or iron plates, and its size or capacity varies from one to five cubic yards, but capacities of 1, 1½, 2, and 2½ yards are the ones most common. For digging blasted rock the front edge or lip of the dipper has steel teeth. The excavating capacity of steam shovels varies from 2400 cubic yards of sand to 600 cubic yards of loose rock per ten hours, with a 2½ cubic yard dipper. For extensive records of actual operation in various kinds of material, consult Hill, *The Chicago Main Drainage Channel* (New York, 1896).

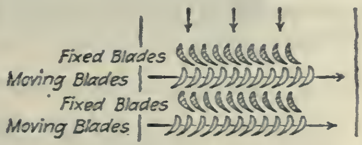


SECTION SHOWING MECHANISM OF STEAM SHOVEL.

STEAM TURBINE. A form of prime motor in which the kinetic energy of expanding steam acts upon a wheel provided with vanes so as to cause rotation. The ordinary method of using steam to obtain power is to admit it into a closed cylinder, where it acts upon a movable piston. (See STEAM and STEAM ENGINE.) In this case work is performed by the static expansive force of the steam pressing against the piston; in the case of the steam turbine the work is developed by the kinetic energy of particles of steam which are given a high velocity by reason of the steam expanding from one pressure to a lower pressure. In the æolipile (q.v.) or 'Hero's steam engine,' invented by Hero of Alexandria (q.v.), we have the germ of the steam turbine. The next steam turbine was invented by Branca in 1629 and consisted simply of a jet of steam impinging upon the vanes of a paddle wheel and blowing it around. Branca's device was the first impulse steam turbine. Practically no attention was given to the steam turbine from this time until the last quarter of the nineteenth century, when several inventors began experimenting, among whom C. A. Parsons of England and Dr. de Laval of Sweden deserve particularly to be noted. Mr. Parsons built his first turbine in 1884, and Dr. de Laval recorded his first patent in 1889. The first Parsons turbine developed 10 horse power at 18,000 revolutions per minute, and proved entirely practical. The Parsons turbine consists of several successive turbine wheels, or rows of blades, on

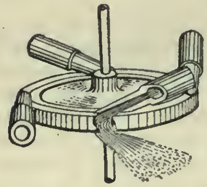


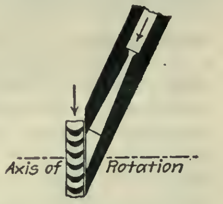
SECTION OF PARSONS'S STEAM TURBINE.



ACTION OF STEAM ON BLADES OF PARSONS'S TURBINE.

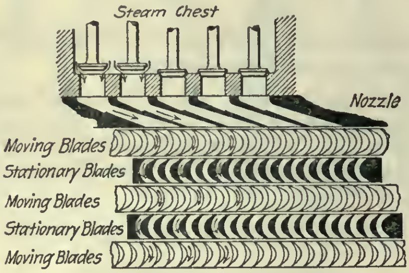
one drum or shaft within a concentric case having interior blades; the moving vanes or blades on the shaft are in circumferential rows projecting outwardly from the shaft and nearly touching the case, and the fixed blades on the casing are in similar rows, projecting inwardly from the case and nearly touching the spindle or shaft. This construction constitutes what practically amounts to a series of turbine wheels on one shaft, each one complete in itself like a parallel flow or Jonval water turbine, through which the steam is forced to pass. Each successive turbine is also slightly larger in passageway than its predecessor, to allow for the increasing bulk of the elastic steam as it exerts its force on each turbine successively and expands with a consequent reduction of pressure. The steam in passing through the successive turbines transmits to each a rotative impulse partly by reaction and partly by impulse, and thus the Parsons turbine involves the germinal principles of both the Branca turbine and Hero's engine. The notable feature of the Parsons turbine is the 'compounding' of the steam, or its expansion in successive stages, losing a few pounds in pressure at each stage. This quality of the machine permits a slow enough speed of rotation without serious loss of efficiency to allow the turbine to be coupled direct to a dynamo or even a screw propeller without the necessity of reduction gearing. It has been successfully employed in both these capacities.


ACTION OF STEAM IN DE LAVAL'S TURBINE.



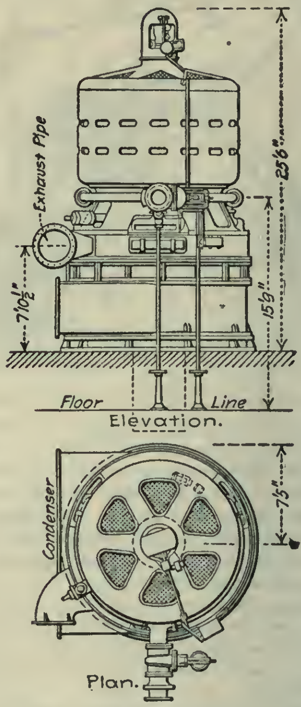
SECTION OF NOZZLE OF DE LAVAL'S STEAM TURBINE.

The De Laval turbine is simply a highly improved form of Branca's impulse turbine. It consists of a divergent nozzle which directs the jet of steam upon suitably formed buckets which are attached to the periphery of a revolving wheel. The outer edge of the buckets is shrouded by a steel ring which prevents the centrifugal escape of the steam. These turbines, especially in the larger sizes, are equipped with several nozzles. They are essentially of very high speed, the smaller sizes running at 30,000 revolutions per minute and the larger sizes at 10,000 revolutions per minute. A train of gearing reduces the speed to reasonable working velocities.



ACTION OF STEAM BLADES OF CURTIS'S TURBINE.

Two other turbines which have gained some prominence are the Seger turbine, a Swedish invention, which is similar in principle to the De Laval, but which employs two revolving vane wheels, instead of one, upon which the steam acts successively, and the turbine invented by J. H. Dow of Cleveland, O., which is notable as having the same principle of 'compounding' the steam as does the Parsons turbine, but which differs materially in construction from the Parsons machine.



CURTIS TURBINE OPERATING DYNAMO.

STEARIC ACID (from Gk. στέαρ, *stear,* tallow), $C_{18}H_{36}O_2$. One of the solid fatty acids. It exists as a glyceride (stearin) in most fats, and is especially abundant in the more solid kinds, such as mutton-suet. The stearic acid of commerce is in reality a mixture of stearic and palmitic acids. Pure stearic acid may readily be separated from this mixture by dissolving in hot alcohol and precipitating with a hot alcoholic solution of magnesium acetate, the precipitate being composed of practically pure stearate of magnesium; in this reaction, one part, by weight, of magnesium acetate should be employed for every four parts of commercial stearic acid treated. The magnesium stearate thus obtained is decomposed by boiling with hydrochloric acid, and the stearic acid set free is further purified by recrystallization from alcohol. Pure stearic acid is a colorless crystalline substance having neither taste nor odor; it melts at 69.2° C. (157° F.). It is insoluble in water, on which it floats, but dissolves in alcohol and ether, its solution reddening litmus powerfully. It may be distilled under diminished pressure. The only stearates soluble in water are the stearates of the alkalies, whose solutions are frothy and form a lather, but on the addition of an excess of water separate into an acid salt which is deposited in silky crystalline plates, and the free alkali, or more probably a basic salt, which remains in solution. (See SOAP.) The stearates of the alkalies are soluble also in alcohol. Chloride of sodium (common salt) has the property of separating the alkaline stearates from their aqueous solution.

Free stearic acid has been found in decomposing pus and in the caseous deposits of tuberculosis. In adipocere and in fæces stearic acid occurs in the form of its calcium salt; in blood, chyle, and in serous fluids, in the form of sodium salts. See CANDLE; FATS; OILS; SOAP.

STEARIN (from Gk. *στέαρ*, *stear*, tallow), or TRI-STEARIN, $C_3H_5(C_{17}H_{35}CO_2)_3$. One of the chief constituents of fats. It is considerably harder than palmitin (q.v.) and is less soluble than both palmitin and olein, the other characteristic constituents of natural fats. It may be obtained in a tolerably pure state from mutton-suet, by repeated crystallization from ether. The only way in which it may be obtained chemically pure is by synthesis: first, anhydrous glycerin is heated with an equal weight of stearic acid, the product being a compound called monostearin; the mono-stearin, freed from the excess of glycerin, is then heated with a further excess of stearic acid, and the product, tri-stearin, is carefully freed from the excess of stearic acid. Like palmitin and certain other tri-glycerides, it presents a remarkable peculiarity in melting: it melts first if heated to 55° C.; on further heating, however, it resolidifies and then melts again when the temperature of 72° C. is reached.

STEARNS, WILLIAM AUGUSTUS (1805-76). An American clergyman and educator, born at Bedford, Mass. He was educated at Harvard and at Andover, and was ordained in the Congregational Church in 1831. In 1854 he became president of Amherst College, his term being marked by extensive improvements of the institution and by the establishment of more than fifty scholarships. His publications include *Discourses and Addresses* (1855), and *A Plea for the Nation* (1876).

STEATITE. See SOAPSTONE.

STEB'BING, THOMAS ROSCOE REDE (1835—). An English naturalist. He was born in London and was educated at King's College, London, becoming a fellow of Worcester College in Oxford. In 1858-84 he was engaged in teaching, and thereafter devoted himself to literary and scientific pursuits. He made a special study of crustacea, and besides being a large contributor to various reviews wrote *Essays on Darwinism* (1871), *The Naturalist of Cumbrae, a True Story, Being the Life of David Robertson by His Friend* (1891), and *A History of Crustacea* (1893).

STECCHETTI, stĕ-kĕt'tē, LORENZO. The pseudonym of the Italian poet Olindo Guerrini (q.v.).

STED'MAN, CHARLES (1753-1812). An English military historian, born at Philadelphia. He was educated at William and Mary College and studied law. At the outbreak of the Revolutionary War he adhered to the Crown. He served in the British Army at Lexington and Bunker Hill and the subsequent operations about Boston, later became commissary to the army of Sir William Howe, and during the latter part of the war was with Cornwallis in the South. In 1783 he settled in England. He published a *History of the Origin, Progress, and Termination of the American War* (1794), which remains the best contemporary account of the Revolution from a British standpoint, and is of particular value for its military maps. It called forth from Sir Henry Clinton a reply, *Some Observations upon Mr. Stedman's History* (1794).

STEDMAN, EDMUND CLARENCE (1833—). An American poet, critic, and essayist, born at Hartford, Conn., and educated at Yale. In 1852 he entered journalism as editor of the Norwich (Conn.) *Tribune* and the following year he became editor of the Winsted (Conn.) *Herald*, where he remained till 1855. He then went to New York and in 1859-61 was on the staff of the *New York Tribune*. At the outbreak of the Civil War he was sent to the front by the New York *World* as war correspondent, and there continued till 1863. In the meantime he studied law and was for a time private secretary to Attorney-General Bates in Washington, D. C. In 1864 he was interested in constructing and financiering the first Pacific railroad. The following year he entered Wall Street, New York, as a broker and banker, becoming a member of the Stock Exchange and holding his seat till 1900. His chief volumes of verse are: *Poems, Lyrical and Idyllic* (1860); *Alice of Monmouth, An Idyll of the Great War* (1864); *The Blameless Prince* (1869); *Hawthorne and Other Poems* (1877); *Lyrics and Idylls* (1879); and *Poems Now First Collected* (1897). His prose works include *The Victorian Poets* (1875) and *The Poets of America* (1885) and *The Nature and Elements of Poetry* (1892), a work of sound appreciation and technical knowledge. These volumes of critical writing he supplemented by *A Victorian Anthology* (1895) and *An American Anthology* (1900). He was also editor, with Ellen M. Hutchinson, of *A Library of American Literature* (1888-90, 11 vols.), and, with George E. Woodberry, of the *Works of Edgar Allan Poe* (1895, 10 vols.). Upon the death of Lowell many accorded to Mr. Stedman the primacy among living American poets and critics.

STEED'MAN, CHARLES (1811-90). An American naval officer, born at Charleston, S. C. He was appointed a midshipman in the navy in 1828. He distinguished himself in the Mexican War at Vera Cruz and at Tampico. From 1847 to 1855, with slight interruptions, he was attached to the United States Naval Observatory at Washington, attaining the rank of commander in the latter year; and in 1859 he commanded the *Dolphin* in the Paraguay expedition. He was loyal to the Union during the Civil War. He took part in DuPont's attack and capture of Port Royal, and in the capture of the Savannah forts and of Fort McAllister. In October, 1862, he captured the Confederate batteries at the mouth of the Saint John's River, Florida. In 1865 he was placed in command of the Mediterranean Squadron, and in 1866 was made a commodore. He commanded the Boston Navy Yard from 1869 to 1872, became a rear-admiral in 1871, and was retired in 1873.

STEEDMAN, JAMES BARRETT (1818-83). An American soldier, born in Northumberland

County, Pa. In 1837 he settled in Ohio, where he became interested in the Wabash and Erie Canal. In 1856-60 he was printer to Congress. He led the Fourth Ohio Volunteers at the battle of Philippi, was promoted to the rank of brigadier-general, and at the battle of Perryville brought his troops on the field just in time to fill a dangerous gap in the Federal battle line. At Chickamauga he led the vanguard of Granger's reserve corps to Thomas's aid on the afternoon of the second day. He served under General Sherman during the Atlanta campaign and then rejoined Thomas at Nashville, where he was given command of a provisional division of negro troops, with which on December 15, 1864, he opened the battle of Nashville. He resigned from the service in 1866 with the rank of major-general of volunteers. During President Johnson's administration he was collector of internal revenue at New Orleans, and in 1879 he was elected to the Ohio State Senate.

STEEL. See Iron and Steel.

STEEL, Flora Annie (Webster) (1847—). An English novelist, born at Harrow. In 1867 she married a Bengal civilian and went to India, where she lived till 1889. She was for some time inspectress for the Government and aided schools in the Punjab. While in India she published, in conjunction with Lieut.-Col. Richard Temple, a collection of Punjab folk-tales, under the title *Wide-Awake Stories* (1884). After her return to England she began a series of novels and short stories illustrative of native and Anglo-Indian life. Among them are: *Miss Stuart's Legacy* (1893); *Tales from the Punjab* (1894); *Flower of Forgiveness* (1894); *On the Face of the Waters* (1896); *Voices in the Night* (1900); *The Hosts of the Lord* (1900); and *In the Guardianship of God* (1903).

STEEL, Sir John (1804-91). A Scottish sculptor, born in Aberdeen. He first gained prominence by the bronze group of "Alexander Taming Bucephalus," in Saint Andrew's Square, Edinburgh, and his colossal statue of the Queen, surmounting the Royal Institute, brought the appointment as sculptor to her Majesty in Scotland (1838). Among other works by him in Edinburgh are the seated marble figure of Sir Walter Scott, the equestrian statue of the Duke of Wellington (1852), and the memorial statue of Prince Albert. In the United States are a bronze statue of Robert Burns and one of Walter Scott, in Central Park, New York City. He executed many portrait busts. Steel was the first to introduce bronze-casting into Scotland.

STEELE, stā'le. A town in the district of Essen, Prussia, four miles east of Essen, on the Ruhr River. In the town are sandstone quarries, coal mines, grist-mills, brick-kilns, distilleries, breweries, gas-works, and water-works. Population, in 1900, 12,243.

STEELE, stēl, Anne (1717-78). An English hymn-writer. She was the daughter of a lay Baptist preacher living at Broughton in Hampshire. Her life mainly passed quietly in her native shire. In 1760 appeared her devotional *Poems,* which were reissued after her death with additions, and a memoir by Dr. Caleb Evans (3 vols., Bristol, 1780). Many of her hymns are in common use. Among them are "Far from These Narrow Scenes of Night" and "Dear Refuge of My Weary Soul." Consult her *Hymns, Paslms, and Poems,* ed. with memoir by J. Sheppard (London, 1863).

STEELE, Joel Dorman (1836-86). An American educator and author, born at Lima, N. Y., and educated at Genesee College. From 1862 until 1866 he was principal of the Newark, N. Y., High School, and from 1866 until 1872 of the Elmira Academy. In 1866 he published a popular text-book entitled *Fourteen Weeks in Chemistry.* Its success led him to publish a series of books, likewise intended for terms of fourteen weeks, upon *Astronomy* (1867), *Natural Philosophy* (1869), *Geology* (1870), *Human Physiology* (1873), and *Zoölogy* (1875). With his wife, Esther B. Steele, he also wrote an even more successful series of school histories, known, from the name of the publisher, as *Barnes' Brief Histories.* He bequeathed $50,000 to Syracuse University to found the Steele chair of theistical science.

STEELE, Sir Richard (1672-1729). An English essayist, playwright, and politician, born in Dublin. In 1684 he was sent to the Charter House School, where he formed a memorable friendship with Addison. In 1690 he was enrolled at Christ Church, Oxford, but he passed to Merton College (1691). In 1694 he left Oxford without a degree, and enlisted in the Life-Guards. An elegy which he wrote on the death of Queen Mary (December, 1694), wisely dedicated to Lord Cutts, Colonel of the Coldstream Guards, led eventually to a captaincy in the regiment. "Finding the military life exposed to much irregularity," Steele wrote *The Christian Hero* (1701), a moral treatise for his own guidance. It was not taken seriously by his associates, and seems to have had little effect on its volatile author. He now wrote three comedies: *The Funeral* (1701); *The Lying Lover* (1703); and *The Tender Husband* (1703). Though rather too deliberate in their moral purpose, they contain much delightful wit. After some vain searches, it was said, for the philosopher's stone, he married (1705) a Mrs. Stretch, who owned an encumbered estate in Barbadoes. She died about a year after the marriage. In 1706 Steele became gentleman waiter to Prince George; in 1707 he was appointed gazetteer, and seems to have left the army. The two positions brought him £400 a year. He now secretly married (September 9, 1707) Miss Mary Scurlock, of Llangunnor, in Wales, who figures as 'Prue' in his curious letters. He took a house in Bury Street, and lived far beyond his means. The death of Prince George in 1708 put an end to his place at Court, and three years later he lost his gazetteership. But he was appointed commissioner of stamps in 1710, a post with £300 a year. Meanwhile (April 12, 1709) had appeared the *Tatler,* a tri-weekly containing sketches and short essays on manners, written under the pseudonym of Isaac Bickerstaff. The periodical came to an end on January 2, 1711, and was succeeded on March 1 by the more famous *Spectator.* Though the plan of these papers was Steele's, Addison had contributed to the *Tatler,* and Addison now became the more important figure. When the *Spectator* suspended publication on December 6, 1712, Steele had written 236 papers and Addison 274. The *Guardian,* started March 17, 1713, was followed by several other short-lived periodicals, of which the most noteworthy is the *Englishman.* In these later undertakings Steele, a strong Whig, involved himself in political controversy, and was handled without mercy by Swift. He resigned his commissionership of stamps and entered Parliament, but he was expelled (March, 1714) for seditious libel contained in *The Crisis*, a pamphlet in favor of the Hanoverian succession. On the accession of George I. Steele was again elected to Parliament (1715). He also secured the patent of Drury Lane Theatre (worth £1000 a year), for which he wrote his last comedy, *The Conscious Lover* (1722). Broken in health, he passed his last years at Carmarthen, in Wales, where he died September 1, 1729. He was buried there in Saint Peter's Church.

As a man Steele possessed no dark vices. He was improvident, generous, and light-hearted. As a poet he won no place. His political pamphlets, though of interest, are not convincing. His comedies, notwithstanding their aim to purge the stage of immorality, are still read for the wit and gayety in special scenes. As an essayist he has often been compared with Addison to his disparagement. Addison was indeed his superior in taste and humor. But Steele possessed the kindlier heart. Of his generation he stands almost alone in the respect he everywhere shows to women. Anent Lady Elizabeth Hastings he wrote that "to love her was a liberal education." The same sincere heart spoke out in his affection for children. Addison was a stylist. Steele composed off-hand with little attention to form. But he preceded Addison and thus became the father of the essay and sketch dealing with contemporary manners, which, under the hand of Fielding, was transformed into the novel. See ADDISON, JOSEPH.

Consult the excellent biographies of Steele by Aitkin (London, 1889) and by Dobson ("English Worthies," ib., 1886); Thackeray, *English Humourists* (ib., 1853); *The Spectator* (ib., 1898); *The Tatler* (ib., 1899); and *Plays* ("Mermaid" series, ib., 1893), all admirably edited by Aitken.

STEEL-ENGRAVING. See ENGRAVING.

STEELHEAD (from the color and hardness of the head), or HARDHEAD. The large sea-trout or salmon-trout of the Pacific Slope (*Salmo Giardneri*). It is found in coastwise streams from Santa Barbara County, Cal., northward nearly to Alaska. It reaches a length of 30 inches. See SALMON.

STEEL SHAPES. Structural steel produced by a rolling mill in certain fixed shapes such as angles, I bars, tees, bulbs, etc. See illustrations of typical shapes and description of process of manufacture under ROLLING MILL. See also BEAM.

STEEL'TON. A borough in Dauphin County, Pa., 3 miles southeast of Harrisburg; on the Pennsylvania and the Philadelphia and Reading railroads (Map: Pennsylvania, E 3). It has a public library. It is known for its steel interests, the extensive works of the Pennsylvania Steel Company being here. Other establishments are shirt and hose factories, brick-yards, and a flouring mill. The government is vested in a chief burgess, elected every three years, and a unicameral council. The water-works are owned by the municipality. Steelton was settled in 1865 and was incorporated in 1880. Population, in 1890, 9250; in 1900, 12,086.

STEEL WOOL. An abrading material used as a substitute for sand, glass, or emery paper for polishing wood or metal work. It is composed of sharp-edged threads of steel, which curl up like wool or excelsior.

STEELYARD. See BALANCE.

STEEN, stān, JAN (c.1626-79). A celebrated Dutch genre painter, foremost among the delineators of low life, which he illustrated with rare mastery. Born at Leyden, he is said to have been instructed first at Utrecht by Nicolas Knupfer (1603-60), then at The Hague by Jan van Goyen, whose daughter he married in 1649. He lived at Haarlem from 1661 to 1669, in constant pecuniary difficulties, varying his pursuit of art by renting a brewery at Delft and keeping a tavern at Leyden. With regard to his artistic training it seems likely that he received impressions from Frans and Dirk Hals. The influence of the latter is plainly traceable in Steen's early productions, notably in the "Wedding Party" (Ducal Palace, Dessau), the most characteristic specimen, but also in the humorous "Bridal Procession" (1653, Six Gallery, Amsterdam), in "After the Carousal" and "Revelry" (both in Amsterdam Museum), and in "Dissolute Company" (Berlin Museum). All these transplant us to the sphere in which so many scenes depicted by Steen are enacted, the atmosphere of low taverns, where the changes on the theme "Wine, Woman, and Song" are rung in all imaginable variations. Indubitably Jan Steen is the most genial among the masters of the genre in the entire Dutch school. His dated pictures belong, with a few exceptions, to the decade from 1660 to 1671, his Haarlem period, the most brilliant of his artistic activity. Its beginning is marked by the ingenious domestic scene known as "The Menagerie" (1660, Hague Gallery), and in strong contrast to it "Prince's Day" (Amsterdam Museum), with numerous figures. Other noteworthy examples at The Hague are: "The Painter's Family" (c.1663), "Oyster Party in Steen's Brewery," and "Doctor's Visit;" and in Amsterdam: "Eve of Saint Nicholas," a favorite and often repeated subject of the master, "Family Scene" (2). "The Parrot's Cage," "Cat's Dancing Lesson," "Rural Wedding," and "Lovesick," one of his most perfect works. The Brussels Museum contains "A Gallant Offer" and "The Rhetoricians;" the Louvre. "Evil Association," "Family Repast," and "A Village Festival" (1674), with many figures. Besides similar subjects in the galleries of Berlin, Munich, and Vienna, there are to be mentioned "The Feast of Beans" (1668, Cassel Gallery) and "The Marriage Contract" (Brunswick Museum), perhaps his most remarkable work for size, dramatic feeling, and equably carried out execution. A cabinet piece in the manner of Terborch is the "Music Lesson" (1671), in the National Gallery, London, and several fine interiors may be seen in Buckingham Palace, London, while over ninety of his works are in private collections in England. Consult: Van Westrheene, *Jan Steen, Etude sur l'art en Hollande* (The Hague, 1856); Lemcke, in Dohme, *Kunst und Künstler*, etc. (Lipzig, 1878); and Rosenberg, *Terborch und Jan Steen* (ib., 1897).

STEENKERKE, stān′kĕr-ke, or **STEENKERKEN.** A village in the Province of Hainault, Belgium, on the Senne, 19 miles southwest of Brussels. It is noted for the disastrous defeat of the Dutch and English troops under William of Orange, who here attacked the French army commanded by Marshal Luxembourg, August 3, 1692.

STEENSTRUP, stān′strup, JOHANNES JAPETUS SMITH (1813-97). A Danish zoölogist and archæologist, born at Vang. In 1845 he was elected adjunct professor of zoölogy of the University of Copenhagen. In this year appeared the work in which he established the fact of the alternation of generations in the hydroids, and more especally in trematode worms, entitled *On the Alternations of Generations, or the Propagation and Development of Animals Through Alternate Generations.* He was also an authority upon the kitchen-middens (q.v.) of Denmark.

STEENWIJCK, stān′vīk, **STEENWYCK,** or **STEINWICK,** HENDRICK VAN, the Elder (c.1550-c.1605). A Dutch architectural painter, born at Steenwijck. He painted many interiors of churches, and was the first to attempt the effect of artificial light on architectural forms. His works include: "Interior of Aix Cathedral" (1573, Schleissheim Gallery); "The Courtyard of a Palace" (1588, Dessau Gallery); and "The Liberation of St. Peter" (1604, Vienna Museum). His son, HEINDRIK, the Younger (c.1580-c.1650), was born in Frankfort and went early to Antwerp and Amsterdam, settling finally in London (1629). He, too, painted architectural subjects. Many of Van Dyck's backgrounds were executed by him, and Brueghel and Thulden put figures upon his own canvases. Examples of his work are: "A Church Interior" (1605, Vienna); "View of a Public Square" (1614, The Hague); and "Jesus with Mary and Martha" (1620, Louvre).

STEEPLECHASING. Flat racing over a course selected by reason of the obstacles, such as fences, hedges, hurdles, and ditches. It is popularly supposed to have originated in the hilarious spirit of excited fox-hunters, taking a bee line from the point where they were to a distant village church steeple. The Grand National Steeplechase of Liverpool, established in 1839, is the great event of the steeplechase year. In the United States the Meadowbrook Club has been the pioneer organization for steeplechasing.

STEER′FORTH. In Dickens's *David Copperfield,* a friend of the hero, and the seducer of Little Em'ly. He is drowned in a shipwreck, with Ham Peggotty, who attempts to rescue him.

STEERING. That branch of practical navigation which involves the actual control of the direction of a moving vessel. Steering usually involves the manipulation of the helm, or rudder, tiller, and necessary adjuncts, as described under HELM. In addition the effect of sails, paddle-wheels, screws, etc., must be considered, and sea, currents, winds, and other conditions taken into account, these varying from time to time and different types of vessels requiring different methods. A double-screw steamer, for example, will steer differently from one with a single screw, having a greater power of manœuvring. The steering of a vessel depends upon the course followed. (See SAILINGS AND NAVIGATION), and also upon the rules of the road (q.v.). An interesting practical discussion of the subject will be found in Knight, *Modern Seamanship* (3d ed., New York, 1903).

STEE′VENS, GEORGE (1736-1800). An English Shakespeare commentator, born at Poplar. He was educated at Eton and at King's College, Cambridge, but left the university without a degree (1756). Inheriting a small fortune from his father, a director of the East India Company, he was able to give his time to the study of Shakespeare. He reprinted 20 plays from the quartos (4 vols., 1766), collaborated with Dr. Johnson on an edition of Shakespeare (1773), which was revised by Isaac Reed (1785), and, in conjunction with Reed, brought out a new edition (15 vols., 1793). Steevens mutilated the text, but his notes are still valuable.

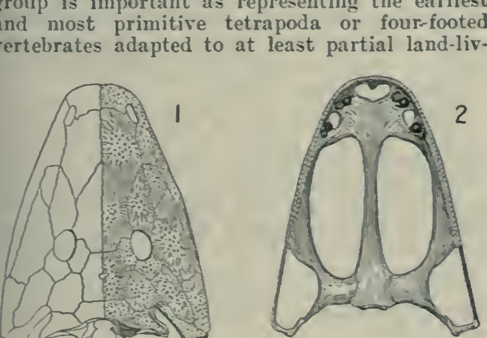
STEEVENS, GEORGE WARRINGTON (1869-1900). An English journalist, born at Sydenham. He was educated at the City of London School and at Balliol College, Oxford. In 1893 he left Oxford for London, where he joined the editorial staff of the *Pall Mall Gazette.* In 1897 he became a special correspondent of the *Daily Mail,* for which he visited in succession the United States, Greece, Egypt, India, Rennes (the scene of the trial of Dreyfus), and South Africa. His letters to the *Daily Mail* were republished under the titles: *The Land of the Dollar* (1897), *With the Conquering Turk* (1897), *Egypt in 1898* (1898), *With Kitchener to Khartum* (1898), *In India* (1899), *The Tragedy of Dreyfus* (1899), and *From Cape Town to Ladysmith* (1900). The last volume, left incomplete, was edited by Vernon Blackburn. All this journalistic work has a distinct literary value from the author's remarkable perceptive and descriptive powers. Before his connection with the *Daily Mail* he had published *Naval Policy* (1896) and the clever *Monologues of the Dead* (1896). He died of enteric fever at Ladysmith, then besieged by the Boers.

STEFFANI, stâ-fä′nê, AGOSTINO, Abbate (1655-1730). An Italian composer and statesman, born at Castelfranco, Venetia. He studied music in Venice and under Ercole Bernabei (c. 1620-87) in Munich, where he became organist in 1675 and director of the Elector's chamber music in 1681. He took holy orders in 1680, was appointed Court kapellmeister at Hanover in 1688, and brought out his Italian operas with great splendor in the garden of Schloss Herrenhausen. They were also produced in German at Hamburg in 1690-1700. He is, however, chiefly remembered for his numerous chamber duets, set to Italian texts, which rank as models of their kind. His compositions are preserved in manuscript in the royal library, London; of the few that appeared in print, may be mentioned: *Psalmodia Vespertina,* for eight voices (1674); *Sonate da camera a due violini, alto e continuo* (1679); *Duetti da camera a soprano e contralto* (1683); and *Janus Quadrifons,* motets with basso continuo for three voices. In 1710 he resigned his post in favor of Handel, and, being made Privy Councilor by the Elector Palatine and bishop in partibus of Spizza, Dalmatia, by the Pope, devoted himself principally to diplomatic and ecclesiastical affairs and died at Frankfort.

STEFFECK, stā′fĕk, KARL (1818-90). A German animal and portrait painter, born in Berlin, where he studied under Krüger and Begas. In 1839 a pupil of Delaroche and of Horace Vernet in Paris, he continued his studies in Italy in 1840-42, and after his return to Berlin attracted attention first with historical, then with sporting subjects, and soon was reputed the foremost painter of horses. In 1880 he became director of the Academy at Königsberg. His principal paintings include: "Margrave Albrecht Achilles Fighting the Nurembergers, 1450" (1848); "Two Spaniels at Play" (1850), "Mare with Colt" (1877), all in the National Gallery, Berlin; "King William at Königgrätz" (1867), Royal Palace, Berlin; "Capitulation at Sedan" (fresco, 1884), Arsenal, Berlin; "Queen Louise with Two Sons" (1886), Breslau Museum; besides many portraits, especially equestrian.

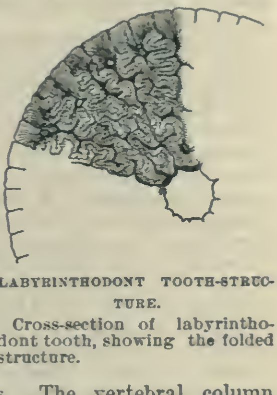
STEGANOPODES (Neo-Lat. nom. pl., from Gk. στεγανόπους, *steganopous*, web-footed, from στεγανός, *steganos*, covered + πούς, *pous*, foot). A group of birds within the Ciconiiformes, characterized by having all four toes 'totipalmate,' or connected by a common web, also a more or less developed gular pouch. The skull is desmognathous and the wing is aquinto-cubital. The neck is without apteria; the tongue is rudimentary. The Steganopodes are cosmopolitan, aquatic piscivorous birds of large size. About 60 species are known, of which half are cormorants (q.v.). These constitute one of the six families, the other five being the pelicans, darters, tropic-birds, gannets, and frigate-birds (qq.v.).

STEG′OCEPHA′LIA (Neo-Lat. nom. pl., from Gk. στέγειν, *stegein*, to cover + κεφαλή, *kephalē*, head). The name proposed by Cope to designate a well-defined order of fossil amphibia, found in strata from the Lower Carboniferous to the Upper Trias. They are distinguished from other amphibians by a dermal armor of overlapping bony scales which usually protects the ventral, and in some cases the dorsal surface. The group is important as representing the earliest and most primitive tetrapoda or four-footed vertebrates adapted to at least partial land-living habits, and breathing by means of lungs. The majority of stegocephalians are salamander-like or lizard-like in form, with a long tail, flattened head, and two pairs of limbs. The presence of gills in the young and grooves for sensory mucous canals on the skull-bones of some forms proves an aquatic habit. A carnivorous diet is indicated by the conical pointed teeth.



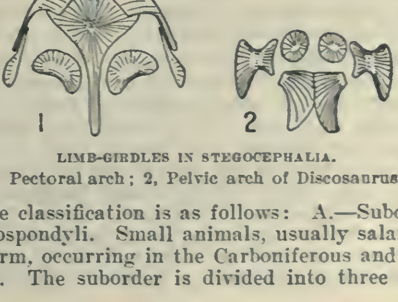
SKULL OF A STEGOCEPHALIAN.
1, Plates of roof of skull (*Capitosaurus*); 2, Palatal view (*Cyclotosaurus*).

The dermal armor, the most distinctive feature of the group, consists chiefly of bony scales, arranged in regular rows on the ventral surface, but scattered or wanting on other portions of the body. Three large plates, one median and two paired, on the pectoral region, represent the interclavicle and the clavicles. The skull, of flattened triangular form, is characterized by a solid roof of paired plates of dermal bone, and the cranial roof is always pierced by five openings—the paired nares and orbits, and the median opening for the pineal body, which may have served as a light-perceiving organ. The teeth are simple hollow cones in the smaller Paleozoic genera, but in many of the later types the dentine and cement exhibit a system of extremely complicated folds—hence the name Labyrinthodontia often applied to these forms. The vertebral column presents widely divergent conditions in different types, as regards the nature and degree of ossification of the centra. As a rule the Paleozoic genera have the notochord largely persistent, the vertebral column thus remaining permanently in the larval condition, while the large Triassic labyrinthodonts have well-developed centra. The limbs are known for but few forms, and in these they do not differ remarkably from those of modern urodeles. The hind foot is always pentadactyl, but in the forefoot (except in Keraterpeton, Melanerpeton, and a few related forms) the number is reduced to four, the fifth or outer digit probably being the one lacking. In any attempt to trace the phylogenetic relationships of vertebrate classes the Stegocephalia are of the greatest importance, since it is in this group only, with its solid skull-roof, that we find on the one hand a close approximation to the Paleozoic bony fishes, and on the other to the most generalized Permian reptiles, the Cotylosauria. See REPTILE.



LABYRINTHODONT TOOTH-STRUCTURE.
Cross-section of labyrinthodont tooth, showing the folded structure.

STEGOCEPHALIAN TEETH.



LIMB-GIRDLES IN STEGOCEPHALIA.
1, Pectoral arch; 2, Pelvic arch of Discosaurus.

The classification is as follows: A.—Suborder Leptospondyli. Small animals, usually salamandriform, occurring in the Carboniferous and Permian. The suborder is divided into three families: (1) Branchiosauridæ; (2) Microsauridæ; (3) Aistopodidæ, the serpent-like footless forms. Dolichosoma, which attained a length of three feet, and Ophiderpeton are the best known forms.

B.—Suborder Ganocephala or Temnospondyli. The most familiar type is *Archegosaurus Decheni* from the Lower Permian of Germany, a species which attained a length of four feet. Cricotus and Eryops, from the North American Permian, measure ten feet, and are the largest American amphibia.

C.—Suborder Labyrinthodontia or Stereospondyli. The true labyrinthodonts are clearly differentiated by the form of the teeth, which have the dentine infolded in a more or less complicated manner, and by the vertebræ, which are completely ossified, with biconcave centra sometimes perforated for the passage of the constricted notochord. A few genera occur in the Carboniferous and Permian, but the maximum development of the group is attained in the Trias, chiefly of Europe. The genera Labyrinthodon, Capitosaurus, Trematosaurus, and Mastodonsaurus, from the European Trias, are all enormous animals, the last-named, with a skull four feet in length, being the largest amphibian known. Consult: Woodward, *Vertebrate Palæontology* (London, 1898); Zittel, *Text-book of Palæontology* (ib., 1902).

STEG′OSAU′RUS (Neo-Lat., from Gk. *στέγειν*, *stegein*, to cover + *σαῦρος*, *sauros*, lizard). A Jurassic dinosaur of most peculiar appearance. Fossil skeletons are found in Wyoming and Colorado. It was from 25 to 30 feet long, had a very small head, highly arched back, short fore and long hind legs, and heavy long tail. The great bulk of the hinder part of the body depended for its nervous control upon a ganglion in the neural cavity of the sacrum, and this ganglion was of a size several times greater than the brain in the head, which latter is by comparison very small. See DINOSAURIA.

STEIER, stī′ẽr. A town of Upper Austria. See STEYR.

STEIN, stīn, CHARLOTTE VON (1742-1827). A friend of Goethe. She was platonically intimate with him from 1775 to the time of his Italian journey (1786), by which he won emancipation. To her he addressed the *Briefe aus der Schweiz* (1779), which are among the classics of travel. and a multitude of letters, first published in 1848, and best edited in the Weimar edition of his *Works* (1886). Her letters to Goethe were long supposed destroyed, but they have recently been recovered in part. After Goethe's union with Christiane Vulpius there was an estrangement between him and Frau von Stein, gradually overcome later on. Consult: Höfer, *Goethe und Charlotte von Stein* (Stuttgart, 1878); Düntzer, *Charlotte von Stein* (ib., 1874).

STEIN, HEINRICH FRIEDRICH KARL, Baron VOM (1757-1831). A Prussian statesman. He belonged to an old Franconian family, and was born at Nassau. He studied at Göttingen, entered the Prussian civil service, and in 1784 was at the head of the Department of Mines for Westphalia. In 1786 he visited England and made a study of its institutions, and his experiences bore fruit at a later period in his guidance of Prussian affairs. In October, 1804, he entered the Prussian Ministry as chief of indirect imposts, taxes, manufactures, and commerce. He introduced useful reforms in his department, particularly by abolishing various restrictions on the internal trade of the nation; but he was hampered in his endeavors by the spirit of Prussian conservatism. In 1807 he was dismissed from office by the King, but the Peace of Tilsit opened the eyes of the sovereign to the wisdom of Stein's policy, and he was recalled, with the approbation of Napoleon, who had as yet no idea of the deep and earnest patriotism of the Minister. Seeing clearly that, from a military point of view, Prussia was powerless for the moment, he set about developing her internal resources by initiating a series of administrative and political reforms, the principal of which were the abolition of serfdom, with indemnification to the territorial lords; the subjection of the nobles to manorial imposts; promotion in the State service by merit alone, without distinction of caste; and the establishment of a modern municipal system. While he was paving the way for German unity, the Prussian army was being reorganized by Scharnhorst and Gneisenau (qq.v.) As the result of a letter criticising Napoleon's policy, which was brought to the knowledge of the French Emperor, Stein was obliged to resign (November 24, 1808), and retired to Austria. In danger of being surrendered by Austria to Napoleon, Stein was summoned in 1812 to Russia by the Emperor Alexander, and contributed by his counsels to the formation of the coalition of the German States against Napoleon. After the battle of Leipzig, in 1813, Stein became head of the council for the administration of the reconquered German countries, as well as of the territory which France had annexed west of the Rhine. He was a leader in all the military diplomacy of that stirring time up to the Congresses of Vienna and Aix-la-Chapelle. After his retirement from political life he devoted himself to the promotion of German science and art and formed the society for the study of early German history whose publications are celebrated as the *Monumenta Germaniæ Historica*. He died at Kappenberg (Westphalia) June 29, 1831. Consult: Seeley, *Life and Times of Stein* (London, 1879); Pertz, *Leben des Freiherrn vom Stein* (1885).

STEIN, LORENZ VON (1815-90). A distinguished German political scientist, born at Eckernförde, in Schleswig. He studied law and philosophy at Kiel and Jena; became a professor in Kiel in 1846; and from 1855 till 1885 was professor of political science at Vienna. He published: *Französische Staats- und Rechtsgeschichte* (1846-48); *System der Staatswissenschaft* (1852-56); *Lehrbuch der Volkswirtschaft* (1858, 1878, 1887); *Lehrbuch der Finanzwissenschaft* (1885-86).

STEIN, MARK AUREL (1862—). An English Orientalist, archæologist, and educator. He was born at Budapest, Hungary. He studied at Vienna and Tübingen, and in England at Oxford and London. In 1888 he was appointed registrar of the Punjab University and principal of the Oriental College at Lahore, and in 1899 principal of the Calcutta Madrasah. He was deputed by the Indian Government to conduct archæological and topographical explorations in Chinese Turkestan. The first results of his discoveries on this journey are published in his *Preliminary Report* (London, 1901). On his return from

Turkestan he became inspector of schools in the Punjab. Among the more important of his publications are a critical edition of Kalhana's *Rājataranginī, or Sanskrit Chronicle of the Kings of Kashmīr* (1892), together with an English translation and commentary on the same (2 vols. 1901); *A Classified Catalogue of Sanskrit MSS. in the Raghunath Temple Library, Jammu* (1894); and *The Sand-buried Cities of Khotan* (1903).

STEINAMANGER, stīn'ȧm-ăng'ẽr (Hung. *Szombathely*). The capital of the County of Eisenburg (Vas), Hungary, 68 miles south of Pressburg (Map: Hungary, E 3). It has a beautiful modern cathedral, a fine county building, and a theological seminary. Important State railway workshops are located here, and two factories for agricultural machinery. Steinamanger is on the site of the Roman *Sabaria*, and has ruins of a triumphal arch, amphitheatre, and aqueduct in the vicinity, with many remains in the local museum. Population, in 1900, 24,751.

STEINBOK (Ger., stone-goat), or **STEINBUCK.** (1) The European ibex (q.v.). (2) In South Africa, by transference, the Dutch name (also 'steenbok') for the small antelopes of the genus Nanotragus, specifically the widespread *Nanotragus campestris*, which abounds in open or thinly wooded and hilly places from the Cape to the Zambezi River. It is of an indeterminate reddish hue, about 24 inches tall, long-necked, with short, erect, forward-curving ringed horns, and exceedingly swift and active, and skillful in hiding. Other species of the genus are the oribi, grysbok, and royal antelope (qq.v.), with still others in Zanzibar and Abyssinia. Consult *Proceedings of the Zoölogical Society of London* for 1900.

STEINER, stī'nẽr, JAKOB (1796-1863). A Swiss mathematician, born at Utzenstorf, near Solothurn. He studied at Heidelberg, gave private instruction in Berlin, and in 1834 was made assistant professor in the university and member of the Academy of Sciences. Steiner's chief work is the *Systematische Entwicklung der Abhängigkeit geometrischer Gestalten* (1832; in the Ostwald Classics, 1896). He also wrote: *Die geometrischen Konstruktionen ausgeführt mittels der geraden Linie und eines festen Kreises* (1833; in the Ostwald Classics, 1895). His *Vorlesungen über synthetische Geometrie* (3d ed. 1887) and his *Gesammelte Werke* (1881-82) appeared posthumously. Consult Graf, *Der Mathematiker Jakob Steiner von Utzenstorf* (Bern, 1897).

STEINHEIL, stīn'hīl, KARL AUGUST (1801-70). A German physicist and astronomer, born in Rappoltsweiler, Alsace. He studied law at the University of Erlangen, and astronomy at Göttingen and Königsberg. He became professor of physics and mathematics in the University of Munich; later entered the Austrian Government service, organized and perfected the telegraph system in that country, and brought about the Austrian-German Telegraph Association; performed a similar service for Switzerland; and in 1852 returned to Munich. In 1854 he founded an establishment for making superior optical and astronomical instruments, where the great telescopes of the observatories of Upsala, Mannheim, Leipzig, Utrecht, etc., were made, and where he began the making of the photograph objectives since known by his name.

Steinheil devised an electric-magnetic telegraph, in 1836 constructed the first printing telegraph, and in 1838 discovered the possibility of leading back the current through the ground. He invented the electrical clock, constructed an excellent pyroscope, and made the first daguerreotype picture in Germany. He also completed the laws of electrotype, and constructed several optical instruments. Consult Marggraff, *Karl August Steinheil und sein Wirken* (Munich, 1888).

STEINITZ, stī'nits, WILHELM (1836-1900). A German chess master, born in Prague, Bohemia, and educated at the Vienna Institute of Technology. In 1866 he defeated Anderssen in a contest for the world's championship. At the London tournament of 1872 he won every game, and in 1873, at Vienna, he secured the Kaiserpries of 2000 florins. After defeating Blackburne in England, he withdrew from active tournament play, but the increasing success of Zukertort, whom he had defeated in 1872, forced him back into the field. At a tournament in London (1883) Zukertort defeated him for first place, but at a second match in 1886 Steinitz won from his great rival with 10 to 5 games won and 5 drawn. He defended his title in 1889 at Havana against Tchigorin, but lost the championship in 1894 to Lasker, who again defeated him in 1897. Steinitz was the first to see the value of a steady development of position with an accumulation of minute advantages over the more dashing and open game. After 1883 he lived in the United States, and from 1885 to 1891 he was the editor of the *International Chess Magazine*. His published works were *Book of the Sixth Chess Congress of 1889* and *The Modern Chess Instructor* (1889).

STEINLE, stīn'le, EDUARD VON (1810-86). A German historical painter, born in Vienna, the son of an engraver. First instructed at the Academy, he then became a pupil of Kupelwieser, and from 1828 to 1834 worked in Rome under the influence of Veit and Overbeck. In 1843 he settled at Frankfort, where he had been commissioned to paint "The Judgment of Solomon" (1844), and the portraits of Albrecht I. and Ferdinand III. for the Kaisersaal in the Römer, and in 1850 was appointed professor at the Städel Institute. There Frederick Leighton was among his pupils. Steinle's creative sphere embraces with equal command subjects of profoundly religious aspect and scenes of the merriest playful humor. His works are distinguished by finished grace and beauty of form, masterly technique in drawing, and inexhaustible power of invention. After executing, at Cologne, the "Angel Choirs" (1844), in the cathedral, and the frescoes illustrative of "The Artistic and Cultural Development of the City" (1860-63), in the staircase of the museum, he painted in seven scenes the "Immaculate Conception" (1865-66), in Saint Mary's at Aix-la-Chapelle, designed mural decorations for Saint Ægidius at Münster, and frescoed the apsis of Strassburg Cathedral (1877-80). In Frankfort he designed and in part executed the entire decoration of the cathedral, also the cartoons for some of the stained-glass windows, besides many others for churches in Cologne, Treves, Fürth, and Vienna. His oil paintings, of rare coloristic charm, include "The Visit of Mary to Elizabeth" (1848) and "Saint Luke Painting the Virgin," both in the Karlsruhe Gallery; "Sibylla Tiburtina" (1848, Städel Institute, Frankfort); "Madonna," altar-piece (Saint Boniface, Wiesbaden); "The Warder" (1858); "Loreley," "Adam and Eve," and "Tartini Playing on a Tower at Padua" (all in the Schack Gallery, Munich); and "Madonna in a Garden" (1884, National Gallery, Berlin). He also composed many cycles in water colors and sepia, such as the "Legend of Saint Euphrosine," Brentano's "Rheinmärchen," several from Shakespeare's plays, and "Parsifal" (Pinakothek, Munich). Consult: Wurzbach, *Ein Madonnenmaler unserer Zeit* (Vienna, 1879); Valentin, *Eduard von Steinle* (Leipzig, 1887); and Reichensperger, *Erinnerungen* (Frankfort, 1887).

STEINLEN, stăɴ′lăɴ′, Théophile Alexandre (1859—). A French draughtsman and illustrator, born in Lausanne, Switzerland. He first became known by his drawings in the newspapers, especially those done in color for the *Gil Blas Illustrée.* Afterwards he became a successful poster designer. He was also successful in portraying Paris street life, particularly about Montmartre. Some of the best of his later work is included in Pelletan's *L'Almanach du Bibliophile.* His publications include the album *Les Chats.*

STEINMETZ, stīn′mĕts, Karl Friedrich von (1796-1877). A Prussian field-marshal, born at Eisenach. He fought in the wars against Napoleon, and against Denmark in 1848; became lieutenant-general in 1858, and in the campaign against Austria of 1866 won great distinction as commander-in-chief of the Fifth Army Corps, by his victories at Nachod, Skalitz, and Schweinschädel. At the beginning of the Franco-German War he was made commander-in-chief of the First Army. Owing to his surpassing self-confidence, he engaged in disputes with other commanders and the general staff. After his rashness had almost caused a disaster at Gravelotte (q.v.), he was deprived of his command. In September, 1870, Steinmetz was appointed Governor-General of Posen and Silesia, and in April, 1871, he was made general field-marshal.

STEINSCHNEIDER, stīn′shnī′dĕr, Moritz (1816—). A distinguished bibliographer and Orientalist, born at Prossnitz, Moravia. He studied at Prague, Vienna, Leipzig, and Berlin, and taught in Prague and Berlin. The most important of his publications are his catalogues, and among them the chief are *Catalogus Librorum Hebræorum in Bibliotheca Bodleiana* (1852-60), *Katalog der hebräischen Handschriften zu Leyden* (1857), and lists of the Semitic manuscripts in the Royal Library of Munich (1875; 2d ed. 1895), in the Hamburg Library (1878), and in the Berlin Royal Library (1878). He wrote *Hebräische Uebersetzungen des Mittelalters* (crowned by the French Academy, 1893); an article on Jewish literature in Ersch and Gruber's *Encyklopädie*, translated by Spottiswoode as *Jewish Literature from the Eighth to the Eighteenth Centuries* (1857); *Uebersetzungen aus dem Griechischen* (1891-96); and *Die arabische Litteratur der Juden* (1902). Consult the *Festschrift zum 80. Geburtstage M. Steinschneiders* (Leipzig, 1896), with a full bibliography by George Kohut.

STEINTHAL, stīn′täl, Heymann (1823-99). A German philologist, born at Gröbzig, in Anhalt, and educated at Berlin, where he became privatdocent in 1850 and extraordinary professor in 1863, lecturing on language and mythology. After 1872 he also lectured on criticism of the Old Testament, ethics, and the history of religion at the school for the science of Judaism. With Lazarus he edited from 1860 to 1890 the *Zeitschrift für Völker-psychologie und Sprachwissenschaft*, and his works include: *Der Ursprung der Sprache* (1851; 4th ed. 1888); *Die Entwickelung der Schrift* (1852); *Geschichte der Sprachwissenschaft bei den Griechen und Römern* (1863; 2d ed. 1889-91); *Die mande-Negersprachen, psychologisch und phonetisch betrachtet* (1867); *Abriss der Sprachwissenschaft* (1871 et seq.); *Allegemeine Ethik* (1885); *Zur Bibel und Religeons-philosophie* (1890-95). Consult Achelis, *Heymann Steinthal* (Hamburg, 1898).

STEINWAY, stīn′wā, Heinrich Engelhard (1797-1871). A German-American piano manufacturer, originally named Steinweg, born at Wolfshagen, Harz Mountains. He began to manufacture guitars and zithers in Brunswick, and finally undertook the making of pianofortes. In 1850 he went to New York City with his four sons—Charles, Henry, William, and Albert—leaving the German business to his oldest son, Theodor. In 1853 they established the firm of Steinway & Sons.

STEJNEGER, stī′ne-gĕr, Leonhard (1851—). An American naturalist. He was born in Bergen, Norway, and graduated at the University of Christiania in 1871. Ten years later he came to the United States, and became connected with the United States National Museum, of which he became curator of reptiles and batrachians in 1889. He prepared the greater part of the fourth volume of the *Standard Natural History, Birds* (1885); the *Poisonous Snakes of North America* (1893); *Report of the Rookeries of the Commander Islands* (1897); *The Asiatic Fur Seal Islands and Fur Seal Industry* (1898); and *The Herpetology of Porto Rico* (1903).

STEL′LA. See Swift, Jonathan.

STEL′LA. (1) The name applied by Sir Philip Sidney, in his splendid collection of sonnets, entitled *Astrophel and Stella*, to Penelope Devereux, Lady Rich. (2) The name given by Swift to Esther Johnson, who is generally known as Stella.

STELLENBOSCH, stĕl′len-bŏs. A town of Cape Colony, 25 miles east of Cape Town, with which it has railway connection (Map: Cape Colony, E 9). After Cape Town it is the oldest settlement of the colony, having been founded by Huguenot refugees near the close of the seventeenth century. Population, about 6000.

STELVIO (stĕl′vē-ō) **PASS** (Ger. *Stilfser Joch*). A lofty Alpine pass leading across the Ortler group of Tyrolese Alps on the boundary between Tyrol and Italy, 68 miles southwest of Innsbruck (Map: Austria, B 3). The carriage road passing through it is the highest in Europe, being 9055 feet above the sea. It forms part of the great road between Milan and Innsbruck, and was completed by the Austrian Government in 1820-24, at an expense of 3,000,000 florins.

STEM (AS. *stemn*, OHG. *stam*, Ger. *Stamm*, stem; connected with OIr. *tamon*, stem, and ultimately with Eng. *stand*). In general, stems of plants are axes distinguished from roots by bearing leaves or leaf-like organs. Although there are stem-like structures among the thallophytes and bryophytes, it is only among vascular plants (pteridophytes and spermatophytes) that real stems appear.

Stems may be variously classified. By duration, they are annual or perennial; by structure, herbaceous or woody; by direction, erect, decumbent, prostrate, climbing, etc. Perhaps one of the most important classifications is upon the basis of character of foliage organs produced, as follows: *Foliage-bearing stems*, which generally give style to the whole plant body, are the most conspicuous, since they display green leaves, and are necessarily aerial. As a consequence, they are inclined to branch, and the leaf-bearing joints are well separated. *Scale-bearing stems*, which bear the comparatively small and colorless (not green) leaf-like bodies (scales), may be subterranean or aerial, and the joints may be so near together that the scales overlap, as in the aerial scale bud of shrubs and trees, or the subterranean bud-like structures called bulbs, whose scales and stem become gorged with reserve food. Other prominent subterranean types are tubers (potato), comparatively short, thick stems, with much reduced and not overlapping scales, and the more slender rootstocks and rhizomes (Fig. 1). *Stems bearing flower parts* are very much modified, and constitute the so-called flowers of angiosperms (q.v.). The most essential classification of stems is on the basis of their anatomical structure (see below). The bracing (q.v.) of stems, especially those bearing foliage and flowers, is a conspicuous feature. (For structural details of stems, see ANATOMY OF PLANTS; HISTOLOGY.) Certain broad outlines must be presented here as a basis of the most fundamental classification. At the tip of the stem there is a single apical cell (some pteridophytes) or a group of apical cells, which by their power of continuous division increase the stem in length and give rise to all the tissues. Just behind this growing tip the three great regions begin to be defined (Fig. 2). On the outside is a layer of cells (dermatogen) that gives rise to the epidermis. In perennial stems that increase in diameter the epidermis as sloughed off on the older parts, and the region beneath develops a cork tissue of greater or less thickness, which constitutes the bulk of the bark (q.v.). Within the dermatogen is a zone consisting of several layers of cells (periblem) that gives rise to the cortex. Within the periblem is a central solid cylinder of cells (plerome) that gives rise to the stele, characterized by developing the vascular or woody bundles. The arrangement and character of the woody bundles developed in

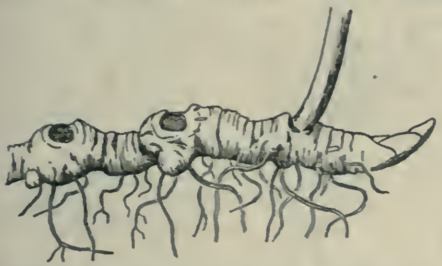


FIG. 1. UNDERGROUND STEM OF SOLOMON'S-SEAL.

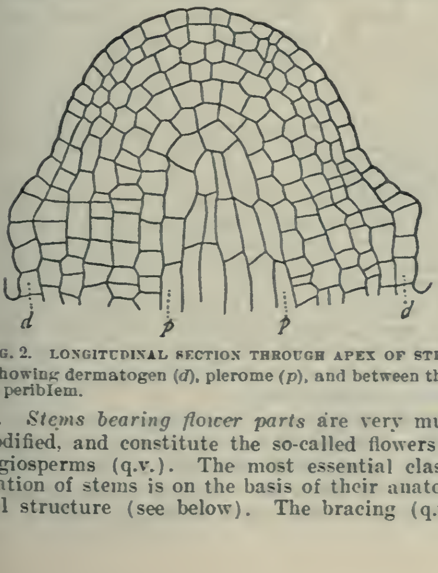


FIG. 2. LONGITUDINAL SECTION THROUGH APEX OF STEM.
Showing dermatogen (*d*), plerome (*p*), and between them the periblem.

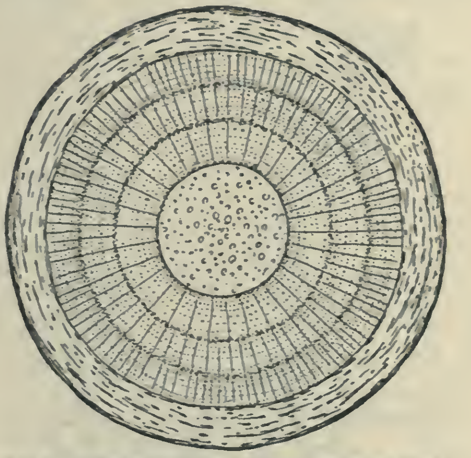


FIG. 3. CROSS-SECTION OF A DICOTYLEDONOUS STEM.
Showing pith, three growth rings, and cortex.

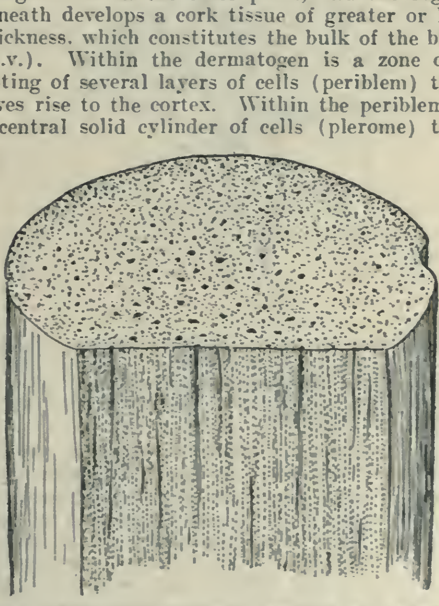
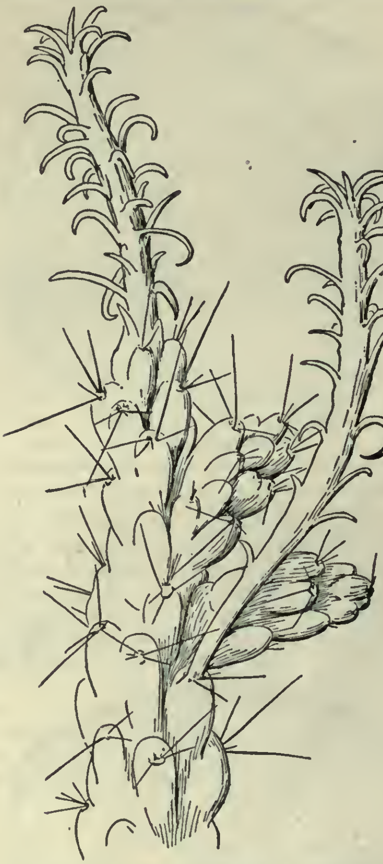


FIG. 4. CROSS AND LONGITUDINAL SECTION OF CORN STEM.
Showing the monocotyledonous structure.

the stele determines the three general and most fundamental types of vascular stems. In the dicotyledon and conifer types (Fig. 3) the woody bundles are arranged in a hollow cylinder surrounding a central pith. Around the woody tissue of perennial stems there is developed a layer of actively dividing cells, the cambium, that adds a new outer zone of woody bundles each growing season, in cross-section giving the appearance of concentric annual rings. This power of increasing in diameter is one of the prominent features of these stems. In the monocotyledon type (Fig. 4) the woody bundles are scattered irregularly through the stele, as in the cornstalk and palm, so that there is no defined central pith region. Such stems show no annual increase in diameter. In the pteridophyte type usually a single large woody bundle of peculiar structure appears in the stele, in such a way that there can be no annual increase in diameter.



FIF.5. BRANCH OF CACTUS (*Opuntia arborescens*), GROWN IN THE DARK.

The stem form above differs from the normal stem below in general shape, in the loss of protuberances and spines, and in the gain of leaves.

The primary function of the stem is to develop foliage leaves and display them to the air and sunlight, and also to act as a great conducting region between the root system and the leaves. (See CONDUCTION.) Subsidiary functions are vegetative propagation (as in horizontal ground stems); the storage of foods (as in bulbs and tubers); and the manufacture of foods, as in leafless stems, such as Equisetum and the cacti. Among the external factors which influence stem development, light and moisture are perhaps most important. In general, light is thought to retard stem development, as seen when stems grown in full light are compared with those grown in weak light and in the case of tubers. In some cases, however, as in the cacti, light has been found to favor stem development. Experiments seem to show that much of the so-called influence of light is due to a moisture influence (Fig. 6).

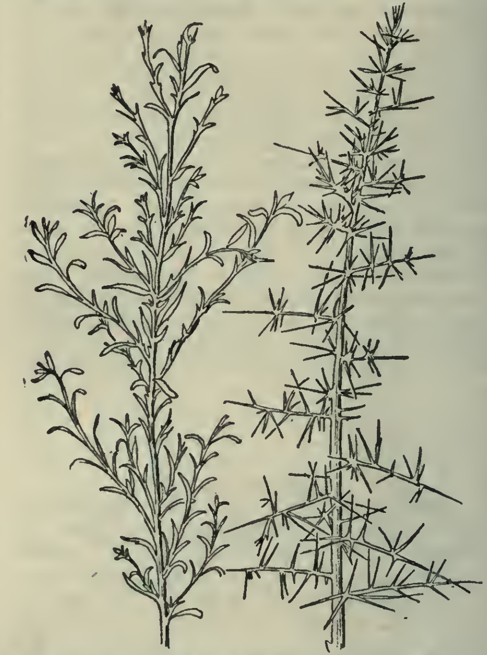


FIG. 6. BRANCHES OF GORSE (*Ulex Europæus*).

Showing the influence of moisture; the spiny branch at the right grew in dry air, the other branch in moist air.

STEM-GIRDLER. A horn-tail fly (*Phylloecus flaviventris*) which with its ovipositor girdles the twigs of currant bushes and deposits an egg below the cut. The resulting larva bores downward into the pith, which it devours, with the adjacent woody portion of the stem. In the autumn it spins its cocoon in the burrow, transforms to a pupa in the following spring, and shortly after emerges. An allied species (*Phylloecus integer*) works similarly in willows. See WILLOW INSECTS.

STENDAL, stĕn′däl. A town in the Province of Saxony, Prussia, on the Uchte, 36 miles north-northeast of Magdeburg (Map: Prussia, D 2). It has a fifteenth-century late-Gothic cathedral restored in 1893. There are railway repair shops, and factories for iron furniture, cloth, gilt cornices, agricultural implements, and sugar. Stendal, founded in the twelfth century, was the capital of the Altmark of Brandenburg. Population, in 1900, 22,081.

STENDHAL, stäN′dȧl′. The name assumed by MARIE HENRI BEYLE (1783-1842). A French novelist remarkable for the keenness of his analysis of character. Though never popular, Stendhal has been much read and admired by

Flaubert and the naturalistic school, and by the later psychologic novelist Bourget. Stendhal was born at Grenoble. At seventeen he entered the service of Bonaparte, for whom he conceived great admiration. After Napoleon's downfall he resided in Italy. In 1821 he was expelled by the Austrians and returned to Paris. In 1831 he became French Consul-General at Civitavecchia. In the age of Châteaubriand Stendhal sympathized with Voltaire, in the day of the Romantic carnival he was practicing the restless dissection of character that marks the work of Taine and Bourget. Hardly one of his books could have paid the expense of printing, and of his now admired essay on love (*De l'amour*) it is said that seventeen copies were sold in eleven years. Nisard, the great literary historian of his time, does not name him. To-day he takes his place among the 'great French writers.' His works are collected in twenty-four volumes, of which five are posthumous. They begin with a book of Italian travel and an essay *De la peinture en Italie* (1817); *De l'amour* follows in 1822, with a striking essay on *Racine et Shakespeare*, participating much in the contention of the Romanticists. His first novel, *Armance* (1827), was followed by *Le rouge et le noir* (1831) and *La chartreuse de Parme* (1839). In all these he analyzes the various forms of restlessness into which the fall of Napoleon had thrown a generation trained to expect a life filled with violent emotion. All the novels are realistic studies of social types, but of types of energy and passion. The greatest of his creations is Julien Sorel, the criminal hero of *Le rouge et le noir*, whose career, founded on fact, is a veritable breviary of hypocrisy, though the Fabrice of *La chartreuse de Parme* is hardly inferior. But, though skillful in the dissection of motive, Stendhal's novels are careless in style, slovenly in construction, much inferior in this to his posthumously published *Vie de Napoléon* (1876). Consult: Sainte-Beuve, *Causeries du lundi*, vol. ix. (Paris, 1857-62); Zola, *Les romanciers naturalistes* (ib., 1881); Bourget, *Essais de psychologie contemporaine* (ib., 1883); Rod, *Stendhal*, in "Les grands écrivains français" (ib., 1892); Farges, *Stendhal diplomate* (ib., 1892); Brun, *Stendhal* (ib., 1900).

STEN'NIS, The Standing Stones of. A name applied to two circles of stone pillars on two headlands in the Loch of Stennis, Scotland.

STE'NO, Nicholas, or, in Danish form, Niels Stensen (1639-86). A distinguished anatomist and Roman Catholic bishop. He was born and educated as a Protestant at Copenhagen. In 1660-63 he lived at Amsterdam and Leyden and won renown for his discoveries in anatomy. In 1666 he became head of a hospital in Florence and body physician to the Grand Duke of Tuscany. In 1667 he accepted the Roman Catholic faith. From 1672 to 1674 he was professor of anatomy at the University of Copenhagen. In 1675 he became a priest and gave up his scientific studies. In 1677 he was made a titular bishop and thenceforth he labored zealously among the northern missions as vicar apostolic. He wrote several religious works, including *Prüfung der Reformatoren* (1678). Consult his *Life* by Plenkers (Freiburg, 1884).

STENOGRAPHY. See Shorthand.

STEN'SEN, Niels. See Steno, Nicholas.

STENTOR (Lat., from Gk. Στέντωρ). In Homer's *Iliad*, a Grecian herald in the Trojan War. His voice was as loud as that of fifty men together. His name is preserved in the adjective stentorian.

STENZLER, stĕnts'lĕr, Adolf Friedrich (1807-87). A German Sanskrit scholar, born at Wolgast. He studied at Greifswald, Berlin, and Bonn, and in Paris and London. In 1833 he became professor of Oriental languages at Breslau. He edited, with Latin versions, the *Raghuvainça* (1832) and the *Kumâra Sambhava* (1838) of Kalidasa; with German translations, Yâknavalkya's *Book of Laws* (1849), and *Indische Hausregeln* (1864-78; containing the *Açvalâyana* and the *Pâraskara*); Kalidasa's *Meghadûta*, with commentary and glossary (1874); and *The Institutes of Gautama* (1876); as well as a very valuable *Elementarbuch der Sanskritsprache* (1868; 6th ed. 1892).

STEPHAN, stĕ'fän, Heinrich von (1831-97). A German administrator. He was born at Stolp, in Pomerania; entered the Prussian postal service in 1848 and was rapidly promoted until in 1875 he became Postmaster-General of the German Empire, having under his control the telegraph lines as well as the mails. In 1877 he assumed charge of the national printing offices. He introduced many internal reforms, invented the postal card, and brought about the formation of the Postal Union. He published *Geschichte der preussischen Post* (1859) and *Das heutige Aegypten* (1872).

STEPHANITE (named in honor of Archduke *Stephan*). A mineral silver sulphantimonite crystallized in the orthorhombic system. It has a metallic lustre and is iron-black in color. It occurs in veins with other silver ores, especially in Freiberg, Bohemia, in Hungary, Mexico, Peru, and in the United States at the Comstock lode in Nevada, and at various localities in Idaho.

STEPH'ANUS, or **ÉTIENNE**, â'tyĕn'. A famous French family of printers and scholars. Henricus (c.1460-1520), the founder of the establishment with which the family is identified, set up a press in Paris in 1501. His publications, about 120 in number, of which only one was in French, were mostly scientific.—His second son, Robertus (1503-59), had a good classical training and on his father's death carried on the business. In 1531 his *Thesaurus Linguæ Latinæ* began to appear, and in 1539 he was appointed royal printer to Francis I. In 1551, after the King's death, he was forced to leave Paris for Geneva, where in the same year he published the Greek New Testament, with his verse divisions, which are still in use. His various editions of the Bible, in Hebrew, Greek, Latin, and French, several works of the Genevan reformers, a *Dictionnaire français-latin* (1539-40 and 1549), French and Latin grammars, and a work on pedagogy, the first book from his press (1526), are the more important titles in a list of neary 400, all of which are marked by wonderful typographical clearness and accuracy.—His son Henricus, the younger (1528-98), after three years in his father's establishment in Geneva, in 1554 became independent. From his extensive travels he brought back valuable collections of classical manuscripts. But his scholarly enthusiasm in launching the editions of Plato (1578), and the *Thesaurus Linguæ Græcæ* (1572), which were so long the source of all Greek lexicons, outran his business prudence. The great printing house was nearly ruined and his later works were printed by others. Thirty first editions of Greek authors constitute a claim to renown second only to that won by the *Thesaurus.*—His son PAULUS (1566-c.1627) succeeded him, edited Euripides (1602) and Sophocles (1603), and in 1602, implicated in the Escalade (see GENEVA), had to leave Geneva.—His eldest son, ANTONIUS (1592-1674), momentarily renewed the glories of the house of Paris, but eventually died in the Hôtel Dieu, old, blind, and poor. Consult: Renouard, *Annales de l'imprimerie des Etienne* (2d ed., Paris, 1843); Feugère, *Essai sur la vie et les œuvres de Henri Etienne* (ib., 1853). For Robert's work in connection with the Greek New Testament, Scrivener, *Introduction to the Textual Criticism of the New Testament* (3d ed., London, 1883).

STEPHEN, stē′ven. The first Christian martyr. He was chosen first among the seven deacons whose selection is related in Acts vi., and the account of his martyrdom is given in the following chapter. His execution does not seem to have had the sanction of the Roman authorities, and therefore was illegal. The authenticity of the speech in chapter vii. has been questioned, but, on the whole, there does not seem to be valid reason for doubting that the account is trustworthy. Saint Stephen's festival is celebrated in the Roman Catholic and Anglican churches on December 26th. His relics were believed to have been discovered at Jerusalem in 415 and a minor festival on August 3d commemorates this event. Consult the commentaries on Acts vi. and vii.; also McGiffert, *The Apostolic Age* (New York, 1897), and for the discovery of the relics, Lagrange, *Saint Etienne et son sanctuaire à Jerusalem* (Paris, 1894).

STEPHEN. The name of nine popes. STEPHEN I., Pope 254-257. The chief interest of his pontificate lies in the controversy over the validity of baptism by heretics, in which Stephen declared definitely that baptism, no matter by whom administered, was valid so long as the proper matter and form were employed. (See HERETIC BAPTISM.) He is called a martyr in the *Liber Pontificalis,* but the tradition cannot be traced further back than the sixth century.—STEPHEN II., Pope 752-757. During his pontificate occurred the epoch-making Donation of Pepin (q.v.), which was the real foundation of the Papal States in the modern sense. Consult Schnüren, *Die Entstehung des Kirchenstaates* (Cologne, 1894).—STEPHEN III., Pope 768-772, a Sicilian by birth. He held a synod at the Lateran in 769, supported by the sons of Pepin, at which an attempt was made to exclude secular influence in Papal elections, and a decree passed against the Eastern Iconoclasts. The relations between the Franks and Lombards troubled the latter years of his reign, and Desiderius, King of the Lombards, had the chief influence in Rome until after Stephen's death.—STEPHEN IV., Pope 816-817. He was closely allied with the Emperor Louis the Pious, whom he crowned at Rheims.—STEPHEN V., Pope 885-891.—STEPHEN VI., Pope 896-897. The most striking event of his pontificate is characteristic of the darkness of the times. Urged on by the faction to whom he owed his elevation, Stephen had the body of his predecessor Formosus disinterred, and after the formality of a trial and condemnation stripped of its sacerdotal robes and thrown into the Tiber. Stephen himself was soon imprisoned by a popular uprising, and died in prison.—STEPHEN VIII., Pope 929-931, during the period when Theodora and Marozia held sway in Rome.—STEPHEN VIII., Pope 939-942, while Marozia's son Alberic II. held the temporal power and restricted the Pope to purely spiritual functions. He was able, however, by threats of excommunication to reduce to obedience the rebellious vassals of Louis IV. of France.—STEPHEN IX., Pope 1057-58, Frederick by baptism, brother of Gozelo, Duke of Lorraine. He was made a cardinal and chancellor of the Roman Church by Leo IX. On his return from an embassy to Constantinople he entered the Monastery of Monte Cassino, and became its abbot in 1057. As Pope he followed his German predecessors in their zeal for reform, but died in less than a year. Consult Will, *Die Anfänge der Restauration der Kirche im 11. Jahrhundert* (Marburg, 1864). Some lists of popes enumerate ten Stephens. The confusion arises from the fact that another of the name was elected immediately before Stephen II., but died four days after, before he had received episcopal consecration, and is therefore not properly called Pope.

STEPHEN (c.1097-1154). King of England from 1135 to 1154. He was the third son of Stephen, Count of Blois and Chartres, by Adela, daughter of William the Conqueror, and was thus the nephew of Henry I. of England. He was brought over to England at an early age and became a favorite with his uncle, who bestowed on him large estates and obtained for him in marriage the hand of Matilda, heiress of Count Eustace of Boulogne. Henry's only son having died in 1120, the King sought to secure the crown for his daughter Matilda, widow of Henry V. of the Holy Roman Empire, and Stephen was among the first of the great barons to take the oath of fealty to Matilda. Nevertheless, on the death of Henry I. in 1135, Stephen hastened from Normandy to England, seized the royal treasure, and was crowned King at Christmastide. Revolts in the south and west occurred in 1136, and though these were speedily suppressed, they broke out anew in the following year. In 1138 David I. of Scotland invaded England in support of the claims of his niece Matilda, but he was badly beaten in the battle of Northallerton (q.v.). Robert, Earl of Gloucester, half brother of Matilda, also rose in rebellion, but was for the time defeated. Stephen, however, foolishly entered into conflict with the Church, whose cause was espoused by his own brother, Henry of Winchester, the Papal legate. While the quarrel was in progress, Matilda and Robert of Gloucester landed in England, toward the end of 1139, and began a civil war which lasted for fourteen years and plunged England into utter misery. The nobles took advantage of the civil strife to make themselves virtually independent, and their castles, which Stephen had unwisely permitted them to build up, became mere robber strongholds and places of terror for the unhappy peasantry. The writer in the *Anglo-Saxon*

Chronicle says: "In this King's time all was dissension and evil and rapine. . . . Thou mightest go a whole day's journey and not find a man sitting in a town or an acre of land tilled. The poor died of hunger and those who had been men well-to-do begged for bread. . . . To till the ground was to plow the sands of the sea." "Men said openly that Christ and His saints slept." In 1141 Stephen was taken prisoner at the battle of Lincoln, and was deposed by a Church council, Matilda being chosen Queen. She soon alienated her supporters by her harsh government, and Stephen, who had been released in exchange for Robert of Gloucester, was declared the lawful King by a second Church council and was crowned on Christmas Day. In 1148 Matilda left England; Robert of Gloucester was now dead and the struggle was henceforth carried on by Henry, the son of Matilda and Geoffrey Plantagenet, Count of Anjou, who in 1151 succeeded his father and by his marriage to Eleanor of Aquitaine, the divorced wife of Louis VII. of France, became one of the richest princes in Europe. Stephen's son, Eustace, died in 1153, and in November of the same year Stephen and Henry concluded the Treaty of Wallingford, by which the former remained King, while the succession was vested in Henry. Stephen died October 25, 1154. Consult: Stubbs, *Constitutional History*, vol. i. (6th ed., Oxford, 1896); id., *The Early Plantagenets* (5th ed., London, 1886).

STEPHEN, HENRY JOHN (1787-1864). An English jurist. He was born at Saint Christopher's, West Indies, studied for a time at Saint John's College, Cambridge, and in 1815 was called to the bar. His legal treatises have given him a permanent place among English jurists. In 1824 appeared his *Treatise on the Principles of Pleading in Civil Actions,* which is a model of form and clearness, and was styled by Kent "the best book that was ever written in explanation of the science." His *New Commentaries on the Laws of England* (1841) enjoyed great contemporary popularity. He also published a *Summary of the Criminal Law at Its Present State* (1834). Consult L. Stephen, *Life of Sir James Fitzjames Stephen* (London, 1895).

STEPHEN, Sir JAMES FITZJAMES (1829-94). An eminent English jurist and writer on legal subjects, born in London. He was educated at Trinity College, Cambridge, and was admitted to the bar at the Inner Temple in 1854. He was recorder of Newark-on-Trent in 1859-69, and was legal member of the Legislative Council of the Governor-General of India in 1869-72, doing much to consolidate, abbreviate, and simplify the Indian law of crimes and of evidence, it being due to his efforts that the Indian Evidence Act was passed in 1872. He returned to England in 1872 and employed his time until 1875 in the work of codifying the law of evidence and criminal law of England. He was appointed professor of common law to the Inns of Court in 1875, and in 1879 was appointed a judge of the Queen's Bench Division of the High Court, which position he held until 1891, when he was disabled by nervous trouble resulting in insanity. His greatest work was his *History of the Criminal Law of England* (1883). It is the best work upon the subject for the period it covers, although marked by a certain bias due to his peculiar temperament; and his *Digest of the Law of Evidence* (1876) is widely used in England and the United States. He also published: *Essays of a Barrister* (1862); *Liberty, Equality, and Fraternity* (1873); *Digest of the Criminal Law* (1877); *A View of the Criminal Law in England* (1863). Consult Leslie Stephen, *Life of Sir James Fitzjames Stephen* (London, 1895).

STEPHEN, JAMES KENNETH (1859-92). An English verse-writer, born in London. At King's College, Cambridge, from which he graduated in 1882, he was elected to the Whewell scholarship in international law, and to a fellowship (1885). In 1884 he was called to the bar at the Inner Temple, and in 1888 he was appointed clerk of assize for the South Wales Circuit. Two years later he resigned to return to Cambridge as tutor. In the meantime he had contributed to the *Saint James Gazette* and had conducted a weekly journal called *The Reflector.* The year before his death Stephen published two slender volumes of light verse, *Lapsus Calami* and *Quo, Musa, Tendis?* which met with instant success. In recent verse there is nothing cleverer than some of the parodies, as those on Browning, Wordsworth, Clough, Whitman, and especially Kipling. To the one on Browning there is a noble apology. Other poems show a keen critic of contemporary life.

STEPHEN, Sir LESLIE (1832—). An English biographer and critic, son of Sir James Stephen. He was born in London and was educated at Eton and at King's College, London, and Trinity Hall, Cambridge, where he graduated in 1854 (M. A. 1857) and remained as fellow and tutor until 1864. In that year he went to London and engaged in literary work, writing much for leading periodicals. His first wife (died 1875) was a daughter of Thackeray. In 1865 he published *Sketches from Cambridge,* reprinted from the *Pall Mall Gazette,* and in 1871 became editor of the *Cornhill Magazine*, the reputation of which he maintained by securing such contributors as Stevenson, Hardy, and Henry James. He resigned this post in 1882 to undertake the editorship of the *Dictionary of National Biography,* which, though ill health forced him to hand the management over to Sidney Lee in 1891, will always be a monument to his scholarship and judgment. He wrote nearly four hundred of the articles himself, including Addison, Burns, Byron, Carlyle, Coleridge, Dickens, George Eliot, Fielding, Gibbon, Hume, Johnson, Milton, Pope, Scott, Swift, Thackeray, and Wordsworth. Practically all his work on the *Dictionary* was excellent, but his type of mind and literary method achieved the happier results, perhaps, with the eighteenth-century subjects. For a year (1883) he held the Clark lectureship in English literature at Cambridge. In addition to biography and literature Stephen showed a keen interest in philosophy and ethics. In this field he was utilitarian and fortified his position with an irony, a subtlety of thought, and a trenchantly critical method that won him high regard among literary men and scholars at the expense, perhaps, of popularity. His works include: *Hours in a Library* (three series, 1874-76-79), able and impartial criticisms about which there plays a delightful humor; *The History of English Thought in the Eighteenth Century* (1876; new ed. 1902); *Essays on Freethinking and Plain Speaking* (1879) *The Science of Ethics* (1882), widely used as a text-book; *Life of Henry Fawcett* (1885); *An Agnostic's Apology* (1893); *Life of Sir James Fitzjames Stephen* (1895), his brother; *Social Rights and Duties* (1896); *Studies of a Biographer* (1898); *The English Utilitarians* (1900); and, in the "English Men of Letters" series, lives of Swift, Pope, Johnson, Hobbes, and George Eliot. Stephen was knighted in 1902.

STEPHEN BÁTHORY, bä′tô-rē. See BÁTHORY.

STEPHEN DUSHAN, do͞o′shän (c.1308-55). Czar of Servia from 1331 to 1355. Profiting by the disorders in the Byzantine Empire, he obtained possession of a large part of Macedonia and of Northern Greece. He also extended his sway over most of Albania, while Bulgaria acknowledged his overlordship, and he defied the power of Louis the Great of Hungary. Stephen was great as a ruler, as a soldier, and as a lawgiver. In 1346 he had himself crowned Emperor (Czar) of the Servians and Greeks. In 1349 an independent patriarchate was instituted for Servia. Under Stephen there was, for a brief period a great Slavic realm in the southeast of Europe. His death was followed by its speedy disruption. Stephen Dushan is regarded as a national hero by the Servians.

STEPHENS, stē′venz, ALEXANDER HAMILTON (1812-83). An American statesman, and the Vice-President of the Confederate States; born in Taliaferro County, Ga., February 11, 1812. His boyhood was one of poverty and toil, with occasional attendance at 'old-field' schools. A society for the education of young men for the Presbyterian ministry became interested in him and provided him with the means for education at Franklin College, now the State University, where he graduated at the head of his class in 1832. He did not enter the ministry, but he returned, with interest, the money advanced for him by the society, in accordance with the understanding upon which he had received it. He taught school for a time, and after three months' study of law without a tutor was admitted to the bar at Crawfordville, his county-town, at the age of twenty-two. At twenty-four he was elected to the State Legislature, and after five years' service there was sent to the United States House of Representatives, where he remained from 1843 until he voluntarily retired in 1859.

In 1861 he became Vice-President of the Confederate States and remained so while that government lasted, though not wholly in accord with its policy. He headed the Confederate Commission that met President Lincoln and Secretary Seward at Hampton Roads in February, 1865, to confer upon terms of peace. (See HAMPTON ROADS CONFERENCE.) There is no foundation in fact for the story that Lincoln told Stephens that he might write his own terms if restoration of the Union were agreed upon as the first condition of peace. After the fall of the Confederacy he was imprisoned in Fort Warren, Boston Harbor, from May until October, 1865. Elected to the United States Senate in 1866, he was not permitted to take his seat, and he did not reënter official public life until 1873, when he became a member of the National House of Representatives, from which he again voluntarily retired in 1882. In the fall of that year he was elected Governor of Georgia, and died in the executive mansion, Atlanta, March 4, 1883, leaving a creditable record as statesman, orator, and writer.

His career is one of the most remarkable in American annals. With moral as well as physical courage, he was independent of party. Hence, until 1855, though he had never been in thorough accord with the Whig Party, he generally acted with it simply because he preferred its policy, on the whole, to that of the Democrats. When the Whig Party became disorganized by affiliations of its Northern members with the Free-Soilers, he acted with the Democrats, opposed the Know-Nothing Party, and supported Douglas for the Presidency in 1860. But as, in 1852, he would not act with the Whig Party in support of Scott, so in 1872 he would not act with the Democratic Party in support of Greeley. While he rejected as fallacious and inconsistent the doctrine of nullification, he believed in the right of secession; but he was opposed to the policy of resorting to it in 1861 as a remedy for the political situation at that time. He was devoted to the Union, but believed his ultimate allegiance due to his State, and when she seceded he went with it; but in the conflict that ensued his efforts were directed to a peaceful adjustment based on the principles upon which the Union was formed, for he held the Union itself secondary in importance to those principles. Besides editing the Atlanta *Daily Sun* from 1871 to 1873, he published: *A Constitutional View of the War Between the States* (1868-70); *The Reviewers Reviewed* (a reply to his critics); and *A School History of the United States* (1872). Consult: Cleveland, *Alexander H. Stephens in Public and Private, with Letters and Speeches* (Philadelphia, 1866); Johnston and Browne, *Life of Alexander H. Stephens* (ib., 1878; new ed. 1883).

STEPHENS, GEORGE (1813-95). An English archæologist, born in Liverpool. He was educated at University College, London. In 1834 he settled in Stockholm, Sweden, as a teacher of English. He translated Tegner's *Frithiof* into English verse (1841); was one of the founders of the Society for the Publication of Ancient Swedish Texts (1843), for which he edited several works; and published a *Catalogue of English and French Manuscripts in the Royal Library at Stockholm* (1847). In 1851 he moved to Copenhagen, and was appointed professor of English and Anglo-Saxon in the university there (1855). While holding this position he prepared his best known work, *The Old Northern Runic Monuments of Scandinavia and England, Now First Collected and Deciphered* (vol. i., 1866; vol. ii., 1868; vol. iii., 1884), which was abridged under the title *A Handbook to the Old Northern Runic Monuments.* As a collection of inscriptions, this work has great value; but the interpretations were proved worthless by Wimmer and other scholars.

STEPHENS, HENRY MORSE (1857—). A British-American historian, born in Edinburgh. He graduated at Balliol College, Oxford, in 1880, became a staff lecturer on history to the Oxford Extension Delegacy in 1891, and in 1892 was chosen lecturer on Indian history at Cambridge University. He was professor of modern European history at Cornell University from 1839 to 1903, when he became professor of history and director of university extension at the University of California. His published works include: *History of the French Revolution* (1886); *Portugal* (1891), in the "Story of the Nations Series;" *Albuquerque and the Early Portuguese Settlements in India* (1891); *History of Europe 1789-1815* (1899), in the "Periods of European History Series;" *Modern European History, 1600-1890* (1899). He also edited *Principal Speeches of the Statesman and Orators of the French Revolution* (1891), and, in collaboration with G. B. Adams, *Select Documents of English Constitutional History* (1901).

STEPHENS, James (1824-1901). An Irish agitator and Fenian leader, born in Kilkenny. After participating in the Young Ireland rising of 1848, he fled to Paris. In 1853 he instituted the foundation of the Irish Republican Brotherhood, commonly known as the Fenian Society (q.v.). His system depended on complete preparation of the people. A favorable opportunity was to be awaited when England should be embroiled in foreign troubles. By 1863, both in point of view of numbers enrolled and revenue raised, the organization had assumed formidable proportions, but from that time dates its decline. The *Irish People*, a newspaper which he founded in Dublin in 1863 as a Fenian organ, he conducted on a private basis. The rising in the autumn of 1865 was an ill-timed affair that had hung fire from the preceding spring, and the leaders were arrested. Stephens's facile escape from Dublin Castle was a cause of reproach on the ground that he sacrificed his lieutenants to his own chances instead of taking them with him. He proceeded to the United States and devoted his energies to pacifying and uniting the branch of the society there, but in 1867 he was formally deposed. He fled for his life to Paris, and in 1891 returned unnoticed to Ireland.

STEPHENS, John Lloyd (1805-52). An American traveler and author, born at Shrewsbury, N. J. He graduated at Columbia College in 1822; from 1825 until 1834 practiced law in New York City, and then traveled for two years in Southern and Eastern Europe and in Palestine and Egypt, writing letters for the *American Monthly Magazine* that attracted widespread attention. Later he published *Incidents of Travel in Egypt, Arabia Petræa, and the Holy Land* (1837) and *Incidents of Travel in Greece, Turkey, Russia, and Poland* (1838). In 1839 he was sent by President Van Buren on an unsuccessful mission to Central America. On his return he published *Incidents of Travel in Central America, Chiapas, and Yucatan* (1841). He again went to Central America in 1841 and made further explorations, the results of which appeared in *Incidents of Travel in Yucatan* (1843). Both works were widely read at the time and attracted attention to the archæological remains in Yucatan. In 1849 Stephens became interested in the plan for building a railroad across the Isthmus of Panama, and was made vice-president and afterwards president of the company that was formed for that purpose. A monument was erected in his honor on the highest point traversed by the railroad.

STEPHENS, William (1671-1753). An English colonial Governor, born at Bowcombe, Isle of Wight. He graduated at King's College, Cambridge, in 1684, and was admitted to the Middle Temple. About 1736 he went to South Carolina to survey a barony and met General Oglethorpe. He removed to Georgia in 1737 and became secretary of the trustees. In 1741 he became president of Savannah, one of the two counties into which the colony was divided, and in 1743 was made president of the colony. He was requested to resign on account of his age in 1750, and gave up his office in April, 1751. He published *Journal of the Proceedings in Georgia, Beginning October 20, 1733* (1742). One volume was printed separately as *State of the Province* (1742). His life was written by his son, Thomas, under the title *The Castle-Builders* (2d ed., 1759).

STEPHENSON, stē′ven-son, George (1781-1848). An English engineer and inventor and the 'founder of railways.' He was born at Wylam, near Newcastle, where his father was fireman at a colliery. After a boyhood spent in farm work he became assistant to his father and was steadily advanced. He got some education while working as fireman and brakeman, and in addition to his regular duties undertook the cleaning and repairing of clocks. He became acquainted with William Fairbairn at this time and the two were in frequent conference. After serving as engineer at various collieries and other establishments he was made engine-wright of the Killingworth High Pit, having by this time gained a thorough practical knowledge of the operation and construction of engines and pumping machinery. Devoting his leisure to scientific pursuits, he invented a miner's safety lamp (q.v.) known as the 'Geordie' (1815), and there resulted a controversy over the priority of the invention, as a similar idea had been successfully worked out by Sir Humphry Davy (q.v.). His attention was meanwhile turned to the experiments of Blackett and Hedley with locomotives, then in progress at Wylam, and he induced the owners of the Killingworth Colliery to undertake the construction of a locomotive. (See Locomotive.) In 1821 he became chief engineer of the Stockton and Darlington Railway (see Railways), and in 1824 he was appointed engineer of the Liverpool and Manchester Railway. In 1825 the Stockton and Darlington road was opened, and was the first regularly operated in the world where locomotives were employed to haul freight and passengers. In 1829 his *Rocket* won in the celebrated competitive trial of locomotives on the Liverpool and Manchester Railway, and in 1830 the line was formally opened. Subsequent improvements were made in the locomotive and Stephenson became chief or consulting engineer to nearly all of the railway projects that were soon set on foot. His success in this field made it possible for him to become interested also in the development of coal mines. Stephenson visited the Continent in 1846, where he was received with unusual honors. He was the first president of the Institution of Mechanical Engineers, which he founded in 1847, but was never a candidate for political honors. In the latter part of his life he devoted himself to farming at his country place at Tapton House, where he died. By his successful development of the locomotive and of the railway Stephenson ranks as one of the foremost mechanical engineers of the nineteenth century. Not only was his influence felt in the purely mechanical and engineering difficulties to be overcome, but also in the conservative organization and prosecution of the railway enterprises of his time. Consult Smiles, *Lives of the Engineers*, vol. iii. (London, rev. ed., 1874). Read in this connection articles on Locomotive and Railways.

STEPHENSON, Robert (1803-1859). A British civil engineer. He was the son of George Stephenson (q.v.) and was born at Wallington Quay, near Newcastle. He was educated at Newcastle and received practical engineering experience at the Killingworth Colliery and with his father in railway surveying and the construction of locomotives, being, in the meanwhile, a student for six months at Edinburgh University. After managing his father's locomotive factory in Newcastle for a few months he went to South America on account of ill health (1824) and engaged in mining. Coming back to England in 1827, he returned to the locomotive works and supervised the construction of the *Rocket* (see Locomotive), incorporating in its mechanism many original and serviceable ideas, and assisted his father in other work. In 1833 he became the engineer of the London and Birmingham Railway, one of the first in which great engineering difficulties were encountered in the construction, but which was completed in 1838. The firm of Robert Stephenson & Co. by this time had become the leading engine builders of the world and a standard type of locomotive was evolved which was subsequently enlarged and improved. Robert Stephenson was interested in every department of railway construction, and particularly in the design of bridges, where he achieved the highest reputation. Among the bridges he designed were the high-level bridge over the Tyne at Newcastle, the Victoria Bridge at Berwick, the famous Britannia Tubular Bridge across Menai Strait, the Conway Bridge, and the Victoria Bridge over the Saint Lawrence. (See Bridge.) In 1847 Stephenson was elected to Parliament from Whitby as a Conservative, and in 1856 became president of the Institution of Civil Engineers. See Smiles, *Lives of the Engineers* (London, rev. ed., 1874); Jeafferson and Pole, *The Life of Robert Stephenson* (ib., 1864). See Locomotive; Railways; Steam Engine; Bridge.

STEP'NIAK' (pseudonym of Kravtchinski), Sergei Mikhailovitch (1852-95). A Russian revolutionary exile and writer, born in Southern Russia. He graduated at the Saint Petersburg School of Artillery, and entered the Forestry Institute at Saint Petersburg. In 1872 he joined a Nihilist circle and engaged in spreading revolutionary ideas among the factory workmen in the capital. He was arrested in 1874 in the Government of Tver, but escaped, and henceforth led the life of an outlaw. He engaged in conspiracies in Italy, took an active part at Geneva in the publication of *The Commune*, and smuggled into Russia a press and type for illegal publications in 1878. When the revolutionists resolved upon the death of General Mezentseff, chief of the gendarmes, Stepniak, chosen by lot for the purpose, stabbed him on August 16, 1878, and somewhat later published *Life for Life* in justification of the act. During the years 1879-83 he lived in Switzerland and Italy, where appeared his famous *Underground Russia* (1882). In 1884 Stepniak settled in London. In 1885 appeared his *Russia Under the Tsars*, followed by *The Russian Storm Cloud* (1886), *Russian Peasantry, Career of a Nihilist* (1889), *The Little Cottage on the Volga*, and *King Stork and King Log* (1895). He edited *Free Russia* (founded in 1890), the monthly organ of the English Society of Friends of Russian Freedom. He died in London.

STEPPE (Russ. *stepĭ*, waste, heath, steppe). The name given to the undulating plains of Southeastern Europe and Northern Asia which correspond in general to the prairies and pampas of America, but are marked by some peculiarities due to their elevation and dry climate. The steppes are covered with grass in the rainy season or early summer and afford pasturage to great herds of cattle, sheep, and horses, and are largely occupied, where not brought under cultivation, by nomadic tribes of Tatars. See Grassland; Prairie.

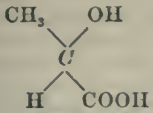
STERE (Fr. *stère*, from Gk. *στερεός*, *stereos*, solid). Another name for a cubic meter. The measure is much used for wood, especially firewood. See Metric System.

STEREO-CHEMISTRY. A branch of chemistry dealing with those cases of isomerism that cannot be explained by the doctrine of the linking of atoms, and explaining those cases on the assumption that the combining forces of an atom act in certain definite directions in space. Isomerism (i.e. the existence of compounds having the same qualitative and quantitative composition and the same molecular weight, yet differing more or less in their properties) and the doctrine of the linking of atoms (the structural theory) have been discussed in the article Carbon Compounds, which should be read in connection with the present sketch.

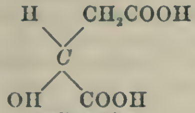
Optical Isomerism. Most of the cases not explained by the doctrine of the linking of atoms are presented by compounds identical in all their chemical and physical properties except the power of rotating the plane of polarized light. It is well known that this power is possessed by a number of crystalline substances in the solid state, and that every such substance can be obtained in two 'enantiomorphous' crystalline forms, rotating the plane of polarized light through equal angles but in opposite directions. But when melted or dissolved such substances usually lose that power completely—which shows that their optical property is peculiar, not to their nature, but to the particular crystalline form which they assume in the solid state. These are not the substances that stereo-chemistry has to deal with: such substances, inasmuch as they lose their difference of optical rotatory power with their crystalline form and are therefore identical in the liquid, gaseous, or dissolved state, cannot be considered as different chemical individuals, and hence cannot form the subject of a theory of chemical compounds. Cases of optical isomerism proper are presented by substances retaining or acquiring their difference of optical rotatory power in the liquid, gaseous, or dissolved state.

In 1874 Le Bel and Van 't Hoff discovered, independently and almost simultaneously, that *all optically active compounds, and only optically active compounds, contain one or more 'asym-*

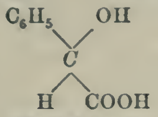
metric' carbon atoms, i.e. carbon atoms directly linked to four atoms or groups of atoms different from one another. The following formulas, containing asymmetric carbon atoms (denoted by an italic *C*), represent optically active compounds:



Lactic acids

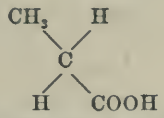


Malic acids

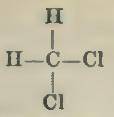


Mandelic acids

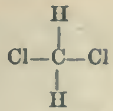
On the contrary, formulas like that of propionic acid,



which contains no asymmetric carbon atom (i.e. no atom combined with four *different* atoms or groups), have in no case been found to represent optically active compounds. The relation between the optic rotatory power and the asymmetric carbon atom must therefore form the cornerstone of any explanation of optical isomerism that might be advanced. Altogether three different explanations suggest themselves as possible: (1) the assumption that the four valencies of the carbon atom are unequal and that cases of isomerism may result from different distributions of the four atoms or groups combined with the carbon atom, among its different valencies; (2) the assumption that the atoms or groups combined with the carbon atom are in constant motion around it and that the molecules of optically different compounds may be made up of the same atoms or groups in different motions around the carbon atom; and (3) the assumption that the molecules of different compounds may be made up of the same atoms or groups, similarly linked to the carbon atom, but differently arranged in space around it. The first of these assumptions compels us to recognize the possible existence of isomers that are positively known to be impossible. For instance, if the assumption were correct, two different nitro-methanes would be possible; yet a systematic experimental investigation carried out by Henry showed that nitro-methane can exist in one form only. The second of the above assumptions is altogether incapable of either purely theoretical development or systematic correlation with facts, and must therefore be abandoned. The third assumption, viz. that the difference between optical isomers is due to differences in the configuration of the atoms in their molecules, presents itself, therefore, as the only possible explanation. Furthermore, even this explanation must first of all discard the hypothesis of the arrangement of atoms in a plane. Indeed, were the plane graphical formulas, as we ordinarily write them, true to reality, then, for instance, two methylene chlorides would be possible, the configurations of whose atoms would be represented by the following formulas:

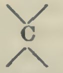


$$\begin{array}{c}\mathrm{H}\\ |\\ \mathrm{H-C-Cl}\\ |\\ \mathrm{Cl}\end{array}$$



$$\begin{array}{c}\mathrm{H}\\ |\\ \mathrm{Cl-C-Cl}\\ |\\ \mathrm{H}\end{array}$$

Yet only one methylene chloride is possible. If the valencies of the carbon atom were assumed to be distributed, in the plane, not at equal angles, but, say, as in the symbol



then the number of theoretically possible yet really non-existing isomers would be even greater.

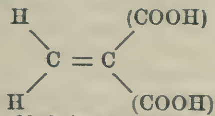
Considerations of this nature have led to the conclusion that if optical isomerism is to be explained, it is necessary to assume that the four atoms or groups held by an asymmetric carbon atom are situated at equal distances from the carbon atom and at equal distances from one another—which is equivalent to assuming that *the asymmetric carbon atom is situated at the centre of a regular tetrahedron, and the four different atoms or groups held by it are situated at the four corners of the tetrahedron.* This, then, is the fundamental hypothesis of stereo-chemistry. Its application to the study of isomerism is very difficult to explain or to grasp without the use of models. A crude but sufficient form of model may be readily made in a few minutes from pasteboard, by cutting out four equal equilateral triangles and fastening them together to form a regular tetrahedron, by means of strips of gummed paper. Small slips of paper of different colors may be used to represent the four different atoms or groups and may be fastened to the corners by means of pins. With the aid of two such models it is easy to demonstrate the following cases: (1) With three slips of paper of one color and one of another color, only one arrangement is possible, which corresponds, for instance, to the fact that only one nitro-methane, $CH_3(NO_2)$, can be obtained. (2) With two slips of paper of one color and two of another color, again only one arrangement is possible, which corresponds, for instance, to the fact that only one methylene chloride, CH_2Cl_2, can be obtained. (3) With two slips of paper of one color, one slip of another color, and one of a third color, again only one arrangement is possible, which corresponds, for instance, to the fact that only one propionic acid, $CH_2(CH_3)(COOH)$, can be obtained. (4) With four slips of different colors two different arrangements are possible, which corresponds to the fact that only molecules containing an asymmetric carbon atom, i.e. one linked to four different atoms or groups, can be different in spite of being made up of the same atoms linked together in the same manner. The two models will, in this case, be like an object and its image in a mirror, or like the right hand and the left hand; turn both hands palm downward and it is impossible to superpose them so that the corresponding fingers touch—the thumb of the right hand will touch, not the thumb, but the little finger of the left hand, etc. Thus the models will illustrate the difference between the two optically active lactic acids, malic acids, or mandelic acids (see above); or, in general, any pair of optical isomers whose molecules contain one asymmetric carbon atom. As an instructive example it may be demonstrated, by means of the models, why only one acetic acid, $CH_3(COOH)$, is possible; why only one mono-chlor-acetic acid, $CH_2(Cl)(COOH)$, is possible; why only one di-chlor-acetic acid, $CHCl_2(COOH)$, is possible; why only one tri-chlor-acetic acid, $CCl_3(COOH)$, is possible; why two optically isomeric chloro-bromo-acetic acids, $C(H)(Cl)(Br)(COOH)$, are possible; and why two optically isomeric chloro-bromo-fluor-acetic acids, $C(Cl)(Br)(F)(COOH)$, are possible.

As already pointed out above, optical isomers are invariably found to possess precisely the same chemical and physical properties and to differ only with regard to the direction in which they rotate the plane of polarized light. The question now suggests itself, How can such isomers be separated from each other when mixed? This problem is so much the more important because all reactions by which compounds with asymmetric carbon atoms may be produced from compounds containing no such atoms cause the simultaneous production of both optical isomers in precisely equal quantities; so that a separation is required whenever optically active compounds are to be prepared artificially (in nature either one or the other of a pair of optical isomers is often found isolated). Three methods have thus far been found for effecting the separation. First, it is possible, in many cases, and under certain conditions of temperature, to separate the isomers mechanically—in those cases, namely, in which the two crystallize from their solutions separately. In all such cases the two isomers are found to form enantiomorphous crystals. Below, or sometimes above, the point or interval of temperature at which this takes place, the two isomers usually crystallize together, forming a double compound, the so-called 'racemic' modification of the given compound. The racemic modification is optically inactive because its two components tend to rotate the plane of polarized light to the same extent in opposite directions. The second method of separating optical isomers is applicable only to acids and bases. If a mixture of two optically isomeric acids is treated with an optically active base, two salts result differing more or less considerably in solubility, and therefore capable of being separated by fractional crystallization. The result is similar when a mixture of two optically active isomeric bases is treated with an optically active acid. Finally, the third method is based on the fact that certain processes of fermentation often destroy one of the optical isomers and leave the other intact. Thus, *levo*-glucose may be prepared by subjecting to fermentation its mixture with *dextro*-glucose, the latter alone being affected by the fermentation. The reason of such facts is not yet understood. It has been assumed by some that the living organisms (e.g. Penicillium glaucum) causing fermentation are capable of discriminating, by a sort of instinct, between the isomers, and, while feeding on one, reject the other. But the lifeless enzymes (q.v.) obtained from ferments have been shown to exercise the same action as the ferments themselves; and hence the peculiar action of the latter may be assumed to be due to the purely chemical properties of their enzymes.

Passing now to the consideration of compounds whose molecules contain more than one asymmetric carbon atom, the most important case to be mentioned is that of tartaric acid, $(COOH)C(H)(OH)\cdot C(H)(OH)(COOH)$, with two asymmetric carbons in its molecule. By the use of models like those mentioned above, it is easy to convince one's self that three different arrangements are possible: (1) a right-handed arrangement of the groups around either of the asymmetric carbons; (2) a left-handed arrangement of the groups around either of the asymmetric carbons; (3) a right-handed arrangement around one, and a left-handed arrangement sponding to these are the well-known *dextro*-rotatory, *levo*-rotatory, and inactive modifications of the acid, the last named being inactive because one-half of its molecule rotates the plane of polarized light to the same extent in one direction as the other half does in the opposite direction. Besides these there is the racemic modification ('racemic acid'), which is nothing but a double compound of the dextro-rotatory and levo-rotatory tartaric acids. (See TARTARIC ACID.) The compounds containing more than two asymmetric carbon atoms include the sugars—an important class of compounds whose theory could not possibly have been developed, and many of which could hardly have been discovered without the concepts of stereo-chemistry. See SUGARS.

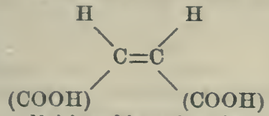
GEOMETRICAL ISOMERISM. It may be seen from the preceding paragraphs that the fundamental hypothesis of stereo-chemistry, viz. that the valencies of a carbon atom act symmetrically around it in space, while indispensable for correlating optical isomers, also throws additional light on the phenomena of chemical isomerism proper. Take, for example, again the case of methylene chloride, CH_2Cl_2. Were optical isomerism unknown and the stereo-chemical hypothesis non-existent, the question as to why only one modification of this compound is possible would be answered by pointing out that the four carbon valencies are identical and that, hydrogen and chlorine atoms being univalent, only one mode of linking the atoms is possible. If it were further asked, "But how do we know that two methylene chlorides might not exist, in whose molecules the atoms are *linked* similarly, but *arranged* differently?"—chemists would answer: "Of course, such a state of things is not inconceivable; only in all the innumerable cases thus far discovered, the doctrine of the linking of atoms is sufficient, the number of known isomeric compounds never exceeding the number of possible modes of linking; and so we deem it unnecessary to enter into speculations as to the arrangement of atoms in space." From the standpoint of stereo-chemistry the answer is thorough: only one methylene chloride is possible, (1) because the four valencies of carbon are identical; (2) because only one mode of linking the atoms is possible; (3) because only one arrangement of the atoms in space is possible, as may be readily demonstrated by the use of tetrahedron models.

It is, therefore, clear that stereo-chemistry not only explains, and hence permits of foreseeing, all possible cases of optical isomerism, but also explains thoroughly why more cases of chemical isomerism than are explained and foretold by the doctrine of the linking of atoms are not possible. But stereo-chemistry has still another important application. Its fundamental hypothesis applied to the so-called 'unsaturated' compounds (see Carbon Compounds) leads to a clear explanation of cases of isomerism which, again, cannot be explained by the doctrine of atomic linking alone. In the simplest class of unsaturated compounds one carbon atom is united by *two* valencies to another carbon atom. In stereo-chemistry this means that two carbon-tetrahedra have an edge in common, the four atomic groups held by the two carbons being situated at the four free corners of the tetrahedra. Take, for example, the case of two carbon atoms united by a double bond and holding two hydrogen atoms and two carboxyl (COOH) groups. In this case the doctrine of the linking of atoms recognizes the possibility of two isomeric modifications, viz.:



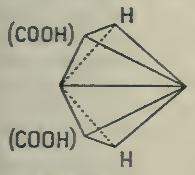
Methylene-malonic acid

and

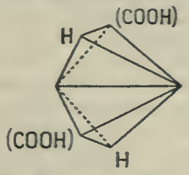


Maleic and fumaric acids

Stereo-chemical doctrine recognizes that with the second of these modes of linking two different arrangements in space are possible, as may be seen from the accompanying diagram, and

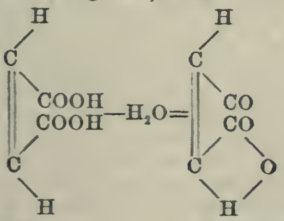


Maleic acid



Fumaric acid

better still by the use of models. As a matter of fact, three unsaturated acids $C_2(H_2)(COOH)_2$ are known, viz. methylene-malonic acid characterized by the first of the above modes of linking, and two acids—maleic and fumaric—both characterized by the second mode of atomic linking, and differentiated from each other by the different *configuration* of their atoms. Optical activity is of course out of question, because none of the molecules under consideration contains an asymmetric carbon atom. But corresponding to the difference in configuration are certain differences in the chemical behavior of maleic and fumaric acids, although the close relationship between the two is indicated by the great readiness with which they are transformed into each other. The most important difference between the two consists in the fact that maleic acid readily forms an anhydride, its two carboxyl groups losing the elements of water and becoming joined together, thus:



Maleic acid Maleic anhydride

Fumaric acid, on the contrary, has no anhydride of its own. This indicates that in maleic acid the two carboxyl groups must be nearer together than in fumaric acid, and therefore the first of the above two stereo-chemical formulas is assigned to maleic, the second to fumaric acid. See Maleic and Fumaric Acids.

As to compounds with triple bonds in their molecules (see Carbon Compounds), the verdict of stereo-chemistry is that no more isomers are possible than can be foreseen by the doctrine of atomic linking. This, too, may be best demonstrated by means of models.

History. In conclusion it may be mentioned that the optical rotary power of a substance in the non-crystalline state (sugar in solution) was first observed by Biot in 1815. The optically isomeric tartaric acids were thoroughly investigated by Pasteur, who in 1860 discovered the three known methods of separating such isomers (see above). Ten years later Wislicenus studied the isomeric lactic acids, and in a memoir published in 1871 expressed the view that the doctrine of atomic linking was no longer sufficient for the purposes of organic chemistry. Wislicenus's remark attracted the attention of Van 't Hoff, who advanced the stereo-chemical theory of optical isomerism in 1874. Meanwhile Le Bel, in Paris, had undertaken to continue the work of Pasteur, and soon independently arrived at the same conclusions as Van 't Hoff. Remarkably enough, Le Bel's and Van 't Hoff's memoirs appeared within one month. The theory of geometrical isomerism was worked out by Van 't Hoff about 1878. At present stereo-chemistry forms quite an extensive science, and its theories, to which no exception has yet been found in the case of carbon compounds, are being gradually extended also to the compounds of nitrogen.

Consult: Wislicenus, *Ueber die räuimliche Anordnung der Atome*, etc. (Leipzig, 1887); Hantzsch, *Grundriss der Stereochemie* (Breslau, 1893; French trans., Paris, 1896); Van 't Hoff, *Die Lagerung der Atome im Räume* (Brunswick, 1894); Bischoff, *Handbuch der Stereochemie* (Frankfort-am-Main, 1893). Consult also the works on theoretical and organic chemistry recommended in the article Chemistry. See Chemistry; Carbon Compounds; Lactic Acid; Tartaric Acid; Fumaric and Maleic Acids; Valency.

STEREOCHROMY, stĕr′ē-ŏk′rō-mĭ (from Gk. *στερεός*, *stereos*, solid + *χρῶμα*, *chrōma*, color). A process of wall-painting, invented in 1896 by Prof. J. N. von Fuchs, of Munich, and first practiced by the painter Joseph Schlotthauer. Upon a thin coating of mortar forming a part of the wall, mineral water colors mixed with soluble glass are applied, thus admitting of any part of the picture being retouched, as in the case of oil paintings. A coating of liquid glass is then added to protect it from the effects of the atmosphere. Experience has shown, however, that the surface of the painting cracks, and the process is no longer practiced.

STEREORNITHES, stĕr′ē-ŏ′nĭ-thēz (Neo-Lat. nom. pl., from Gk. *στερεός*, *stereos*, solid + *ὄρνις*, *ornis*, bird). A group of extinct ratite birds of gigantic size whose remains are found in the Miocene strata of Patagonia. The propriety of this name as indicative of a distinct group has been criticised, and it is believed that, on the contrary, many of the species are not ratite at all, but carinate, one, at least, having been determined to be a vulture. The most conspicuous genus is Phororhacos. See Bird Fossil. Consult Newton, *Dictionary of Birds* (New York, 1893-96).

STEREOSCOPE (from Gk. *στερεός*, *stereos*, solid + *σκοπεῖν*, *skopein*, to view). An optical instrument that enables one to see the pictures of objects not merely as plane representations, but with an appearance of solidity or relief. When a person looks at a solid body with both eyes the pictures formed on the retina of the two eyes are not alike, as the right eye is able to see more of the right side of the object and vice versa. When these two impressions are blended the object is seen with an appearance of depth or relief. It was not until 1838 that an attempt was made to produce this effect. This was accomplished in the first stereoscope, which was devised by Wheatstone (q.v.) and consisted of two plane mirrors at an angle of 90° and two similar clamps or supports for holding the picture. The face of the observer was placed close to the meeting point of the two mirrors and the light from each picture was reflected into the eye by the adjacent mirror. The pictures for use in this instrument were drawn as they would appear to each eye separately, and consequently were reflected to the eyes as they would actually be seen. The apparatus was successful so long as the pictures were confined to representations of geometrical objects of three dimensions, which could be constructed readily, but the reproduction of more complex objects, such as natural scenery, was beyond the skill of the artists, and it did not occur to the inventor to use photography, which was then being developed. The stereoscope was brought to its present state by Sir David Brewster, who in 1849 constructed a lenticular stereoscope in which lenses were substituted for the reflectors used by Wheatstone. In this way he was able to obtain a magnified image as well as one characterized by the stereoscopic effect. Instead of employing whole lenses he divided a double convex lens transversely into halves, which were placed in front of the two pictures with their thin edges adjacent. This was done so that the rays would be deviated by such an amount that they would apparently originate in a common point between the two pictures, the lens acting as a prism which always bends the rays around its base. In this way the two pictures, which are placed directly in front of the two lenses at a distance equivalent to the principal focus, are united into one image. The growth of photography and the ease with which pictures for the stereoscope could be produced soon made the instrument extremely popular, and the open form used in the United States was devised by Dr. Oliver Wendell Holmes, the poet. Brewster also invented a form of photographic camera with two lenses to take stereoscopic pictures. Instead of two lenses, which in modern stereoscopic cameras are generally of the rapid rectilinear type, the position of the camera can be shifted, but the results are not as good as those obtained with two similar lenses mounted on a camera with a vertical partition which enables two pictures to be taken on the same plate. The lenses, generally speaking, should be about 2½ inches apart, though a slight increase does not make any great difference, the relief becoming more prominent. Too great a difference, however, makes an exaggerated and unnatural picture. In printing, the negative reverses conditions, and the prints must be interchanged, as the pictures taken on the right-hand side must always be seen with the right eye.

The opera glass furnishes a familiar instance of the application of the bonocular principle, and in the more modern double-tube telescopes and field glasses, particularly for military operations, great success has been attained in securing the stereoscopic effect with considerable magnifying power. Consult: Brewster, *The Stereoscope* (Leipzig, 1856); Helmholtz, *Physiologische Optik* (ib., 1856-66); Le Conte, *Sight* (New York, 1881); Müller-Pouillet, *Lehrbuch der Physik* (9th ed., Brunswick, 1897).

STEREOTYPING. See Printing.

STERILITY (Lat. *sterilitas*, barrenness, from *sterilis*, barren; connected with Gk. *στερεός*, *stereos*, solid, stiff, barren, *στέριφος*, *steriphos*, hard, barren). Barrenness, infecundity. In a woman, sterility consists of an incapacity for conception; in a man, of the inability to procreate the species. T. G. Thomas, of New York, has analyzed exhaustively the cause of sterility in a woman as follows: (1) Causes preventing the entrance of semen into the uterus, including absence of the uterus or vagina, obturator hymen, vaginismus, atresia vaginæ, occlusion of cervical canal, conical shape of cervix, cervical endometritis, polypi or fibroids, displacements, very small os internum or externum. (2) Causes preventing the production of a healthy ovule, including chronic ovaritis, cystic disease of both ovaries, cellulitis or peritonitis, absence of ovaries. (3) Causes preventing passage of ovule into uterus, including stricture or obliteration of Fallopian tubes, absence of Fallopian tubes, detachments and displacements of Fallopian tubes. (4) Causes destroying the vitality of semen or preventing fixation of impregnated ovum, including corporeal or cervical endometritis, membranous dysmenorrhœa, menorrhagia or metrorrhagia, abnormal growths, areolar hyperplasia.

Sterility in man is *organic* when there is anatomical derangement of the apparatus; *atonic* when erections are wanting or feeble; *anæsthetic* when there is a diminution of sensitiveness in the nerves supplying the male organ; or *psychic* when mental conditions (as of fright, repulsion, etc.) inhibit the genital centre in the spinal cord. The determination of which partner in marriage is sterile is of great importance. In many countries obloquy and derision attach to the wife who fails to bear children, and her legal status is impaired. The woman is much less often to blame than has been supposed.

STERILIZED FOOD. Food that has been subjected to an agent (usually heat) capable of destroying the germs of fermentation or disease which may be present. The articles of diet not usually prepared by heat before ingestion, and which are capable of conveying disease, are fresh fruits and certain vegetables, water, and milk. The two latter are particularly likely to act as carriers of pathogenic microörganisms. Water may be rendered sterile by boiling or by distillation. It is then best kept for use in sterile bottles, sealed, and maintained at a low temperature. Ice may be the means of carrying disease, since many bacteria, although retarded in their growth, are not killed by freezing.

Milk is the food around which the question of sterilization centres, because it is the sole nourishment of infants and swarms with bacteria, particularly during the summer months. Although it comes sterile from the breast of the suckling mother or the udder of the healthy cow, milk is almost a perfect culture medium for many varieties of bacteria, pathogenic and nonpathogenic, which multiply with astonishing rapidity. It may become contaminated during the interval between milking and ingestion in various ways. Unclean materials may be introduced into the milk from the udders of the cow or the milker's hands. Impure water used either as an adulterant or for cleansing containers may be a means of contamination. Typhoid fever has been proved to have been conveyed in this manner. Exposure to the air alone is sufficient to introduce, through dust, many different forms of bacterial life.

The diseases most likely to be propagated through milk are typhoid fever, tuberculosis, scarlet fever, cholera, suppuration, and especially the summer diarrhœa of children. Besides producing their specific diseases bacteria produce poisonous elements in milk which are capable of giving rise to ptomaine poisoning (q.v.) in individuals who drink it. It has been proposed at various times to prevent the development of germs in milk by the addition of non-poisonous antiseptic substances. But it has been found that even with such drugs as salicylic acid and boric acid quantities too large to be wholesome must be employed. Formalin has been extensively used of late years to keep milk sweet and aseptic. Cold is a very imperfect means of sterilization. A low temperature retards development of bacteria for a time, but does not destroy them nor their spores.

Milk is usually sterilized by boiling or by exposure to superheated steam. Germs existing in this fluid can be absolutely destroyed only by heating to 212° F. or higher on two or three successive occasions. The ordinary method of sterilizing milk is to place it in sealed jars or bottles containing sufficient for one feeding, which are then subjected to the action of steam. It is then cooled rapidly, kept sealed from the air, and placed on ice until needed. Exposure to such high temperatures alters the character of milk very materially, both as to its digestibility and nutritive qualities, and it is therefore rendered unfit for use except as a makeshift in very hot weather and in cases of infantile summer diarrhœa. Prolonged use of sterilized milk for children dependent solely upon it for nutriment has resulted in symptoms of scurvy. To obviate this difficulty milk is often subjected to a process known as pasteurization. This consists in heating it to a temperature of 167° F. and maintaining it at this point for a period of twenty minutes. Pasteurization has been shown to be sufficient to kill the microörganisms most commonly found in milk, and in particular those giving rise to diarrhœal diseases, which are very vulnerable to heat. Spores, however, are not destroyed. The tubercle bacillus is more resistant, but, as has been said before, tuberculosis is not often conveyed by milk. Pasteurized milk will keep two or three days at ordinary temperatures or several days on ice, and its taste, digestibility, and nutritive value are believed to be unchanged. See Adulteration; Milk.

STERLING. An epithet generally applied to the coinage of Great Britain. Charlemagne superseded earlier systems by a coinage in which a pound of 12 ounces became the money weight. The older *silfer* or scruple of 24 wheat-corns being superseded by the penny of 32 wheat-corns, the term sterling seems to have been applied to the latter, in consequence of its being in use among the Ripuarian or Austrasian Franks, sometimes called the *Esterlings.* In England the word 'sterling' came in the course of time to indicate the fineness of the silver. The superiority of the English standard silver was generally acknowledged over Europe; and hence the adjective 'sterling' has become a synonym for 'pure' or 'genuine.'

STERLING, stẽr′lĭng. A city in Whiteside County, Ill., 109 miles west of Chicago, on Rock River, and on the Chicago and Northwestern and the Chicago, Burlington and Quincy railroads (Map: Illinois, C 2). It is of considerable industrial importance, having good water power. The principal manufactures are agricultural implements, caskets, watches, canned goods, flour, paper, and foundry and machine-shop products. There is a public library with more than 9000 volumes. Population, in 1890, 5824; in 1900, 6309.

STERLING, John (1806-44). An English author, born on the island of Bute. He was educated at Glasgow and at Cambridge. He went to London and began writing for the *Athenæum.* Owing to ill health, he passed two years in the West Indies (1830-32). Returning to England, he took orders and served eight months as a curate. In 1838 he formed the Anonymous (afterwards the Sterling) Club, which included Lord Houghton, Carlyle, and Tennyson. Among his writings are *Arthur Coningsby* (1833), *Poems* (1839), *The Election,* a poem (1841), and *Strafford,* a drama (1843). Sterling, a man of many friends, cut down with consumption in the prime of life, has been immortalized by Carlyle in a *Life* (Boston, 1851). Consult *Essays and Tales* with a memoir by J. C. Hare (London, 1848).

STERN, stĕrn, Adolf (1835—). A German literary historian, born in Leipzig. He studied at the Universities of Leipzig and Jena, and in 1868 was appointed professor of the history of literature in the Polytechnikum of Dresden. His publications include the compilation *Fünfzig Jahre deutscher Dichtung* (1871); two collections of essays, *Aus dem achtzehnten Jahrhundert* (1874) and *Zur Litteratur der Gegenwart* (1880), and his most important work, *Geschichte der neuern Litteratur* (7 vols., 1882-85).

STERN, Daniel. See Agoult, Comtesse d'.

STERNBERG, stĕrn′bĕrk. A town in Moravia, Austria, 12 miles north-northeast of Olmütz (Map: Austria, E 2). It is the chief seat of the Moravian cotton and linen industry, and there is a large tobacco factory. Population, in 1900, 15,195.

STERNBERG, Constantin (1852—). A Russian-American pianist and composer, born at Saint Petersburg. In 1871 he became conductor of the Court Opera at Strelitz; in 1875 director of the music school, and Court pianist at Schwerin. He settled in the United States in 1885, becoming director of the College of Music at Atlanta, Ga. In 1890 he became the head of the Sternberg School of Music in Philadelphia. His compositions include some admirable pianoforte music.

STERNBERG, George Miller (1838—). An American bacteriologist and army surgeon, born in Otsego County, N. Y. He was graduated from the College of Physicians and Surgeons, New York City, in 1860, and was appointed assistant surgeon in the United States Army in 1861; he served through the war. After close of the Civil War he was assigned to several posts until 1875, when he was promoted to the rank of surgeon and major. In 1879 he was sent to Havana, Cuba, by the National Board of Health as a member of the yellow fever commission. In 1885 the American Public Health Association awarded to him the Lomb prize of $500 for his essay on "Disinfection and Individual Prophylaxis Against Infectious Diseases." In 1893 Sternberg was made surgeon-general of the United States Army, with the rank of brigadier-general, and in this capacity he directed the medical affairs of the United States Army during the Cuban War. Among his published works are *Photomicrographs and How to Make Them* (1883) and *Malaria and Malarial Diseases* (1884).

STERNE, Laurence (1713-68). An English author. He was born at Clonmel, in Ireland. Carried about in the regiment in which his father was an officer, he saw many phases of life in Ireland and England. From ten to eighteen he was at school at Halifax, in Yorkshire. Later he went to Jesus College, Cambridge, where he took his degree in 1736. He was ordained two years later, probably with a view to taking the family living of Sutton, near York, which was immediately given him, to be followed in 1741 by the prebend in York Minster. In 1743 the living of Stillington, which carried with it another prebendal stall in the cathedral, was given to him. He passed twenty years in his Yorkshire home, preaching curious sermons, associating with boisterous squires and reading Cervantes, Rabelais, and the old romances. He found himself suddenly famous when the first two volumes of his *Tristram Shandy* apeared at York at the end of 1759. He went up to London, became the lion of the moment, and published a collection of sermons. In 1760 he was presented to the living of Coxwold. There he went on with *Tristram*, publishing the ninth and last volume in 1767. During these years he spent much time in London and traveled on the Continent. The outcome of his tour in the autumn of 1765 was *A Sentimental Journey Through France and Italy* (1768). Less than a month after its publication Sterne died in a London lodging. In 1775 appeared *Letters to His Intimate Friends,* with the fragment of an autobiography, edited by his daughter, and *Letters from Yorick to Eliza* (i.e. Mrs. Elizabeth Draper).

Sterne's work reached a wide popularity at once, and had a following in England, France, and Germany for years. His sentimentality, the deliberate self-conscious indulgence in feelings of pathos, became the fashion of the day. His work is curiously subjective, dependent upon the moods and whims of the moment; and its formless, easy-going style, such a contrast to the ordered regularity which had marked English prose from Dryden to Addison, thus admirably represents his thought. His characters are remarkable for their genuine human quality, remote as they live from the interests of the ordinary people of the time, and belong to the small class of positive creations in literature. Consult the biographies by Fitzgerald (London, 1864; 2d ed. 1896) and Traill (ib., 1882); Stapfer, *Laurence Sterne, sa personne et ses ouvrages* (Paris, 1870); Texte, *Rousseau et le cosmopolitisme littéraire au XVIIIème siècle* (ib., 1895); Thackeray, *English Humourists* (London, 1853). His works, collected in 1780, were reprinted with newly discovered letters under the editorship of J. P. Browne (London, 1873). A convenient but less complete edition was edited by G. Saintsbury (London, 1894).

STERN'HOLD, Thomas (c.1500-49). One of the authors of the metrical English version of the Psalms. He was probably born in Gloucestershire, England. According to Wood he studied at Christ Church, Oxford, but did not take a degree. He held the office of groom of the robes to Henry VIII. and Edward VI. The first edition (undated, but about 1547) contains nineteen psalms. A second edition (1549) with additions by John Hopkins (d. 1570) contains 37, and in the complete psalter (1562) 40 bear the name of Sternhold. The rest were by Hopkins and several others. The rendering is very literal, but somewhat coarse and homely in phrasing. It was used in England long after the new version by Tate and Brady (1696). "My Shepherd is the Living God" (Psalm xxiii.) is still current. Consult Julian, *Dictionary of Hymnology* (London and New York, 1892).

STERNUM (Neo-Lat., from Gk. στέρνον, breast-bone), or Breast-Bone. A narrow flat bone in the median line of the chest in front, giving attachment to the first seven ribs through their costal cartilages and thus closing anteriorly the thoracic cavity. In the adult it consists of three parts, the upper or manubrium, the middle or gladiolus, and the inferior or ensiform. A sternum is not present in fishes, batrachians, or serpents, but it does occur in all warm-blooded vertebrates and reaches its highest development in the flying birds, where a heavy ridge or keel furnishes a joint of attachment for the powerful muscles of the wings. In the tortoise it is represented by the lower shell or plastron.

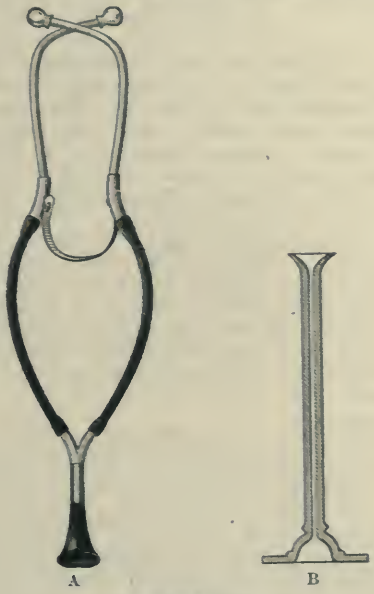
STER'RETT, John Robert Sithington (1851—). An American classical scholar, born at Rockbridge Baths, Va. He was educated at the University of Virginia and in Europe. Later he engaged in important archæological expeditions in Asia Minor, the results of which were published in the papers of the American School at Athens under the titles *Wolf Expedition to Asia Minor* (1885), *Epigraphical Journey in Asia Minor* (1888), and also in *Leaflets from the Notebook of a Traveling Archæologist* (Texas, 1889). After holding professorships of Greek at Miami University and the University of Texas, he was called in 1892 to a similar position at Amherst College; he remained there until 1901, when he became head of the department of Greek in Cornell University. In 1896-97 he was professor in the American School of Classical Studies at Athens. Other publications by him are *Qua in re Hymni Homerici quinque maiores inter se differunt* (1881); *Inscriptions of Assos; Inscriptions of Tralles* (1885).

STER'RY, JOSEPH ASHBY-. An English critic. See ASHBY-STERRY, JOSEPH.

STESICHORUS, stē-sĭk'ō-rŭs (Lat., from Gk. Στησίχορος) (c.640-555 B.C.). A famous Greek lyric poet, born in the Locrian Mataurus, but considered as a Himeræan, since he spent the greater part of his life in the city of Himera, of which his father seems to have been one of the early settlers. It is reported that he was at first the friend of Phalaris, the tyrant of Agrigentum, but that later, recognizing the cruel character of that tyrant, he warned his fellow-citizens against his schemes by telling them the fable of the horse that gave himself up to man in order to revenge himself on the stag. The Himeræans did not listen to his advice and he was compelled to flee to Catana, where he died. The Himeræans, however, in later times honored him with a statue which was seen by Cicero; his figure was also stamped on their coins. A famous story connected with Stesichorus relates that he was struck with blindness because of his attack on Helen, but recovered his sight after he had published a recantation in which he declared it was only the shade of Helen, not Helen herself, that went to Troy.

In his hands the religious hymn, which had been cultivated by previous lyricists, was somewhat secularized. The content also was epic, although the form continued to be that which had been established for melic verse. He treated in his *Destruction of Troy* the story of Æneas's wanderings, which thereafter was established in literary tradition. He also employed folk-tales and was the forerunner of the Greek romance in that he established in Greek literature the impersonal love poem, and he was the first to give literary treatment to the Sicilian story of Daphnis, which was later handled by Theocritus and other bucolic poets. His dialect was a combination of epic with Doric. He also contributed to the development of the strophic and epodic structure of lyric poetry. His poems were written in strophe, antistrophe, and epode, and this arrangement became the norm for lyric poetry, which was thereafter changed only in minor details. The fragments are published by Bergk, *Poetæ Lyrici Græci* (Leipzig, 1882). Consult, also: Welcker, *Stesichorus, Kleine Schriften* (Bonn, 1884); Rizzo, *Questioni Stesichoree* (Messina, 1895).

STETHOSCOPE (from Gk. *στῆθος, stēthos,* breast + *σκοπεῖν, skopein,* to view). An instrument for examining the heart and lungs through their sounds. In its simplest form, invented by Lænnec (q.v.), the stethoscope consists of a tube of wood, from 10 to 12 inches long, with a flanging end to be placed on the chest to receive the sound, an open canal to conduct it, and a broad flat ear piece at the other end for apposition to the ear and excluding extraneous sounds. (See Fig. B.) An improvement upon this is the binaural stethoscope, introduced by Dr. Camman of New York, in the form of a binaural or double instrument having an ear piece for each of the ears and flexible rubber tubes connecting them with the chest piece. (See Fig. A.) A still finer instrument is the phonendoscope, which conveys with greater minuteness and intensity. The chest piece of the phonendoscope consists of a shallow metal cup covered by a disk of ebonite, with a perforation in the cup for attaching the rubber tubes for the ears. From the centre of the disk of ebonite springs a small rod ending in a button, which is placed upon the spot to be auscultated. This instrument is useful in the finer phases of diagnosis, particularly to distinguish between pericardial and endocardial sounds and to detect the fœtal heart. See AUSCULTATION; RESPIRATORY SOUNDS.



STETHOSCOPE.
A, stethoscope with ear tubes; B, older form.

STETTIN, stĕt-tēn'. The capital of the Province of Pomerania, Prussia. The city is situated on both banks of the Oder, 17 miles south of the Stettiner Haff, an inlet of the Baltic, and 83 miles by rail northeast of Berlin (Map: Prussia, F 2). The district on the right bank of the river comprises the former suburbs of Lastadie and Silberwiese. The site of the town is hilly, and consequently the streets are uneven, but the houses are well built. The extensive fortifications were demolished in 1874. The castle, dating from 1577, formerly occupied by the Dukes of Pomerania, is now a Government building. The Königs-Thor and the Berliner Thor are interesting sandstone gates built by Frederick William I. Saint James is an imposing thirteenth-century church in the centre of the town, restored in 1897; Saint Peter and Saint Paul is the oldest church in Pomerania, restored 1816-17; and the fine new Roman Catholic church (1890) is also worthy of note.

Stettin is the most important manufacturing town in Pomerania. Its principal industrial establishment is the Vulcan ship-building yard, employing over 6000 men, and covering 65 acres. There is also a large iron foundry, where all the anchors for German ships are forged. The clothing industry ranks second in importance only to ship-building, and employs over 10,000 men, women, and children. There are numerous large factories for the manufacture of chemicals and cement, bicycles and sewing machines, soap and candles, sugar, paper, glass, etc. A new harbor on the east bank of the Oder was opened in 1900. This, together with the deepening of the Oder to the Stettiner Haff, enabling large vessels, which formerly stopped at Swinemünde, to reach the city, has made Stettin the third port of Germany. It has direct steamship communication with New York, London, and other foreign cities. The port was cleared in 1900 by 4594 vessels, of 1,552,543 tons burden. The chief exports are corn, spirits, lumber, sugar, and cement; the imports, iron, petroleum, wine, groceries, and coal. Population, in 1890, 116,228; in 1900 (Greater Stettin), 210,680.

Stettin is of Slavic origin. It first came into notice in the twelfth century. As a member of the Hanseatic League it became a flourishing commercial town. It belonged to Sweden from 1648 until 1720, when it passed to Prussia. It was held by France from 1806 to 1813. Consult W. H. Meyer, *Stettin in alter und neuer Zeit* (Stettin 1887).

STEUBEN, stū′ben, *Ger. pron.* stoi′ben, FRIEDRICH WILHELM VON, Baron (1730-94). A German-American soldier, born at Magdeburg, Prussia. He was educated at the Jesuit colleges of Neisse and Breslau, and at the age of fourteen served as a volunteer under his father at the siege of Prague. In 1747 he was appointed cadet of infantry, and in 1758, after several promotions, became an adjutant-general with the rank of captain. He fought with distinction in the Seven Years' War, at the close of which he was appointed grand marshal of the Prince of Hohenzollern-Hechingen, in which position he remained until about 1774. While in Paris in 1777 he was induced by Saint Germain to go to America and arrived at Portsmouth, N. H., on December 1st. He immediately offered his services as a volunteer to Congress, and was directed to join the army at Valley Forge. This he did February 23, 1778, and in May, 1778, he was appointed instructor-general of the Continental army with the rank of major-general. He devoted himself to the task of reorganizing the army on the European model, drilling the awkward and untrained soldiers and introducing order and system. He increased enormously the general efficiency of the army and thus contributed in no small degree to the success of ensuing campaigns. At Monmouth he rendered valuable service, and in 1780 he was sent with a separate command to coöperate with General Greene in Virginia, where he opposed the marauding expedition of Benedict Arnold, and finally took an active part in the siege of Yorktown. In 1780 he prepared a manual for the army entitled *Regulations for the Order and Discipline of the Troops of the United States*, which came into general use. After the war he received grants of land from several States, and finally Congress voted him a tardy pension of $2400. For several years he lived in New York City and then removed to the tract of land (Steuben Township) granted to him by New York, where he lived in a rude log cabin (near the site of the present Utica) until his death, November 28, 1794. Friedrich Kapp has written the most trustworthy biography (New York, 1859).

STEUBENVILLE, stū′ben-vĭl. The county-seat of Jefferson County, Ohio, 43 miles west by south of Pittsburg, Pa., on the Ohio River and on the Pennsylvania, the Wheeling and Lake Erie, and other railroads (Map: Ohio, J 5). It is favorably situated for commerce and industry. Noteworthy features are the Carnegie Public Library, city hall, court house, Gill Hospital, Stanton Park, and Altamont Park and Casino. The surrounding section has coal deposits, natural gas, and petroleum wells. There are manufactures of glassware, chimneys and electric light bulbs, paper, foundry and machine shop products. Several plants are connected with the iron and steel industry. The water-works are owned and operated by the municipality. Population, in 1890, 13,394; in 1900, 14,349. A fort named in honor of Baron Steuben was erected here in 1787 and the town was laid out in 1798. The city was chartered in 1851 and its limits were extended in 1891. Consult Howe, *Historical Collections of Ohio* (Columbus, 1890-91).

STE′VENS, ABEL (1815-97). A Methodist Episcopal clerical writer. He was born at Philadelphia and entered the New England Conference (1834). He was editor of *Zion's Herald* (Boston, 1848-60), of the *National Magazine* (New York, 1852), of the *Christian Advocate* (ib., 1856-60), corresponding editor of the *Methodist* (ib., 1860-74). He was the author of *Memorials of the Introduction of Methodism Into the Eastern States* (1852), *Memorials of the Early Progress of Methodism in the Eastern States* (2d series, 1854), *The History of the Religious Movement of the Eighteenth Century Called Methodism* (1858-61), *History of the Methodist Episcopal Church in the United States of America* (1864-67), *Supplementary History* (1899), *Madame De Staël, A Study of Her Life and Times* (1880).

STEVENS, ALFRED (1828—). A Belgian genre painter. He was born at Brussels, and studied principally with Roqueplan and under Ingres in the Ecole des Beaux-Arts, Paris. He first exhibited in Brussels, but in 1849 settled at Paris where he has since resided. Among his works are the "Discouragement of the Artist" and "Love of Gold" (1853); "Masquerade on Ash Wednesday" (1853, Marseilles Museum); "Consolation" (1857, Ravené Gallery, Berlin); "The Lady in Pink," "La bête a Bon Dieu" (Brussels Museum); "The Japanese Robe" (Metropolitan Museum, New York). He painted in fresco "Allegories of the Four Seasons" (in the Royal Palace, Brussels). His most characteristic subjects depict the interiors of modern houses as background and accessories for the figures of piquant women and children of fashionable life. He revels in the arrangements of furniture and rich stuffs, by means of which he secures remarkable effects of texture and quality. His management of tone and light is scientific, at the same time pure and admirable. His type of women possess the quality of charm with a reserve of expression and a refinement not shown by the ultra-moderns in his genre.

STEVENS, ALFRED GEORGE (1818-75). An English sculptor. He was born in Dorset County, England, and received his artistic training in Italy (1833-42). In 1841 he studied for a year under Thorwaldsen, after which he returned to England, where, in 1845, he was made professor in the Art School at Sheffield. His greatest achievement in sculpture is the Duke of Wellington monument, Saint Paul's Cathedral, including the powerful groups of "Truth Tearing Out the Tongue of Falsehood" and "Valor Triumphing Over Cowardice," which decorate the canopy above the edifice. He is also celebrated for his designs for metal articles of daily use, executed in exquisite classical taste, as well as for more ambitious efforts like the vases decorating the railing in front of the British Museum, and the lions on the posts, since placed in the Museum; the mantelpiece in the dining room of Dorchester House, Park Lane; and the mosaics designed to fill the spandrels under the dome of Saint Paul's. He was almost unrecognized by the British public. His Italian training, exempt from English influence, accounts for his excellence at a time when English sculpture was in the decline. Consult Stannus, *Alfred Stevens and His Work* (London, 1891).

STEVENS, Benjamin Franklin (1833-1902). An eminent American bibliographer, born in Barnet, Vt. He joined his brother, Henry, in London in 1860; for many years had charge of the Chiswick Press, acted as purchasing agent for American libraries, and became United States dispatch agent. For more than thirty years he and his agents searched the archives of England, France, Holland, and Spain for papers relating to America. His publications include: *American Manuscripts in European Archives* (1887); *Campaign in Virginia in 1781* (1888); *Facsimiles of Manuscripts in European Archives Relating to America, 1773-83* (25 vols., 1889-98); *Gen. Sir William Howe's Orderly Book at Charlestown, Boston, and Halifax* (1890); *Columbus, His Own Book of Privileges, 1502* (1893); *Introduction to Calendar of American Papers in the Earl of Dartmouth's Collection* (1895).

STEVENS, Ebenezer (1751-1823). An American soldier, born in Boston, Mass. He enlisted as a lieutenant in a Rhode Island artillery regiment in May, 1775, and by successive promotions rose to the rank of lieutenant-colonel in April, 1778, serving in the expedition against Quebec (1775), and commanding the artillery at Ticonderoga, at Freeman's Farm, and, for a time, at Yorktown. He was one of the founders of the Society of the Cincinnati, became prominent as a merchant in New York, and was made a major-general of militia.

STEVENS, Edward (1745-1820). An American soldier. He was born in Culpepper County, Va., became colonel of Virginia militia early in 1775, was in command at the skirmish at Great Bridge (December 9, 1775), saved part of Washington's army from capture at Brandywine (September 11, 1777), served with gallantry and marked ability at Germantown, Camden, and Guilford Court House, and became a brigadier-general of militia in 1779.

STEVENS, Edwin Augustus (1795-1868). An American capitalist, railroad organizer, and ship-builder, born at Hoboken, N. J. With his brother Robert L. Stevens (q.v.) he succeeded to the large shipping and railroad interests of their father, John Stevens (q.v.), and became one of the most prominent railroad organizers in the United States. After his brother's death he tried to dispose of the famous Stevens Floating Battery and on his own death bequeathed it to his native State, together with $1,000,000 to insure its completion. This sum proved inadequate, however, and the State disposed of the vessel to the United States Government, which finally sold it for old iron. Another vessel of his, the *Naugatuck,* was accepted by the Federal Government and was used during the Civil War. He founded the Stevens Institute of Technology (q.v.).

STEVENS, George Alexander (1710-84). An English wit, the son of a London tradesman. He joined a company of strolling players, and for many years followed the stage as an actor in minor parts. He became famous for his *Lecture on Heads*, first delivered at the Haymarket in 1764 and repeated for many years throughout Great Britain and in America. The lecture is a humorous and extravagant series of hits on contemporary follies as represented by various heads. Stevens also wrote many popular songs, as "Cease, rude Boreas, blustering railer." Consult the *Lecture* with heads executed by Charlton Nesbit from designs by Thurston (London, 1799), and *Songs, Comic and Satirical,* with cuts by Berwick (Oxford, 1772; and numerous reprints).

STEVENS, George Barker (1854—). An American theologian, born in Spencer, N. Y., and educated at the University of Rochester (class of 1877) and at Yale Divinity School, where he graduated in 1880. He was pastor of the First Congregational Church of Buffalo (1880-83) and of the First Presbyterian Church of Watertown, N. Y. (1883-85), and then, after a year's study in the University of Jena, became professor of New Testament criticism and interpretation at Yale, a chair which he left in 1895 for that of systematic theology in the same university. He wrote *The Pauline Theology* (1892); *The Johannine Theology* (1894); *A Short Commentary on Galatians* (1894); *The Epistles of Paul in Modern English* (1898); *The Messages of the Apostles* (1900); and *The Teaching of Jesus* (1901).

STEVENS, Henry (1819-86). An American bibliographer, born at Barnet, Vt. He graduated at Yale in 1843 and studied law at Harvard. Attracted to colonial history, he visited England in search of Americana in 1845, and remained there till his death, acting as purchasing agent for the British Museum and for many libraries, public and private, noteworthy among which was the Lenox Library of New York, whose collection of Americana he formed. He published many bibliographical catalogues and pamphlets, highly prized for their minute accuracy, and made a collection of Franklin documents which was purchased by the United States Government. Of his very numerous publications the more noteworthy are: *Catalogue Raisonné of English Bibles* (1854); *Catalogue of American Books in the Library of the British Museum* (1857); *Bibliotheca Americana* (1861); *Bibliotheca Historica* (1870); *Historical Collections* (1881-86); *Who Spoils Our New English Books* (1885); and *Recollections of James Lenox* (1886).

STEVENS, Isaac Ingall (1818-62). An American soldier and administrator, born at North Andover, Mass. He graduated at West Point in 1839. He joined General Scott's army in Mexico as adjutant of engineers in 1847, and participated in all of its important engagements. In 1849 he became the assistant in charge of the United States Coast Survey office at Washington, but resigned from the army in 1852 to accept the Governorship of Washington Territory. In 1855 the Washington Indians revolted. Stevens at once sternly suppressed the insurrection, and arrested Chief Justice Edward Lander, who had issued writs of habeas corpus for Indian prisoners. On the outbreak of the Civil War he was commissioned colonel of the Seventy-ninth New York Volunteers, and a few months later was promoted to the rank of brigadier-general. He participtated in the actions on Stone River and at Secessionville. On July 4, 1862, he was promoted to the rank of major-general, and during August he took part in the campaign in northern Virginia, participating in the second battle of Bull Run and the battle of Chantilly. While leading his men in a charge during the latter, he was killed, September 1, 1862. He published *Campaigns of the Rio Grande and Mexico, with Notices of the Recent Work of Major Ripley* (1851); and a *Report of Explorations for a Route for the Pacific Railroad near the 47th and 49th Parallels of North Latitude, from Saint Paul, Minn., to Puget Sound,* printed by order of Congress (1855-60).

STEVENS, John (1749-1838). An American inventor, engineer, and steamboat builder. He was born in New York City, and in 1768 graduated at King's (now Columbia) College. He then studied law, and in 1771 was admitted to the bar. In 1790 he petitioned Congress for legislation for the protection of American inventors, and through his efforts a bill was passed which laid the foundations for the present patent system of the country. As early as 1788 he had begun experiments in the application of steam as a motive power, and in 1792 took out two patents for marine engines under the new law. Subsequently, in association with Nicholas Roosevelt and Robert R. Livingston, he built a steamboat, and attempted to obtain from the New York State Legislature the exclusive right of navigation of the Hudson River, but the boat, when completed in 1801, failed to fulfill the speed conditions imposed, and Livingston subsequently became associated with Fulton in his more successful attempt. In 1804 he built a steamship propelled by twin screws, and in 1807, with his brother Robert, built the paddle-wheeled steamboat *Phœnix,* which was put in successful operation only a few days after Fulton's *Clermont.* The *Phœnix* was shut out of the waters by the monopoly of Fulton and Livingston, but was operated for six years on the Delaware River, to reach which the *Phœnix* sailed around from New York City, and was thus the first steamship to navigate the ocean successfully. In October, 1811, between Hoboken and New York City he established the first steam ferry in the world. He invented and designed many improvements in steamboat and steam-engine construction, and designed in 1812 a circular iron-clad floating battery for harbor defense. In 1826 he constructed a locomotive model after his own designs, which he exhibited in operation in Hoboken, and which was said to have been the first locomotive ever to run on a track in America.

STEVENS, John Austin (1795-1874). An American banker and financier, born in New York City. He graduated at Yale in 1813, and in 1818 became a partner in the extensive mercantile business of his father, Ebenezer Stevens, in New York City. During the Civil War be was one of the principal financial advisers of the Government, and his greatest public service was rendered as chairman of the famous 'treasury note committee' of New York, Boston, and Philadelphia bankers, which played a prominent part in placing the first 7-30 and later war loans.

STEVENS, John Austin (1827—). An American author, born in New York City. He graduated at Harvard in 1846; was secretary to the New York Chamber of Commerce from 1862 to 1868; and later was for some years librarian of the New York Historical Society. He founded the Society of the Sons of the Revolution and the Loyal League. In 1877 he established the *Magazine of American History,* of which he was the editor until 1883. His publications include: *The Valley of the Rio Grande* (1864); *Colonial Records of the New York Chamber of Commerce* (1867); *The Expedition of Lafayette Against Arnold* (1878); and *Life of Albert Gallatin* (1884), in the "American Statesmen Series."

STEVENS, John Leavitt (1820-95). An American journalist and diplomat, born at Mount Vernon, Me. In 1855 he became associate editor of the Kennebec (Me.) *Journal,* and in 1857 chief editor of the paper. He was an advocate of the Republican Party, in whose organization in Maine he assisted. He was Minister Resident to Uruguay and Paraguay from 1870 until 1873. In 1877-83 he was Minister Resident to Sweden and Norway, and in 1889 became Minister Resident to the Hawaiian Islands. His title was made Envoy Extraordinary and Minister Plenipotentiary in 1890. Upon the outbreak of a revolution against the royal Government in 1893, and the establishment of a provisional government (see Hawaiian Islands, *History*), he established a protectorate over the islands. This action was disavowed by the Secretary of State of the United States, and subsequently Stevens was recalled, and was exonerated by the Senate. His publications include a scholarly and valuable *History of Gustavus Adolphus* (1884).

STEVENS, Phineas (1707-56). A colonial soldier in America, born at Sudbury, Mass. About 1711 he removed with his father to Rutland, N. H. (now in Vermont), and in 1723 was a captive for a time among the Saint Francis Indians. He was one of the pioneer settlers of "Township No. 4" (now Charlestown, N. H.), and in April, 1747, during King George's War, as commandant of the fort there, repelled the attack of 400 French and Indians under Niverville. He was twice (1749 and 1752) sent to Canada to negotiate an exchange of prisoners. A journal kept by him during his first trip to Canada is printed in the *New Hampshire Historical Collections,* vol. v.

STEVENS, Robert Livingston (1787-1856). An American inventor and marine engineer, son of John Stevens (q.v.), born in Hoboken, N. J. He applied the wave line to shipbuilding, invented a percussion shell (the rights to which were bought by the Government), was one of the first to use anthracite coal in steam navigation, and introduced many improvements in the construction of steamships and marine engines. In 1842 he was commissioned by the Government to build the first iron-clad warship ever constructed, generally known as the Stevens Floating Battery; but, owing to improvements in ordnance and the consequent changes in specifications, he died without completing it. See STEVENS, EDWIN AUGUSTUS.

STEVENS, THADDEUS (1792-1868). An American statesman and Congressional leader, born at Danville, Vt., April 4, 1792. He graduated at Dartmouth College in 1814; taught school in York, Pa., and studied law; began to practice in Gettysburg, and removed to Lancaster, Pa., in 1842. In 1833 he became a member of the State Legislature, in which he sat for a number of years, serving with credit. In 1836 he was a delegate to the State Constitutional Convention, winning notoriety by his advocacy of negro suffrage. Stevens affiliated with the Anti-Masonic Party (see ANTI-MASONS), and was an active member of its Baltimore convention in 1831; but from the time of his election to the Legislature he acted with the Whigs. His career in the Legislature was varied, but indicative of his energy and ability, and although his business interests suffered severely, he conquered the 'machine' in his own party, and in December, 1849, took his seat in Congress. During two terms that he filled there he opposed not only the Fugitive Slave Law, but also every form of concession to the South. After an interval of six years devoted to the practice of law he returned to Congress in 1859, and from then until his death was the recognized leader of the House of Representatives, being chairman of the Committee on Ways and Means throughout the war, and later chairman of what was then the equally important Committee on Reconstruction. He was regarded as the most radical antislavery advocate in Congress. He was one of the authors of the so-called Wade-Davis Reconstruction Bill of 1865 and reported the Reconstruction Act of 1867 from the committee of which he was chairman. (See RECONSTRUCTION.) He was chairman of the House committee in charge of the impeachment of President Johnson (q.v.). He died at Washington, August 11, 1868. Biographies have been written by E. B. Callender (Boston, 1882), and by S. W. McCall (Boston, 1899), the latter being one of the "American Statesmen Series."

STEVENS, WALTER LE CONTE (1847—). An American physicist. He was born in Gordon County, Georgia, and graduated from the University of South Carolina in 1868. He was professor at Oglethorpe College, Atlanta, Ga.; Chatham Academy, Savannah, Ga.; Packer Collegiate Institute, Brooklyn, N. Y.; Rensselaer Polytechnic Institute, Troy, N. Y.; and in 1903 occupied the chair of physics at Washington and Lee University, Lexington, Va.

STEVENS INSTITUTE OF TECHNOLOGY. A school of mechanical engineering, in Hoboken, N. J., established in 1870, and named for its founder, Edwin A. Stevens, who bequeathed to it a block of land and $650,000. The school was opened in 1871 with Henry Morton as its first president. The curriculum embraces thorough training in applied mathematics, in the theory of machine construction with a study of existing systems, mechanical drawing and designing, shop practice and experimental mechanics, physics, chemistry, and applied electricity, with English branches and the modern languages. Admission is by examination solely; the only degree conferred is that of mechanical engineer. The institute has been the recipient of many benefactions, the most notable being those of Henry Morton, who, during his presidency of thirty years, gave to the institute about $150,000, and those of Andrew Carnegie, whose gifts amounted to $290,000 in 1903, in which year the endowment was $820,000, with an income of $91,000. The grounds and buildings were valued at $390,000, with a total estimated value of $1,250,000 for the property under its control. The Institute had in that year an attendance of 296, with 22 instructors, and the academic department an enrollment of 254, with 15 instructors. The library contained about 8000 volumes. In 1901 Alexander C. Humphreys became president of the Institute.

STE'VENSON, ADLAI EWING (1835—). An American politician, Vice-President of the United States in 1893-97. He was born in Christian County, Ky., and was educated at Centre College, Danville, Ky., but removed with his parents to Bloomington, Ill., before graduating. At Bloomington he studied law and in 1857 was admitted to the bar. He was a master in chancery from 1860 to 1864, became prominent in Democratic local politics, and was a member of the 44th Congress (1875-77), and of the 46th Congress (1879-81). As First Assistant Postmaster-General during President Cleveland's first administration he antagonized civil-service reformers by his sweeping removal of Republican postmasters. In 1892 he was chairman of the Illinois delegation to the Democratic National Convention, by which he was nominated for Vice-President on the Cleveland ticket, which was elected. In 1897 he was appointed by President McKinley a member of the commission sent to Europe to inquire into the feelings of European Powers in regard to the possible establishment of international bimetallism. In 1900 he was again the candidate of the Democratic party for Vice-President.

STEVENSON, GEORGE JOHN (1818-88). An English hymnologist, educated at Saint John's College, Battersea, London. In 1846 he became head master of the Philanthropic Institute, a reformatory at Southwark; and in 1848, head master of the parochial school at Lambeth Green. Resigning his position in 1855, he started as a London bookseller and publisher, and continued this business until a short time before his death. In 1831 he became a Methodist, and thereafter gave much time to the history and the literature of his sect. From 1861 to 1867 he edited the *Wesleyan Times*. His *Methodist Hymn Book and Its Associations* (1869; enlarged with slightly changed title, 1883) is a valuable work. Among other publications are books on Spurgeon (1857 and 1867), *Memorials of the Wesley Family* (1876), and *Methodist Worthies* (1884). Consult Julian's *Dictionary of Hymnology* (London, 1892).

STEVENSON, JOHN JAMES (1841—). An American geologist, born in New York City. He graduated at New York University in 1863. He became professor of chemistry at West

Virginia University in 1869 and in 1871 was appointed professor of geology in New York University. He served as geologist on the United States Geological Survey west of the 100th meridian in 1873-74 and 1878-80. He was also on the Pennsylvania Geological Survey in 1875-78 and in 1881-82. In this work he made out the classification of the upper coal measures of Ohio and Pennsylvania, and also described the coal area of New Mexico and southeastern Colorado. He became corresponding member of the more important scientific societies and academies of foreign countries. He was president of the New York Academy of Sciences from 1896 to 1898, and president of the Geological Society of America in 1898. His publications include: *The Geology of a Portion of Colorado Explored and Surveyed in 1873* (1875); *Report of Progress in the Greene and Washington District of the Bituminous Coal Fields of Western Pennsylvania* (1876); *Report upon Geological Examinations in Southern Colorado and Northern New Mexico During 1878 and 1879* (1881); *Origin of the Pennsylvania Anthracite* (1893); *Lower Carboniferous of the Appalachian Basin* (1903); and more than a hundred other memoirs, many of the greatest importance, on geological topics.

STEVENSON, Joseph (1806-95). A Scottish antiquary, born at Berwick-upon-Tweed. In 1831 he was appointed to a post in the manuscript department of the British Museum, and in 1834 became a sub-commissioner of the public records. He was ordained a priest in the Church of England (1839), but his studies in the Reformation period of English history led him to the Roman Catholic Church (1863). In 1877 he entered the Society of Jesus. For his services he was granted a Government pension, and was honored by Saint Andrews with the degree of LL.D. At the suggestion of Stevenson, the English Government began in 1857 the valuable *Chronicles and Memorials of Great Britain and Ireland*, otherwise known as the *Rolls Series*. The Government also sent him to Rome to make an exhaustive examination of the Vatican archives. The thirteen volumes of his manuscript were deposited in the Public Record Office, but were not published. Stevenson edited nearly fifty works for the leading learned societies.

STEVENSON, Robert (1772-1850). A Scotch engineer, born at Glasgow. His progress in the study of engineering was so rapid that in 1791 he was entrusted with the erection of a lighthouse on Little Cumbrae. During forty-seven years' service as engineer and inspector of lighthouses, he planned and constructed twenty-three lighthouses round the Scottish coasts, employing the catoptric system of illumination, and his valuable invention of intermittent and flashing lights. The most remarkable of these structures was that on the Bell Rock (q.v.). The enterprise was unprecedented in lighthouse engineering, for the Bell Rock was never uncovered except at the lowest ebb tides. Stevenson was the author of four volumes of professional printed reports, a large work on *The Bell Rock Lighthouse* (Edinburgh, 1824), and articles in the *Encyclopædia Britannica* and in the *Edinburgh Encyclopædia.*—His son Alan (1807-65) was also an engineer of prominence, and was the author of a *Treatise on Lighthouse Illumination.* See Lighthouse. Consult Stevenson, *Life of Robert Stevenson* (Edinburgh, 1878).

STEVENSON, Robert Alan Mowbray (1847-1900). An English art critic, a cousin of Robert Louis Stevenson. He was born in Edinburgh, was educated at Sussex College, Cambridge, and studied art in the Edinburgh School of Art, and in Paris and Antwerp, but never attained much success as a painter. In 1882 he began to teach art at Cambridge and in 1889 became professor of fine arts at University College, Liverpool. He was one of the most gifted and just of English critics. His sympathies were with the impressionist school, but his judgment was impartial, and he possessed a keen analytical mind and an effective style. His works include: *Engraving* (1886), from the French of Delaborde; *Peter Paul Rubens* (1898); *The Art of Velazquez* (1895; revised ed. in Williamson's series of *Great Masters,* 1899); and an *Essay on Raeburn* (1900).

STEVENSON, Robert Louis (properly Robert Lewis Balfour) (1850-94). A Scottish romancer, essayist, and poet, born in Edinburgh, November 13, 1850, the only son of Thomas Stevenson, a distinguished lighthouse engineer. After beginning his education at various schools and under private tutors, he entered Edinburgh University in 1867, with the intention of becoming an engineer. On this profession he turned his back in 1871, and prepared for the bar, to which he was called in 1875. He had already written several essays and tales and some verse, but chiefly with a view of, in his own forcible phrase, "playing the sedulous ape" to the great masters. His strong bent to a literary career was now encouraged by the friendship of such men as Edmund Gosse, Andrew Lang, and Sidney Colvin, whom he met in London. A canoeing trip in Belgium and France and a walking tour in the Cévennes furnished material for *An Inland Voyage* (1878) and *Travels with a Donkey* (1879), sketches in which he gave full proof of his exquisite literary art. Without attracting much attention, he was contributing to the *Cornhill Magazine* and *Temple Bar* short stories, and some of his best essays, those which were afterwards collected under the titles of *Virginibus Puerisque* (1881) and *Familiar Studies of Men and Books* (1882). To this period also belong the fascinating, fantastic *New Arabian Nights* (1882), first published between 1876 and 1878. In 1876 he had met, in an artistic colony near Paris, Mrs. Osbourne, an American lady, who was afterwards to be his wife. In 1879, hearing from California that she was seriously ill, he made up his mind to go there. His resources were so limited that he made the long journey in an emigrant ship and train, noting his curious experiences and publishing them afterwards in *The Amateur Emigrant* (1894) and *Across the Plains* (1892). He spent two years in California, often in very delicate health, and in 1880 married Mrs. Osbourne. The next few years were spent in various health resorts—Davos, the Riviera, Bournemouth, and the Adirondacks. Often under the most discouraging conditions, but with that brave cheerfulness which was the distinguishing note of his character, he worked incessantly. Success first came to him with the publication in 1883 of *Treasure*

Island, a tale of pure adventure. *Dr. Jekyll and Mr. Hyde* (1886), a striking ethical parable under the guise of fiction, attracted the more thoughtful and was recommended from many a pulpit. In the same year appeared *Kidnapped*, which, with its sequel *David Balfour* (1893) and the *Master of Ballantrae* (1889), offered vivid pictures of the Scottish life of the past. In 1888, still in quest of health, he left San Francisco with his family on a voyage to the South Seas. Pleased with the scenery and the people of Samoa, he made a permanent home for himself there in 1890 and acquired a position of commanding influence among the natives. After an heroic struggle against consumption, he died, through the rupture of a blood-vessel in the brain, December 3, 1894, and was buried on the peak of Mount Vaea, above Vailima, his Samoan home. Active to the last, he left several manuscripts, among which were two romances, *Weir of Hermiston* (1896) and *St. Ives* (completed by Quiller-Couch, 1897). The former, which no writer was bold enough to touch, is generally considered, even in its unfinished state, Stevenson's masterpiece. Others of his works which deserve special mention are: *The Silverado Squatters* (1883); *Prince Otto* (1885), a dainty romantic tale; three books written in collaboration with his stepson, Lloyd Osbourne, *The Wrong Box* (1888), *The Wrecker* (1892), and *The Ebb Tide* (1894); a volume of exquisite verse, *Underwoods* (1887); *A Child's Garden of Verses* (1885); *The Merry Men and Other Tales* (1886), a volume of short stories in which his mastery over the grim and terrible best shows itself; *Memoir of Fleeming Jenkin* (1887); and *Father Damien, an Open Letter* (pamphlet, 1890), unique among Stevenson's writings, and one of the most powerful *apologia* in English.

In both fiction and essays Stevenson displays the possession of an exquisite and finished style; his work is that of a true artist in words, and his example stimulated many of the younger artists of the day to more or less conscious imitation. His influence was also great in regard to the subject-matter of fiction. At a time when the novel had forgotten to tell a story and was running into minute philosophical analysis, Stevenson came forward with adventure as purely romantic as Scott's, though in structure, in method of description and narrative, and in brilliancy of style he marks the great technical advance which had been made since the days of the *Waverley Novels*. But it was not only the many delightful qualities of his written work which made Stevenson the best loved writer of his time; even more, perhaps, he was endeared to countless readers by the frank revelation of a most engaging personality, which shines through all his works—of a serene undaunted cheerfulness, gained not by shutting his eyes to the pathos and the difficulty of human conditions, but by a brave rising to the height of their demands and an unwavering sense of the compensations which such an attitude offers.

The most nearly completed collection of his works is the sumptuous Edinburgh edition, edited by Sidney Colvin (1894-98); two volumes of charming letters arranged by the same editor, with much biographical matter, appeared in 1899, and the *Vailima Letters*, written from Samoa in 1895. Consult also the biographies by his cousin Graham Balfour (London, 1901), Baildon (ib., 1901), Black (Edinburgh, 1898), and Cornford (ib., 1899); also Simpson, *Stevenson's Edinburgh Days* (London, 1898); Fraser, *In Stevenson's Samoa* (ib., 1895); Osbourne and Strong, *Memories of Vailima* (ib., 1903); and critical studies by Raleigh (London, 1895); James, in *Partial Portraits* (ib., 1888); Chapman, in *Emerson and Other Essays* (New York, 1896). See also English Literature; Novel; Romanticism.

STEVENSON, Sara (Yorke) (1847—). An American archæologist, born in Paris, France. She was educated in Paris at the Cours Rémy and the Institut Descauriet, resided in Mexico in 1862-67, and later became known as an archæologist. In 1889 she was an organizer of the department of archæology of the University of Pennsylvania, in 1890 became curator of its Egyptian and Mediterranean sections, and in 1894 its secretary. She also received the secretaryship of the American Exploration Society in 1897 and the presidency of the Pennsylvania branch of the Archæological Institute of America in 1899; in 1898 visited Egypt for the Exploration Society and the city of Philadelphia; and in 1893 was vice-president of the jury on ethnology at the World's Columbian Exposition. Among her writings are various papers and articles on archæology, and the volume *Maximilian in Mexico* (1898).

STE'VENS POINT. The county-seat of Portage County, Wis., 150 miles northwest of Milwaukee, on the Wisconsin River, and on the Wisconsin Central Railroad (Map: Wisconsin, D 4). It is the seat of a State normal school, and has a Polish normal academy and a public library. The region is one of the richest lumbering sections in the State. It also has some mineral wealth and there is excellent water power. There are saw mills, paper mills, knitting mills, a foundry, and manufactories of sashes and doors, furniture (including tables and desks), engines, boxes, wall paper, etc. The manufacture of artificial flies for fishing is an important industry. The government is vested in a mayor, elected biennially, and a unicameral council. Stevens Point was settled in 1836, and received its present charter in 1897. Population, in 1890, 7896; in 1900, 9524.

STEVIN, Simon (1548-1620). A Dutch mathematician, physicist, and engineer born in Bruges. After being a merchant and traveling extensively through Europe, he enjoyed the favor of Prince Maurice of Orange, holding under his appointment civil and military offices, his scientific qualifications making him particularly valuable in military engineering, where he enjoyed a high reputation. He is best known for his mathematical work which led to the introduction of decimal fractions, and he stated that the universal use of a decimal system of coinage, measures, and weights was bound to come. He also made valuable contributions to mechanics and physics, demonstrating the resolution of forces, the equilibrium of forces on an inclined plane, showing the difference between stable and unstable equilibrium, and the fact that the pressure of a liquid is independent of the shape of the containing vessel and depends merely upon the height and area of the base. He wrote on double-entry bookkeeping and adopted it for the material needs of Prince Maurice. Stevin's mathematical works, a part of which were published in Dutch in 1568 were collected and translated into French, being published in 1634. For his work in mathematics consult: Cantor, *Vorlesungen über Geschichte der Mathematik* (Leipzig, 1892); for his work in physics, Gerland and Traumüller, *Geschichte der Physikalischen Experimentier Kunst* (Leipzig, 1899).

STEWARD (AS. *stīgweard, stiweard,* from *stīg,* pen for cattle, sty + *weard,* guard), LORD HIGH. The first of the great offices of State in England. Although of ancient origin, it owes its eminence to John of Gaunt (1340-99). It was hereditary in various lines until the accession of Henry IV. (1399), when it was merged with the Crown, and has since been in abeyance except when temporarily revived from time to time under the great seal *pro hac vice.* It is now revived only on the occasion of a coronation, when the Steward is of great ceremonial importance, or the trial of a peer by the House of Lords for treason or felony, when the Steward presides. The last session of this character occurred in 1901, before which the Lord High Steward's Court had not met for sixty years. When the proceedings are at an end, the Lord Steward terminates his commission by breaking his wand of office.

STEWART, stū'ērt. A Scotch and English royal family. See STUART.

STEWART, ALEXANDER TURNEY (1803-76). An Irish-American merchant, born at Lisburn, near Belfast, Ireland, of Scotch parentage. He entered Trinity College, Dublin, with the intention of studying for the ministry, but left before graduating and in 1823 emigrated to America. Settling in New York City, he taught school for two years, and in 1825, having fallen heir to a small legacy from some Irish relatives, he established himself in the dry-goods business. In 1848 he built the store at Broadway and Chambers Street, which at the time was the largest dry-goods store in the world. In 1862 he removed his retail business to a new store, which he erected at a cost of $2,750,000, at Broadway and Ninth and Tenth Streets, retaining his old store for wholesale trade. At the time of his death the business of A. T. Stewart and Company comprised branches and agencies in the principal cities of Europe, and several mills and factories in the United States.

STEWART, ALVAN (1790-1849). An American abolitionist, born at South Granville, Washington County, N. Y. After teaching in the Royal School of the seignory of Saint Armand, Canada, in 1811-12, and practicing law at Utica, N. Y., he devoted himself chiefly to advocating temperance and the abolition of slavery. In 1835 he called together in Utica an anti-slavery convention that was dispersed by mob violence. According to William Godell, Stewart was the first to insist "on the necessity of forming a distinct political party to promote the abolition of slavery." When such a party was formed, he was its candidate for Governor, but was, of course, defeated. Years before Lincoln made his famous 'house divided against itself' speech or Seward his 'irrepressible conflict speech,' Stewart declared that "these States must necessarily be in eternal conflict until liberty conquers slavery, or slavery overturns the liberty of all." A collection of his speeches, with a slight memoir, was published by his son-in-law, Luther R. Marsh (New York, 1860).

STEWART, BALFOUR (1828-87). A British physicist and meteorologist. He was born at Edinburgh, and was educated at Saint Andrews University and Edinburgh University. After a brief career in business in 1856 he became connected with Kew Observatory, later (1859) being appointed its director. He was appointed professor of natural philosophy in Owens College, Manchester, in 1870, where he served until his death.

Professor Stewart's researches in radiant heat procured for him the Rumford medal of the Royal Society. He also devoted himself to the study of terrestrial magnetism and meteorological problems, particularly those connected with solar radiation. He was also a devout churchman and was a member of a committee appointed to promote the interchange of views of scientific men of orthodox religious opinions. In *The Unseen Universe,* a popular work written by Stewart in conjunction with Professor Tait, an attempt was made to combine theological doctrines with the scientific ideas then current to demonstrate the existence of the soul and of a transcendental universe. He published an *Elementary Treatise on Heat* (1866, 5th ed. 1888); *Lessons in Elementary Physics* (1871); *Physics* (1872); *The Conservation of Energy* (1875); and *Lessons in Practical Physics,* with W. H. Gee (vol. i., 1885; vol. ii., 1887).

STEWART, CHARLES (1778-1869). An American naval officer, born in Philadelphia, Pa. At the age of thirteen he shipped on board a merchant vessel as cabin boy, and in a few years rose to be captain of an Indiaman. In 1798 he entered the United States Navy as fourth lieutenant of the frigate *United States,* on which he served until 1800, after which he was given command first of the schooner *Enterprise* and then of the *Experiment.* Soon afterwards he captured the French schooner *Deux Amis,* and a few days later the schooner *Diane.* While on this cruise he captured the British privateer *Louisa Bridger* by a night action, but on discovering her nationality made suitable reparation. In 1804, in command of the *Siren,* he joined the Mediterranean Squadron. He then returned to the United States in command of the *Constellation,* and in 1806 was promoted to be captain. During the following years he was for a time in the merchant service, but he reëntered the navy, and at the outbreak of the War of 1812 aided Commodore Bainbridge in persuading the Administration to send the United States warships to sea instead of keeping them in New York Harbor. In 1813 he was transferred to the *Constitution,* which on February 28, 1815, captured two British war vessels, the *Cyane,* 34 guns, and the *Levant,* 21 guns. Soon afterwards, however, he was surprised by a British squadron and the *Levant* was recaptured. He commanded the Mediterranean Squadron from 1817 to 1820, after which he was sent to the Pacific Station. On his return in 1823 he was tried by court-martial on a number of charges, but was acquitted. He commanded the Home Squadron in 1842-43, and for several years was commandant of the Philadelphia Navy Yard. In 1862 he was promoted to the rank of rear-admiral. During the last seventeen years of his service he was senior officer of the navy.

STEWART, David, Duke of Rothesay and Earl of Carrick. See Rothesay.

STEWART, Sir Donald Martin (1824-1900). A British field-marshal. He was born near Forres, Elginshire; completed his education at Aberdeen University, and in 1840 joined the Bengal Army. He saw active service on the frontier; served with distinction during the Indian Mutiny at the sieges of Delhi and Lucknow; commanded the Bengal troops in the Abyssinian War in 1867-68; and from 1869 to 1874 was chief commissioner of the Andaman and Nicobar Islands. During the Afghan War in 1878 he was in command of the Kandahar field force, and in 1880 on his celebrated march from Kandahar to Kabul won the battles of Ahmed Khel and Urzu. As military and civil commander in Northern Afghanistan, he sent Sir Frederick Roberts on his famous march from Kabul to Kandahar, while he withdrew with the remainder of the army through the Khyber Pass.

STEWART, Dugald (1753-1828). A Scottish philosopher, born in Edinburgh. He studied at the University of Edinburgh from 1765 to 1769. In 1771 he went to Glasgow, partly with a view to one of the Snell scholarships at Balliol College, Oxford, and partly to attend the lectures of Dr. Reid. It was there that he wrote an essay on dreaming, which was his first effort in mental philosophy and contained the germs of many of his subsequent speculations. He lived in the same house with Archibald Alison, the author of the *Essay on Taste*, and the two became intimate friends through life. He was at Glasgow only one session. In 1772, in his nineteenth year, he was called upon by his father, whose health was failing, to teach the mathematical classes in the University of Edinburgh; in 1775 he was elected joint professor, and acted in that capacity till 1785. In 1778 Adam Ferguson was absent from his post on a political mission to America, and Stewart taught the moral philosophy class in addition to his mathematical classes. On the resignation of Ferguson in 1785, he was appointed professor of moral philosophy, and continued in the active duties of the chair for twenty-five years. In 1792 appeared his first volume of the *Elements of the Philosophy of the Human Mind*. In 1793 he published his *Outlines of Moral Philosophy* In 1806, on the accession of the Whig Party to power, he received a sinecure office worth £300 a year. In 1810 Stewart gave up his active teaching work and retired to Kinneil House, Linlithgowshire, which the Duke of Hamilton placed at his service. In the same year he published his *Philosophical Essays;* in 1814 the second, and in 1827 the third volume of the *Elements;* and in 1828 *Philosophy of the Active and Moral Powers*. He died in Edinburgh, June 11, 1828.

The philosophy of Stewart was the following up of the reaction against the skeptical results that Berkeley and Hume drew from the principles of Locke. Both Reid and Stewart professed the Baconian method of observation and induction, but considered that these processes of investigation could establish certain ultimate truths of a higher certainty than themselves. His collected works were edited by Sir W. Hamilton, in 11 vols. (Edinburgh, 1854-59), to which Professor Veitch contributed a biography.

STEWART, Matthew, Earl of Lennox (1516-71). A Regent of Scotland. He was born in Dumbarton Castle and was the son of John, third Earl of Lennox. After negotiations with Henry VIII. of England which resulted in treason to his own country, he married Henry's niece, Lady Margaret Douglas, and engaged in several fruitless expeditions in the attempt to bring Scotland under the control of England. When Mary Stuart came to the throne of Scotland, Lennox returned to his native country, was reinstated in his forfeited estates, and arranged the marriage between Mary and his eldest son, Henry, Lord Darnley (q.v.). After his son's murder he took an active part in the seizure and imprisonment of Mary in Lochleven Castle, and was provisionally appointed Regent on behalf of his infant grandson, afterwards James VI. He was appointed lieutenant-general of the kingdom and confirmed in the Regency after the assassination of Murray, in 1570; he led his forces against and gallantly defeated the Queen's supporters, capturing the castles of Doune and Dumbarton; and convened a parliament at Leith which was adjourned to be held later at Stirling. While on his journey to the latter town he was mortally wounded during a skirmish with some of the Queen's partisans.

STEWART, Robert, second Marquis of Londonderry, best known as Viscount Castlereagh (1769-1822). An eminent English statesman. He was the eldest surviving son of Robert, first Marquis of Londonderry, and was educated at Saint John's College, Cambridge. He entered the Irish Parliament in 1790 at the age of twenty-one. In 1796 he became Viscount Castlereagh; and in 1798 he was made Chief Secretary for Ireland. In suppressing the rebellion of that year he was resolute and energetic. In helping to bring about the Parliamentary union with England he made free use of English money in corrupting opponents of the plan. He entered the Imperial Parliament, and in 1805-06 was Secretary of State for the War and Colonial departments. Resigning on Pitt's death in 1806, he resumed the office of War Minister next year, and organized the disastrous Walcheren expedition (1809). Canning (q.v.), then Foreign Secretary, attacked Castlereagh on this account with much bitterness. The result was that both resigned, and a duel took place between them, September 21, 1809, in which Canning was wounded. After the assassination of Perceval in 1812, Castlereagh became Foreign Secretary, a post which he held during the period famous for the achievements of the Duke of Wellington. By this time the general direction of British policy was unalterably fixed by circumstances, and it was the merit of Castlereagh that he pursued this course with steadiness and even obstinacy. His personal influence and his untiring exertions kept together the coalition against Napoleon. He represented England at the Congress of Vienna in 1814-15, at the Treaty of Paris in 1815, and at the Congress of Aix-la-Chapelle in 1818. His foreign policy was favorable to the principles of the 'Holy Alliance' abroad and he constantly recommended despotic measures at home. As the leader of the Liverpool Government in the Lower

House, he carried the suspension of the Habeas Corpus Act in 1817. The 'Six Acts' of 1819 made him extremely unpopular. The retirement of Canning from the Ministry (1820) threw the whole weight of business on Castlereagh. By the death of his father in 1821 he became Marquis of Londonderry. The great toil and responsibility of his office deranged his mind, and he died by his own hand at his seat at North Cray Place, Kent, August 12, 1822. Consult his *Memoirs and Correspondence* (12 vols., London, 1848-53).

STEWART ISLAND. See New Zealand.

STEYN, stīn, Martinus Theunis (1857—). A South African statesman, the last President of the Orange Free State. He was born at Winbury, Orange Free State, and was educated at Grey College, Bloemfontein, and in Holland, after which he studied law at the Inner Temple, London, and was called to the bar in 1882. Returning to South Africa, he resided at Bloemfontein, where he at once gained distinction as a lawyer and in 1889 became State Attorney. In the same year he was elevated to the bench as second puisne judge, and in 1893 was appointed first puisne judge. In 1896 he was chosen by universal suffrage President of the Republic. His policy was at once manifested in an attempt to draw the two Boer States closer together, and the defensive alliance agreed upon by the Orange Free State and the Transvaal in 1897 had his hearty support. In the summer of 1899 he represented his State in the conference at Bloemfontein with Sir Alfred Milner (q.v.) and President Kruger (q.v.) in an attempt to adjust the difficulties existing between the British and the Boers. Upon the failure of negotiations and the breaking out of hostilities he at once called out the Free State troops to act in coöperation with those of the Transvaal. During the course of the war he continued actively assisting and advising the generals in the field, moving his capital from place to place. In May, 1900, after the British had annexed the Orange Free State by proclamation, he issued a counter-proclamation reasserting the State's independence, and calling on the burghers to continue their defense. After Kruger's departure for Europe he became the virtual head of the Boer forces in the field. He took part in the peace conference that led to a cessation of hostilities in 1902 and subsequently took up his residence in London.

STEYNE, Lord. A clever and wicked old nobleman in Thackeray's *Vanity Fair,* who is involved in a scandal with Becky Sharp.

STEYR, stīr, or **STEIER.** A town of Upper Austria, at the confluence of the Steyr and the Enns, 90 miles west by south of Vienna (Map: Austria, D 2). Its principal structures are the Gothic church (1443) and the palace of Count Lamberg (tenth century). It is an important centre of the Austrian iron and steel industry. There is here a large Government rifle factory; the manufactures are cutlery, leather, paper, woolens, hosiery, etc. Population, in 1890, 21,499; in 1900, 17,592.

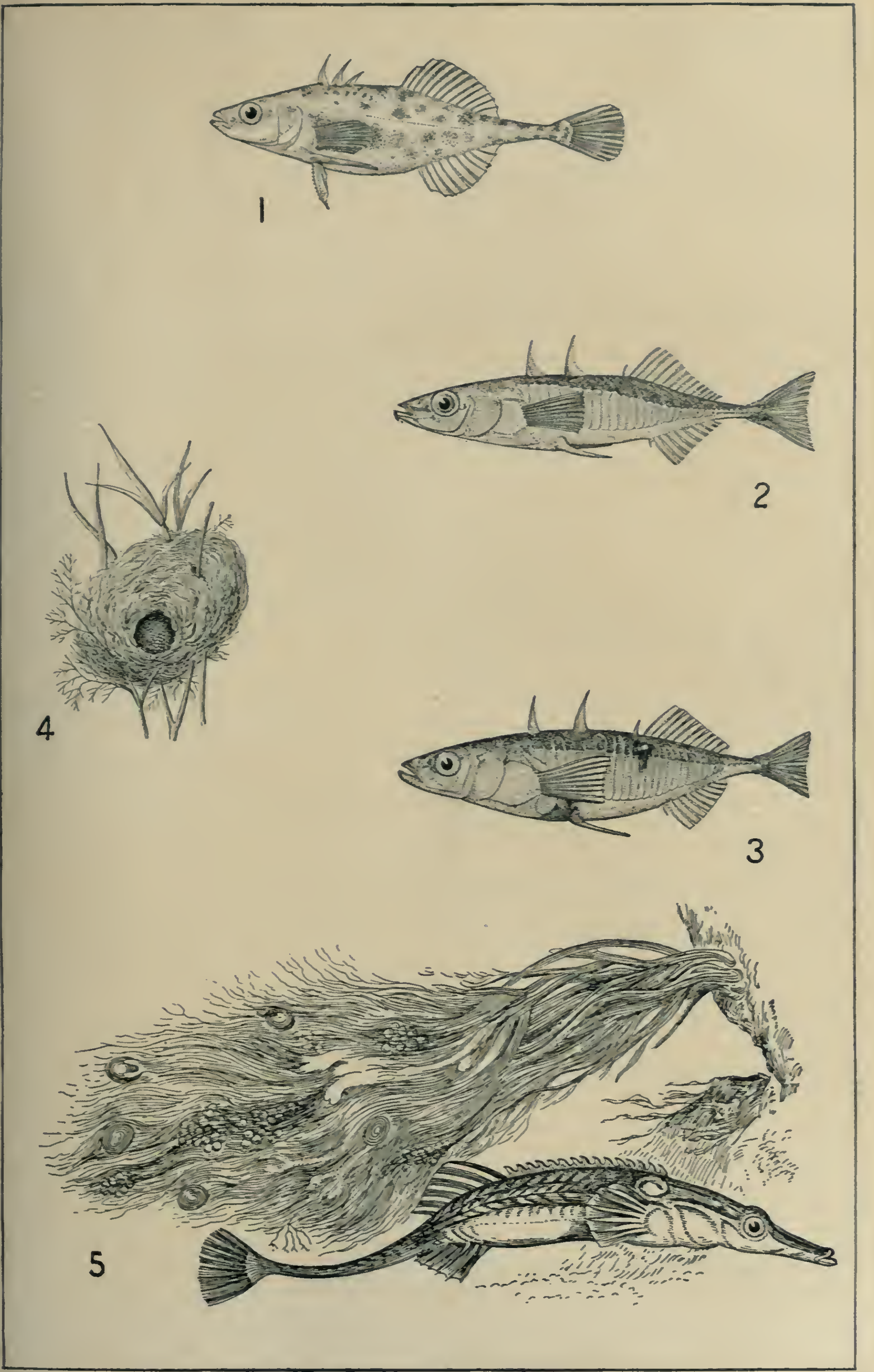
STIBNITE (from Neo-Lat. *stibium*, from Gk. *στίβι, stibi, στίμμι, stimmi,* sulphuret of antimony, probably from Egypt. *sṭm*, stibium). A mineral tri-sulphide of antimony crystallized in the orthorhombic system. It has a metallic lustre, and is red to steel-gray in color. It occurs with quartz, in beds or veins, in granite or gneiss, often with other antimony minerals and metallic sulphides. It is found in the Harz, Freiberg, Cornwall (England), Algeria, Borneo, Japan, and in the United States in Maine, New Hampshire, Maryland, Arkansas, and at various localities in California and Utah. It was used by the ancients for coloring the hair, eyebrows, etc. Stibnite is an important ore of antimony.

STICKLEBACK (so called from the sharp spines on its back). A general name for the small active fresh-water hemibranch spiny-rayed fishes of the family Gastrosteidæ, interesting because of their nest-building. They are natives of Northern America, Europe, and Asia. There are a dozen or so species, none exceeding six inches long. The body is slender and more or less compressed, without scales, but usually mailed with plates. The anterior dorsal fin is replaced by several strong, widely separated spines. The ventral fin consists of a strong spine and one or two rudimentary rays. The typical form is the common European stickleback or 'burnstickle' (*Gasterosteus aculeatus*), represented in Eastern North America by the very similar or identical *Gasterosteus bispinosus.* It is four inches long, is olivaceous and dotted on the back, and has three dorsal spines. In the spring the male of this species builds upon the bottom of the stream a nest composed of bits of straw, sticks, leaves of plants, and sand, glued together by a secretion produced by a special gland. This secretion is drawn out into a silk-like thread by which the materials are entangled or woven together as the fish in moving about trails it after him. The completed shape is like that of a hand-muff, smooth inside, and with its openings in the direction of the current. When the house is completed the male induces a female to enter and deposit her eggs, a process lasting only a few minutes. The female then leaves by one of the openings and the male enters by the other to deposit milt over the eggs. In turn other females are invited in, until the nest contains layer after layer of eggs and milt. These the male guards with care against many enemies, until the young are hatched and able to shift for themselves. Sticklebacks are remarkably voracious and extremely destructive to the young fry of fishes. Consult authorities cited under Aquarium; and Fish. See Plate of Sticklebacks and Their Nests.

STIELER, stē'lēr, Adolf (1775-1836). A German cartographer, born at Gotha, and educated at Jena and Göttingen. He was employed in the Government service at Gotha. His principal cartographic work, establishing a remarkable standard of accuracy and completeness, is *Der Handatlas* (1817), and his other publications include: *Schulatlas* (1821); *Kleiner Atlas der deutschen Staaten* (1876); *Taschenatlas* (revised by Habenicht, 1885); and *Deutschland, Niederlande, Belgien, Schweiz und angrenzende Länder* (1829).

STIELER, Joseph (1781-1858). A prominent German portrait painter, born at Mainz. Self-taught, he practiced miniature painting early in life, then studied at Würzburg under Christoph Fesel (1737-1805) and at the Vienna Academy under Füger. After painting portraits in Hungary and Poland, he spent two years (1807-9) in

STICKLEBACKS



1. COAST STICKLEBACK (Apeltes quadracus).
2. EUROPEAN STICKLEBACK (Gasterosteus aculeatus).
3. SALMON-KILLER (Gasterosteus cataphractus).
4. NEST OF EUROPEAN STICKLEBACK (Gasterosteus aculeatus).
5. SEA-ADDER (Spinachia spinachia) and its eggs hidden among the seaweed.

Paris, a pupil of Gérard, then worked at Frankfort and Milan, and in 1811 went to Rome, where he executed the large altar-piece "Liberation of Saint Leonhard" (Saint Leonhard's Frankfort). Called to Munich in 1812, he portrayed all the members of the royal family, then in Vienna, where he remained from 1816 to 1820, the Emperor Francis and his consort, besides many notables, among them Beethoven (1819). After his return to Munich Stieler became the most fashionable portraitist of his day, among whose numerous paintings of royalties, statesmen, scholars, artists, and other celebrities may be noted the familiar portrait of Goethe (1828, New Pinakothek, Munich), reproduced in an earlier volume (see GOETHE), and the famous "Gallery of Beauties" (1827-47, Royal Palace, Munich).

STIELER, KARL (1842-85). A Bavarian dialect poet and author, born in Munich, son of the preceding. After studying law in his native city he undertook extensive travels, which he described in letters to the *Allgemeine Zeitung*. Afterwards he became State archivist in Munich. His poems, written in the dialect of Upper Bavaria and overflowing with fresh, delicious humor, appeared in the following collections: *Bergbleameln* (1865), *Weil's mi freut* (1876; 11th ed. 1896), *Habt's a Schneid'?* (1877), and others, all of which met with great favor, as did also his High German poems *Hochlandslieder* (1879; 8th ed. 1896), *Neue Hochlandslieder* (1883; 4th ed. 1892), and *Wanderzeit* (1882; 3d ed. 1893). Posthumously were published *Ein Winteridyll* (21st ed. 1897), *Kulturbilder aus Bayern* (2d ed. 1895), *Natur- und Lebensbilder aus den Alpen* (1890), *Aus Fremde und Heimat* (1886), and *Durch Kriegzum Frieden* (1895). For his biography, consult Heigel (Bamberg, 1891).

STIFF-NECK. See WRYNECK.

STIFTER, stēf′tẽr, ADALBERT (1805-68). An Austrian poet, novelist, and painter, born at Oberplan, Bohemia. He studied law at the University of Vienna, but gave the preference to history, philosophy, and natural science, embraced the profession of teaching, and in 1850 was appointed superintendent of public schools in Upper Austria. His idyls and novelettes, collected under the title *Studien* (1844-51, 13th ed. 1895-96), rank with the best prose writings of his time, and from their first appearance evoked unstinted admiration. Their purely idyllic character, utterly alien to all worldly problems and tendencies, the masterly details in the author's original conceptions and descriptions of nature, constituted so grateful a contrast to the current belletristic productions as to atone for the merely accessory rôle assigned to the human element. The *Studien* were followed by *Bunte Steine* (1852; 9th ed. 1892); and the novels *Der Nachsommer* (1857) and *Witiko* (1865-67). His letters, with biography, were published by Aprent (1869). An edition of his complete works appeared in Prague (1901 et seq.). Consult: Kuh, *Zwei Dichter Oesterreichs* (Pressburg, 1872); and the biographies by Markus (Vienna, 1877), Pröll (Prague, 1891), and Stoessl (Berlin, 1902).

STIGMA (from Gk. στίγμα, *stigma*, mark, brand, puncture). In anatomy, a spot or mark on the skin or a small cicatrix; in botany, an apex, as the point of a pistil; in entomology, the spiracle of an insect. To the psychiatrist a stigma is an anatomical or functional deviation from the normal in a degenerate person. Certain stigmata are so constant and so frequent that they have been accepted as indices of degeneration by teachers, physicians and officers in prisons and asylums. Besides idiots, insane persons and certain criminals, the feeble-minded and the markedly eccentric are classed as degenerates. (See DEGENERACY.) The stigmata of degeneration are anatomical, physiological or psychical; that is, they are deviations in form and shape, in function and faculty, from the normal.

ANATOMICAL STIGMATA comprise irregularity in formation of the skull-cap or of the face; deformity of the palate; irregularity of the teeth; anomaly of tongue, lips or nose; spots on the iris, crossed eyes and other ocular changes; absence of pigment in iris, hair and skin (see ALBINO); anomaly of the ears; shortening or lengthening of part of a limb, reduction or increase in the normal number of fingers; deformity of the thorax, dwarfing, giantism, the occurrence of feminine configuration in a male or of masculinity in a female; anomalies of the skin, including abnormal growth of hair or absence of proper hair, etc.

The most frequently and easily observed anatomical stigmata are the irregular ears and teeth. The principal ear types are the Darwin ear, marked by a tubercle; the Morel ear, a large, smooth organ with thin edges; the Stahl ears, with various anomalies of the helix and crura (see EAR); and the Blainville type, in which the ears are not mates. Dental and palatal anomalies are very frequent, the degenerate's hard palate being dome-shaped, hip-roofed or flat-roofed, provided with a Gothic arch, or a horseshoe arch, or asymmetrical. Frederick Peterson (q.v.) considers the deformed palate one of the chief anatomical stigmata of degeneration. Talbot found 43 per cent. of abnormal palates among 1605 feeble-minded persons. Charon found 82 per cent. of abnormal palates in idiots and feeble-minded folk, 76 per cent. in epileptics, 80 per cent. in cases of general insanity, 70 per cent. in hysterical insane, 35 per cent. in cases of general paralysis, and 10 per cent. in apparently normal people.

PHYSIOLOGICAL STIGMATA, to follow Peterson's classification, include (1) anomalies of the motor function, such as delay in learning to walk, tremors, epilepsy; (2) anomalies of sensory function, such as deaf-mutism, migraine, blindness, defects in sight; (3) anomalies in speech, such as stammering, mutism; (4) anomalies of genito-urinary function; (5) anomalies of instinct or appetite, such as desire for liquor or drugs; (6) diminished resistance to external influences and to diseases; (7) delayed development of puberty.

PSYCHICAL STIGMATA include feeble-mindedness, imbecility, idiocy, insanity, eccentricity, certain moral delinquency and sexual perversion. Consult: Morel, *Traité des dégénérescences* (Paris, 1857); Charon, *Thése de Paris* (Paris, July 2, 1891); Nordau, *Degeneration* (New York, 1895); Peterson, "The Stigmata of Degeneration," in *State Hospitals Bulletin* (Utica, N. Y., July, 1896).

STIGMA′RIA (Neo-Lat., from Gk. στίγμα, mark). The generic name given to fossilized plant remains with pitted surfaces, found in the coal measures. They were first thought to represent a distinct species of plant, but they are now known to be the roots of Sigillaria and other trees that lived in Carboniferous times.

STIGMATIZATION (from ML. *stigmatizare*, from Gk. στιγματίζειν, *stigmatizein*, to mark, brand, from στίγμα, *stigma*, mark, brand, puncture, from στίζειν, *stizein*, to mark, puncture). The name applied to the impression on certain individuals of the 'stigmata' or marks similar to the wounds made in the body of Christ during His torture. These stigmata comprise not only the wounds of the hands and feet and of the side received in the crucifixion, but also those impressed by the crown of thorns and by the scourging. In some cases the stigmata have been only subjectively felt and could not be seen by others. In a few cases, wherein it has been claimed that the impression was made upon the heart alone, special marks have been found on that organ after death. The impression of the stigmata, being held in certain cases to be miraculous, was regarded as a mark of signal favor. The first and most remarkable example of stigmatization is that of Saint Francis of Assisi (q.v.). In his case these mysterious markings are said to have persisted for three years, until his death, and to have been seen by Saint Bonaventure and by several popes, and closely observed by multitudes after his death.

Since Saint Francis's time there have been many such cases. Dr. Imbert Gourbeyre in 1894 was able to collect 321 examples, in every century since the thirteenth, in every European country and in every station in life. While the great majority were religious, mostly Dominicans or Franciscans, many were not and some twenty were in the married state. Nearly 100 were reported during the nineteenth century. The most noteworthy of these are Anna Katherine Emmerich (died 1824) and Louise Lateau (1850-83) of Bois d'Haine, Belgium. This last case attracted great attention and provoked public discussion, in which the Salpêtrière school of neurology took the position that stigmatization is only a neurotic phenomenon in hysterical individuals. Dr. Lefebvre, an eminent physician, professor of medicine at the University of Louvain, who had been for many years in attendance at two insane asylums, after a prolonged investigation of Louise Lateau's case, pronounced it miraculous. On the other hand, Theodor Schwann, the distinguished biologist, also a professor at Louvain and himself a Catholic, refused after careful examination to admit the preternatural character of the phenomena. There seems no doubt that phenomena of a nearly similar kind have been produced by suggestion in susceptible individuals. In the *Comptes Rendus* of the Society of Biology of Paris for July 11, 1885, there is a report of a case in which bleeding through the unbroken skin was produced by hypnotic suggestion. Consult: Gourbeyre, *Les stigmatisés* (Paris, 1873); id., *La stigmatisation, l'extase divine et les miracles de Lourdes* (ib., 1894); Bourneville, *Le science et le miracle* (ib., 1878); Lefebvre, *Louise Lateau* (Louvain, 1870); Bourneville, *Louise Lateau* (Paris, 1875); Richer, *Etudes cliniques sur l'hystéro-epilepsie ou grande hystérie* (ib., 1881).

STILES, stīlz, Ezra (1725-95). An American clergyman and college president, born at North Haven, Conn. He graduated at Yale in 1746, was tutor there from 1749 to 1755, was ordained by the Congregational Church in 1749, and preached for a time to the Stockbridge Indians. Transient religious doubts induced him to abandon the ministry and study law (1752); and he was admitted to the bar in 1752, and practiced in New Haven in 1753-55. Returning to the ministry in 1756, he was pastor of the Second Church in Newport, R. I., in 1756-77, and during this period spent a large part of his time in literary and scientific studies, learning several European and Oriental languages and carrying on an extensive correspondence with learned men in many parts of the world. In 1777-78 he was pastor of the North Church, Portsmouth, N. H., and in 1778 became the president of Yale, which position he held until his death. In addition to his presidential duties, he occupied the chair of ecclesiastical history from 1780 to 1795, and lectured on mathematics, astronomy, natural philosophy, and mental and moral philosophy. Both during and preceding the Revolution he was an ardent patriot. Besides several orations and sermons, he published *An Account of the Settlement of Bristol, R. I.* (1785), and a rambling, diffuse *History of Three of the Judges of King Charles I.* (1794); while his *Literary Diary* and bound manuscripts preserved at Yale fill over 45 volumes. The diary edited by Dexter was published in 1901. Consult *Life*, by his son-in-law, Abiel Holmes (1798), and by J. L. Kingsley in *Sparks's American Biography*.

STILES, Henry Reed (1832—). An American physician and author, born in New York City. He was educated at the College of the City of New York, and at Williams, subsequently studied medicine, and practiced for a short time. In 1857 he began the publication of *The American Journal of Education*. In 1859 he resumed his medical practice, and in 1863 became librarian of the Long Island Historical Society. In 1873 he became superintendent of New York Homeopathic Insane Asylum at Middletown, N. Y., and from 1877 to 1881 was director of the Homeopathic Dispensary at Dundee, Scotland. From 1882 to 1885 he was professor of mental and nervous diseases in the New York Woman's Medical College. His publications include: *The History and Genealogies of Ancient Windsor, Connecticut* (1859); *Monograph on Bundling in America* (1861); *The Wallabout Prison-Ship Series* (1865); and *The History of the City of Brooklyn, New York* (1867-70). He edited *Illustrated History of the County of Kings and City of Brooklyn* (1884).

STILETTO-FLY. A small, slender predatory fly of the family Therevidæ, frequently of varied color and closely resembling one of the robber-flies (Asiliidæ). It does not catch its prey on the wing as do the robber-flies, but lies in wait upon leaves and bushes and even upon the ground, springing on weaker insects as they approach. The larvæ are very long and slender, and live in rotten wood and in rich earth, and seem to feed upon both decaying animal and vegetable matter.

STILICHO, stĭl'ĭ-kō, Flavius (?-A.D. 408). A Roman general, one of the most notable figures in the history of the sinking power of Rome and the German invaders. He was the son of a Vandal who served as an officer in the Roman Army under Valens, Emperor of the East (364-378), and himself followed a military career, earning the special recognition of the Emperor Theodosius (379-395), who, in 383, sent him at the head of an embassy to the Court of the Persian King Sapor III. Here, though still a young man, he proved such a successful diplomatist that a very advantageous peace was at once arranged; and on his return to Constantinople, at the end of 384, he married Serena, the Emperor's niece, and received the titles of *comes stabuli sacri* and *comes domesticorum*. During the next decade he was engaged in military operations in various parts of the Empire, attaining the grade of commander-in-chief (*magister militum*) of the army in Thrace in 385, and directing the campaign in Britain against the Picts, Scots, and Saxons in the same year. In 386 he was battling with his Emperor against the barbarians on the banks of the Hebrus. In 392 he was most successful in campaigns against the Bastarnæ, Goths, Alani, and Huns, but was prevented from gaining greater glory by the jealousy of the Consul Rufinus, who exercised a great influence over the Emperor. In 394, however, he received a greater honor; for Theodosius made his own son Honorius *augustus*, giving him the sovereignty of Italy, Spain, Gaul, and Africa, and appointing Stilicho and Serena his guardians. Thus Stilicho found himself on a footing with his hated rival Rufinus, for he became the real ruler of the West, with headquarters at Rome, as the young Honorius was wholly indifferent to the cares of State. While Theodosius lived, Stilicho and Rufinus were forced to maintain a semblance of peace, but no sooner was he dead, in 395, than their rivalry broke out openly. Stilicho had the advantage of a stronger personality and a close connection with the Imperial family, for his daughter Maria was betrothed to his ward, the Emperor Honorius. After successful campaigns on the Rhine, he marched to the East, nominally to drive back the Goths and Huns, whom Rufinus had persuaded to invade the Empire, but really with the design of overthrowing Rufinus, and by connivance with these same Goths Stilicho procured his assassination at the close of 395. He was now the virtual master of the Empire, for Honorius and Arcadius, the joint Emperors, were mere puppets in his hands; but Stilicho never aspired to the throne for himself, remaining as yet loyal to the worthless son of his old patron. His attention, indeed, was now wholly occupied with the formidable invasion of the Goth Alaric, who had forced his way into the Peloponnesus with a great army, and was abetted by Arcadius from jealousy of Stilicho. Alaric was almost caught in a trap, but managed to escape northward, where he held his own for six years, often making predatory incursions even into Italy. At the end of 402 the final contest was fought out. Alaric had invaded Northern Italy, and the cowardly Honorius fled from Mediolanum (Milan) to Ravenna. Stilicho gathered all the available troops from the western provinces and made a brave stand. He was blockaded in Milan, but early in 403 he broke the blockade and won a victory over Alaric at Pollentia, near Turin, and another at Verona. Alaric withdrew from Italy, but retained his power at the Court of Arcadius. In 406 a new invasion threatened Italy. A countless horde of Germans and Celts was led down from the north by their chief, Radagaisus, who occupied the heights of Fæsulæ, above Florence, where Stilicho, by a brilliant movement, that was regarded as miraculous, hemmed him in and forced him to surrender. Radagaisus was treacherously put to death and all his followers were sold into slavery. This was the last great achievement of Stilicho. His ultimate downfall was due to his ambition to see his own son Eucherius on the throne of Rome; and in this he might have succeeded, had it not been for the wily Olympius, who gained influence over Honorius and warned him of Stilicho's designs. Honorius now for the first time showed signs of energy. He aroused the soldiers by a clever speech and won over many partisans of Stilicho, who, deserted by his friends, met death by assassination at Ravenna in 408.

STILL, JOHN (c.1543-1608). An English prelate, born at Grantham, Lincolnshire. He was educated at Christ's College, Cambridge. He became successively Margaret professor of divinity at Cambridge (1570), prebendary of Westminster (1573), master of Saint John's College, Cambridge (1574), Archdeacon of Sudbury (1576), master of Trinity College, Cambridge (1577), and Bishop of Bath and Wells (1593). To him has been ascribed on insufficient evidence *A Ryght Pythy, Pleasaunt, and Merie Comedie, intytuld Gammer Gurton's Nedle*, the second English comedy extant. It contains the spirited drinking song beginning "Backe and side go bare, go bare." On the authorship of the comedy, consult *Modern Language Notes* for June, 1892 (Baltimore).

STILLBIRTH. See ABORTION.

STIL'LINGFLEET, EDWARD (1635-99). An Anglican prelate, born at Cranborne, in Dorsetshire. He received his education at Cambridge. In 1659 he published the *Origines Sacræ, or Rational Account of the Christian Faith, as to the Truth and Divine Authority of the Scriptures*, a work which made his reputation, and is still esteemed as one of the most masterly treatises extant on the subject of which it treats. In 1664 appeared his *Rational Account of the Grounds of the Protestant Religion*, a defense of the Church of England from the charge of schism in its separation from Rome, which was received with great favor, and led to his appointment as preacher at the Rolls Chapel. In 1670 he became canon of Saint Paul's Cathedral, and in 1678 was made dean. After the Revolution of 1688 he received the appointment to the Bishopric of Worcester. Stillingfleet's chief works, besides those mentioned, were the *Origines Britannicæ, or Antiquities of the British Churches* and *The Doctrines and Practices of the Church of Rome Truly Represented* (1686; 3d ed. 1851), a standard work. His complete works were published in six volumes (London, 1710, with life by Richard Bentley, supplementary vol., 1735).

STILLINGIA, stĭl-lin'jĭ-ȧ (Neo-Lat., named in honor of Benjamin *Stillingfleet*, an English botanist of the eighteenth century). A genus of plants belonging to the natural order Euphorbiaceæ. The species are mostly trees or shrubs of tropical Asia and America, and of the islands of Bourbon and Mauritius. The leaves are alternate, petiolate. One species, *Stillingia sylvatica*, queen's delight or yaw shrub, a perennial herb two to three feet high, is found from Virginia to Kansas and south to the Gulf. The root of this plant has been variously used in medicine. *Stillingia sebiferum* or *sapium*, the tallow tree of China, from the fruit of which the Chinese obtain tallow, and which was introduced into the East and the West Indies, has a trunk and branches like the cherry and foliage resembling that of the black poplar.

STILL LIFE. The name applied to that branch of art which concerns itself with the representation of lifeless objects such as game, fruits, flowers, vases, and house furniture. See PAINTING.

STILL'MAN, SAMUEL (1738-1807). An American clergyman. He was born in Philadelphia, Pa., removed to Charleston in 1748, was ordained as a Baptist minister in 1759, and preached first at James's Island (Va.), then at Bordentown (N. J.), and finally at Boston. He was one of the incorporators of Brown University (1764). He was an exceedingly effective preacher, and just before and during the Revolutionary War exerted a powerful influence on the side of the Patriot Party. Among his published sermons are *A Sermon on the Repeal of the Stamp Act* (1766), *Election Sermon* (1779), *Masonic Discourse* (1785), and a *Sermon Occasioned by the Death of George Washington* (1799).

STILLMAN, WILLIAM JAMES (1828-1901). An American journalist, landscape painter, and author. He was born in Schenectady, N. Y., and after graduating at Union College took up landscape painting under Frederick Church. In 1849 he studied in England, where he was influenced by the Pre-Raphaelites, becoming acquainted with Turner, whose work he admired, and with Ruskin, whose influence upon his painting was a baneful one. In 1852 he was commissioned by Louis Kossuth to go to Hungary to carry away the Crown jewels which Kossuth had hidden during the Revolution. From there he went to Paris, where he studied under Yvon, and continued to practice painting until 1855, when he adopted journalism as his profession, devoting himself to political and artistic subjects. Stillman was United States Consul at Rome (1861-65), and at Crete (1865-69). From 1883 to 1885 he was art critic of the *Evening Post*, and from 1875 to 1885 correspondent on political affairs for the London *Times*. He lived in Italy from 1878 to 1898, after which he retired to Surrey, England, where he died in 1901. His published works include the *Cretan Insurrection of 1866-68* (1874), *On the Track of Ulysses* (1888), *Billy and Hans* (1897), *Francesco Crispi* (1899), a biographical study, and the *Autobiography of a Journalist*, with many interesting reminiscences. His most noted painting is the "Procession of the Pines" (1858). Stillman was also an expert photographer, and published series of views of Athens, the Acropolis, and the temples of Sicily.

STILL'WATER. The county-seat of Washington County, Minn., 18 miles northeast of Saint Paul; on the Saint Croix River and Lake, and on the Chicago, Milwaukee and Saint Paul, the Chicago, Saint Paul, Minneapolis and Omaha, and the Northern Pacific railroads (Map: Minnesota, F 5). It has a situation of great natural beauty at the foot of the celebrated 'dalles' of Saint Croix, cliffs which extend for 30 miles above the city. Stillwater has the Minnesota State Prison, a public library, a United States Government building, a fine city hall, Stillwater City Hospital, and Saint Joseph's and Saint Mary's convents. The city is known for its extensive lumber interests. There are breweries, foundries and machine shops, grain elevators, a brick yard, and manufactories of flour, wagons, boats, farm implements, boots and shoes, boxes, etc. The government, under the revised charter of 1891, is vested in a mayor, chosen every two years, and a common council. Stillwater was settled in 1843, was incorporated as a village in 1848, and was chartered as a city in 1854. Population, in 1890, 11,260; in 1900, 12,318.

STILLWATER, BATTLES OF. See SARATOGA, BATTLES OF.

STI'LO, LUCIUS ÆLIUS PRÆCONINUS (called also Philologus). A celebrated Roman grammarian. He was learned in both Greek and Latin and was an instructor of Cicero in rhetoric and of Varro in grammar. His sympathy with the aristocratic party led him to accompany Quintus Metellus Numidicus into exile at Rhodes in B.C. 100. His works include commentaries on the *Axamenta*, or Songs of the Salii, and the *Twelve Tables*, and a volume entitled *De Proloquiis*. The treatise *Ad Herennium*, generally found in editions of Cicero, has been conjecturally assigned to him.

STILT (Swed. *stylta*, OHG. *stelza*, Ger. *Stelze*, stilt, crutch). A large, handsome, long-shanked shore-bird of the genus Himantopus, related to the avocets. The common Old World species (*Himantopus himantopus*) is widely distributed. The American species (*Himantopus Mexicanus*) is common to both continents; and others are known in other parts of the world along seacoasts. They frequent muddy flats in small flocks, and walk with long, measured steps, seeking for food among the reeds, and catching small fishes in the pools and shallows. See Plate of BEACH BIRDS.

STILT-BUG. A plant-bug of the family Berytidæ, which includes very slender species with long, thin legs in which the thighs are thickened at the tip. Only six species are known to occur in the United States.

STIM'SON, FREDERIC JESUP (1855—). An American lawyer and author, born in Dedham, Mass. He graduated at Harvard in 1876 and at the Harvard Law School in 1878, and began practice in Boston. In 1884-85 he was Assistant Attorney-General of Massachusetts, and in 1899-1901 general counsel to the United States Industrial Commission. He is best known as the author of law books, including *American Statute Law* (2 vols., 1886), the standard work on the subject: *Stimson's Law Glossary* (1890); *Government by Injunction; Labor in Its Relation to Law* (1894); *Handbook to the Labor Law of the United States* (1895); and *Uniform State Legislation* (1896). Under the pen-name of "J. S. of Dale" he also wrote several novels and short stories.

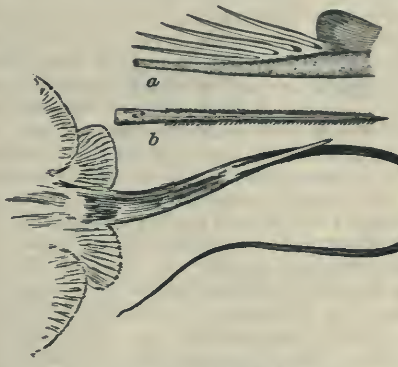
STIMULANTS (from Lat. *stimulare*, to urge, prick, from *stimulus*, goad, incitement; connected with Gk. *στίζειν*, *stizein*, to pierce, Skt. *tij*, to be sharp, OHG. *stehhan*, Ger. *stechen*, Eng. *stick*). Agents which increase temporarily the functional activity of the organism as a whole or of the various organs of the body. These may be cardiac, respiratory, nervous, hepatic, renal, gastric, etc., depending on the organ or system affected. Stimulants embrace a wide range of therapeutic agents, but popularly the term is applied to those acting especially on the circulatory, respiratory, and nervous systems. Alcohol is the most generally employed, in the form of whisky, brandy, or wines. The various preparations of ammonia, inhaled or given as the aromatic spirits of ammonia, are very serviceable diffusable stimulants. Ether may be taken as an inhalation, a hypodermic injection, or in solution by the mouth, and acts rapidly. Among the other general stimulants may be mentioned camphor, strychnine, lavender, ginger, peppermint oil, and the other essential oils. This class of remedies is useful in fainting, hysteria, shock, and similar conditions.

STIMULUS (from Lat. *stimulus*, goad, incitement). A mechanical, molecular, chemical, or ethereal change in the conditions external to a plant cell or to the plant body, which produces a change (reaction) in the cell, a particular organ, or the whole plant. Mechanical stimuli, due to the mass movement of the external agents, are contact, pressure, traction, friction, torsion, etc. (See MOVEMENT; THIGMOTROPISM; TENDRIL.) In the absence of knowledge as to its nature, gravity may be included in this group, since it depends upon the mass of the body acting (the earth), although it is not in itself mechanical. (See GEOTROPISM.) Molecular stimuli depend upon molecular movements. Osmotic pressure has been proved capable of acting as a stimulus. The reactions of organisms to solutions of varying concentration are interpreted as due not to the chemical nature but to the number or impact of the solute molecules, since they are alike with all substances of the same osmotic pressure. (See OSMOSIS.) Chemical stimuli depend not upon the mass, but upon the chemical composition of the body acting. They are, therefore, almost as various as chemical compounds, although many substances are nearly or quite inert. The most common acting upon plants are water, organic acids, mineral salts and other solutes in the water. (See CHEMOTROPISM.) Ethereal stimuli, are propagated in the ether, light and heat. (See HELIOTROPISM; THERMOTROPISM.) Here also may be included electricity, whose action in nature is little understood. (See IRRITABILITY.)

STINDE, stĭn′de, JULIUS (1841—). A German humorist. He studied and practiced chemistry, became editor of a Hamburg trade journal, contributed to periodicals, and was gradually drawn wholly to literature, wherein he won popularity by *Die Buchholzen in Italien* (1883), *Die Familie Buchholz* (1884, translated), a second part of this (1886), *Frau Buchholz im Orient* (1888), *Frau Wilhelmine Buchholz' Memoiren* (1895), and *Hotel Buchholz, Ausstellungserlebnisse* (1896). His other writing, dramatic and otherwise, is of slight worth, but in the *Buchholz* series the lower middle class of Berlin is depicted with a fresh, genial, healthy humor.

STING (from AS. *stingan*, Goth. *us-stiggan*, to push out; connected with OHG. *stanga*, Ger. *Stange*, obsolete Eng. *stang*, sting). An organ possessed by various kinds of animals, by means of which they not only inflict a mechanical wound in their prey, but also insert into it an irritant or poisonous chemical. Stinging or nettling cells (see NEMATOCYST) occur in all the Cœlenterata except ctenophores, in some tubularian worms, and on the cerata of the nudibranch Eolis. The sting of scorpions (q.v.) is in the tail. The poison, secreted by a gland, exudes through small openings into the wound, and is powerful enough to cause death in the small natural prey. Among insects, several forms are provided with a sting. This organ, which is of especial use as a means of defense to the so-called aculeate Hymenoptera, a group which includes the bees, wasps, many ants, and to the Mutillidæ or 'cow-ants' or 'velvet ants,' is simply a modified ovipositor connected with a poison gland. The sting of a bee consists of three distinct pieces: two barbed needles and one gouge-like piece, the 'director;' the needles move up and down on the director, controlled by muscles attached to their bases. In the anterior part of the director there is a slight projection on the needle which catches a bit of the poison in the chamber and carries it to the wound. The director itself is composed of a united pair of stylets, and without the director is a third pair of stylets which are thick and hairy. (See INSECTS, section on *Poisonous Insects.*) The poison is secreted by poison glands which pour their poison into the chamber. The poison of the bee is said to be secreted by two glands, one producing an acid and the other an alkaline fluid. Only acid poison glands are said by some investigators to be present in those wasps which only stupefy the prey that they store up for the nourishment of their young.

STING-RAY, or **STINGAREE**. A ray (q.v.) of the family Dasyatidæ, characterized by the usual possession of a long whip-like tail, bearing near its base one or more long, strong, sharp spines retroversely serrated. When broken off the spine is replaced by the coming forward of one of a succession growing behind it. The family includes about fifty species, inhabitants of the warmer seas, some species occurring in the fresh waters of

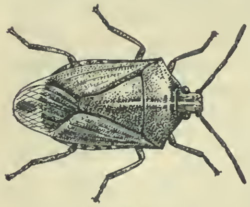


TAIL OF A STING RAY.

a, enlarged view of the base of the tail of a sting-ray, having several spines; *b*, a single spine, barbed on both sides.

Northern South America, some of which are ten or twelve feet in length. They are generally much dreaded because of the ugly wound they are capable of inflicting with the spine or 'sting.' The sting is not poisonous, as is frequently supposed, although the mucous secretions of the skin may be responsible for the serious inflammations frequent in the wounds. See Ray and accompanying Plate; Devil-Fish.

STINK-BUG. Any one of the heteropterous insects of the family Pentatomidæ, very many of which are protected from their natural enemies by a nauseous, penetrating, and persistent odor which remains with berries over which these bugs may have walked. The family is a large one and 4000 species have been described, of which 300 are found in the United States. They are broad, flat insects with five-jointed antennæ, and are usually green, gray, or brown, although some have a brilliant combination of black and red or yellow and black. They vary strangely in habit, some species being exclusively carnivorous and others exclusively plant-feeders, while others seem to feed indifferently upon the juices of plans or of other insects. See Soldier-Bug.


A STINK-BUG.

STINT (from AS. *styntan*, to make blunt, short, from *stunt*, dull, stupid). One of the small sandpipers (q.v.) of the genus Tringa. The American stint (*Tringa minutilla*) is the smallest of the sandpipers, less than 6 inches long, breeds only in the Arctic regions, and is common throughout North America during the migrations. The plumage in summer is variegated bright bay, blackish, ashy and whitish above, whitish beneath; in winter the color is simply ashy above, whitish beneath.

STIPA. See Feather Grass.

STIPENDS, CLERICAL (Lat. *stipendium*, tax, tribute, salary, from *stips*, gift, donation + *pendere*, to weigh out). A general designation of the means of support provided for the clergy. There have developed in Western civilization five general methods of providing clerical support, together with all sorts of combinations of those methods. Those methods may be defined as those of (1) voluntary offerings, (2) tithes, (3) endowments, (4) State aid, and (5) contracts. No country shows any one method prevailing to the exclusion of the others. Without doubt the earliest method of supporting a priesthood was by means of voluntary contributions. Tithes (q.v.) were commanded of Hebrews by revelation, and the system continued in Christian times. State aid may be considered as of two kinds, the direct and the indirect, the latter to be considered first, as of the greater antiquity. When the political power under the Emperor Constantine came openly to the support of the Christian religion one of the first results of the friendly coöperation of the State was the legal capacity given to the churches in a corporate character to receive gifts *inter vivos* and by bequest, and to hold the same in perpetuity. This was an indirect method of State aid. Direct State support of the clergy is a comparatively modern institution, which has developed since the Reformation era. It is now in operation in those European States of Roman Catholic allegiance which have entered into a treaty, technically known as a concordat, with the See of Rome for the support of the clergy. Such treaties came about as a return for the sequestration of the older ecclesiastical endowments in land. France, Spain, Portugal, and Austria give such direct support to the Roman Catholic clergy. The Protestant German and Scandinavian States furnish a like support to the Protestant ministry. Russia supports the hierarchy of the orthodox Church. A similar system of direct State support prevails in the Central and South American States for the Roman Catholic clergy, and under Spanish rule prevailed also in Cuba, Porto Rico, and the Philippines. The fifth method, that of contracts, is essentially American. It consists first of a contract between a local church (in the Protestant denominations) and its minister for the payment of a definite sum for his support, and then a series of contracts between the church as a corporation and the attendants at public worship for the rental of pews and sittings. As a reaction from this method has developed what is known as the 'free church' movement, which seeks to abolish pew rentals and to substitute systems of voluntary contributions.

STIPPLE (from Dutch *stippeln*, to speckle, from *stippen*, to dot, prick, from *stip*, point, dot), or Stippling. In engraving, a process of producing light and shade, and sometimes color, by means of points, dots, or small, short marks, hardly to be considered lines. In water-color work the dots of color inevitably run together, so that the process is somewhat like cross-hatching in ordinary drawing. This is a process used by artists who are in search of very minute detail. See Line Engraving and Etching.

STIPULATION (Lat. *stipulatio*, bargain, *stipulare*, to bargain, covenant). In law, a material clause or provision in a contract. The term is also sometimes applied to a written agreement between attorneys as to some matter of practice. In admiralty practice it is a bond or undertaking filed with the court by one of the parties to an action or proceeding. A libellant must file a stipulation for costs. When a vessel is attached under a libel, the owner must file a 'stipulation for value' to obtain her release. See Bond.

STIRLING, stẽr′lĭng. A river-port and capital of Stirling County, Scotland, on the Forth, 35 miles northwest of Edinburgh (Map: Scotland, D 3). The rich agricultural, mining, and manufacturing districts around it are the main basis of its prosperity. Situated at the head of navigation of the Forth, Stirling, strongly fortified by nature, was the key to the Highlands. It owes its origin to the strong natural fortress of Castle Hill, crowned by the venerable castle, which commands an extensive view of great beauty. From this hill, covering the declivity which slopes north and eastward to the plain, extends the oldest part of the town. Stirling Bridge, which existed in 1571, was until recent years the only one by which wheeled carriages could cross the Forth. Noteworthy are the East and West Churches—the former erected by James IV. about 1494—and 'Mar's Work,' an incomplete and richly ornamented structure, built in 1572. Ropes, malt, leather, soap, and mineral oils are manufactured. Vessels of one hundred and fifty tons can reach the port of Stirling, but its river trade has decreased since the advent of railroads.

Stirling (formerly *Stryvelyne*, or *Estrivelin*) is one of the most ancient and historically important towns of Scotland. Alexander I. died in the castle in 1124. Near by, the battle of Stirling was fought in 1297. (See Wallace, William.) The town was taken by Edward I. after a siege of three months, in 1304. In the vicinity, at Bannockburn (q.v.), the famous battle of that name was fought in 1314. The castle was the birthplace of James II. and of James V. James III. built the Parliament House in the castle, and otherwise improved and embellished the fortress. James V. built the palace, the walls of which are profusely covered with grotesque ornamentation. In the older part of the castle is the 'Douglas Room,' in which William, Earl of Douglas, was assassinated by James II. In 1651, after the battle of Dunbar, the castle was taken by Monk; and it withstood a siege by the Highlanders in 1745. Population, in 1891, 16,800; in 1901, 18,403. Consult: *History of the Chapel Royal of Stirling* (Grampian Club, 1882); *Charters of Stirling* (1884).

STIRLING, Earl of (1726-83). See Alexander, William.

STIRLING, James (1692-1770). An English mathematician, born at Garden, Stirlingshire. He was educated at Glasgow University and Balliol College, Oxford. He was expelled from Oxford (1715) on account of his relations with the Jacobites, and went to Venice, where he took up the study of mathematics. It was during his residence in Venice that he wrote his work *Lineæ Tertii Ordinis Newtonianæ* (1717), and his paper, *Methodus Differentialis Newtoniana Illustrata*, which was communicated to the Royal Society through Newton (*Philosophical Transactions*, 30: 1050). Stirling returned to London in 1725 and devoted himself to the teaching of mathematics, enjoying the friendship of Newton and corresponding with many of the noted mathematicians of the day. His greatest contribution to mathematics was his *Methodus Differentialis, sive Tractatus de Summatione et Interpolatione Serierum Infinitarum* (1730; 2d ed. 1764; English trans. 1749).

STIRLING, James Hutchinson (1820—). A Scottish philosopher, born at Glasgow, January 22, 1820; studied arts and medicine at the Glasgow University. He practiced medicine for some years, but soon gave up medicine to study philosophy. He published *The Secret of Hegel* (1897); a translation of Schwegler's *History of Philosophy* (1867); *As Regards Protoplasm* (1869); *Lectures on the Philosophy of Law* (1873); *Text-Book to Kant* (1881); *Philosophy and Theology* (1890); *Workmen and Work* (1894), etc.

STIRLING-MAXWELL, Sir William (1818-78). A Scotch author, born near Glasgow. He bore the name of Stirling until 1866, when by the death of Sir John Maxwell, his maternal uncle, he succeeded to a baronetcy and assumed the name of Maxwell. He graduated at Cambridge in 1839, after which he visited Spain and France, and devoted several years to studies of the history, literature, and art of Spain at the close of the mediæval period. He was elected to Parliament for Perthshire in 1852, and represented that borough almost continuously for more than twenty years. He was rector of the University of Saint Andrews in 1863, of that of Edinburgh in 1872, and in 1875 was elected chancellor of the University of Glasgow. He was the author of *Annals of the Artists of Spain* (1848); *The Cloister Life of Charles V.* (1852); and *Velasquez and His Works* (1855).

STIR'LINGSHIRE. A west-midland county of Scotland, on the border between the Highlands and the Lowlands of the country, and bounded on the north by Perthshire, and by the river and Firth of Forth (Map: Scotland, D 3). Area, 451 square miles. Much of it is occupied by the carses of Stirling and Falkirk, formerly covered with unproductive moss, but now mostly converted into profitable agricultural lands. The chief elevation is Ben Lomond (q.v.). The rivers are the Forth, the Carron, and the Endrick. Loch Lomond is the only important lake. Stirlingshire is noted for its minerals, especially ironstone, which is wrought on an extensive scale at Carron. Woolen goods are manufactured at Alva and Bannockburn, and in the neighborhood of Stirling. The capital is Stirling. Population, in 1801, 50,800; in 1851, 86,200; in 1901, 142,291.

STITCH'WORT (*Stellaria*). A genus of annual and perennial plants of the natural order Caryophylleæ, having weak stems and white flowers, which in some are minute, and in others are large enough to be ornamental. To this genus the common chickweed is generally referred.

STITH, William (1689-1755). An American colonial historian, born in Virginia. He went to England, studied theology, was ordained priest in the Established Church, and on his return (1721) was made master of the Grammar School at William and Mary College, Williamsburg, Va. He won a distinguished place among the clergymen of the colony, was chosen chaplain of the House of Burgesses in 1738, and rector of Henrico Parish and president of William and Mary College (1752-55). He is known for his scholarly but unfinished *History of Virginia from the First Settlement to the Dissolution of the London Company* (1747, reëdited with a bibliography 1866). This work is highly praised for its accuracy and much blamed for its diffuseness, being, in the opinion of Jefferson, "inelegant and often too minute to be tolerable."

STOA (Gk. *στοά*, *στοιά*, a roofed colonnade, piazza, porch). One of the extended colonnades surrounding the marketplace and often extending through the principal streets of Greek cities. The stoa was always roofed, its main purpose being that of shelter in bad weather, and its floor was above the level of the street. At the back was usually an inclosed wall, and in front a single or double colonnade facing the street. Later, when broader spaces were to be roofed, the stoa became an independent structure. Sometimes a dividing wall was placed between the two rows of columns; but the more usual form was the *stoa diple,* in which a row of columns replaced the dividing wall. The forms of the stoa multiplied; two inner rows of columns were often used and additional stories were added. The stoa originated among the Ionian Greeks in Asia Minor, whence they were introduced into Greece. Celebrated examples were the simple Stoa Poikile (many-colored) upon the marketplace of Athens, the walls of which were decorated with scenes from the battles of Marathon and Œnoë by Polygnotus; the *stoa diple* of Thoricos; the three-aisled "Basilica" of Pæstum; and the two-storied stoa of King Attalus II. at Athens. Stoas were frequently adorned with statuary and painting.

STOAT. The British name for a weasel (q.v.).

STOBÆ'US, JOANNES (Lat., from Gk. Ἰωάννης ὁ Στοβαῖος, *Iōannēs ho Stobaios*). A Greek writer, apparently a native of Stobi, in Macedonia. The date at which he lived is not certain, but was probably about A.D. 500. To him we owe the preservation of a large number of our fragments of over five hundred early Greek poets and prose writers. This excerpt work in four books bore the name *Florilegium* (Ἀνθολόγιον), but in the course of the Middle Ages was divided into two parts, one of which is known as the *Eclogæ,* the other as the *Florilegium.* The best critical edition is by Wachsmuth and Hense (Berlin, 1884-94).

STOCK (AS. *stocc,* OHG. *stoc.* Ger. *Stock,* post, trunk; probably connected with Skt. *tuj,* to thrust). In corporation law, the rights or interest which the organizers of a corporation, or persons who contribute to its capital, have in its assets, franchises, management, and profits. The amount fixed by the charter of a corporation as the sum which is to be paid into its treasury for use in its business operations is called the *capital stock.* The latter term is sometimes inaccurately applied to the actual property owned by a corporation, as the capital stock of a corporation may not represent its actual assets, even at the time of its organization. The total capital stock of a corporation is divided into shares, which are represented by certificates, and the latter are distributed to subscribers according to the amounts of their respective subscriptions. Shares of stock may be made of any value, the par value being fixed by dividing the number of shares issued into the total amount of capital stock. The usual par value is $100, but shares representing other sums, even so small as $1 each, are sometimes issued, especially in industrial enterprises. Many States require stock to be issued at its par value.

Treasury stock is that which is not allotted to subscribers, but retained by the corporation for the purpose of selling it from time to time to raise funds.

Stock may be divided into *preferred* and *common* shares. The amount in dividends which the former can receive in each year is usually fixed and certain, and if more is paid as dividend it must be paid on the common stock. Preferred stock may be *cumulative* or *non-cumulative.* If the former, any deficiencies in dividends in one year must be made up later, before a dividend can be declared on the common. For example, if 7 per cent. cumulative preferred stock is issued, and the earnings are only sufficient to pay 5 per cent. on it in a given year, the deficiency of 2 per cent. must be made up later. If such stock were non-cumulative, the preferred stock would only receive 5 per cent. for that year, even though the earnings the next year were sufficient to pay 15 per cent. on the amount of the capital stock, and an 8 per cent. dividend were declared on the common stock.

The name of each person to whom a share of stock is issued is entered upon the books of the corporation.

Shares of stock are transferable by assignment, and the transferee obtains a right to have his name entered upon the books of the company as a stockholder in the place of his transferror. However, shares of stock are not negotiable instruments in the strict sense of that term, but they are commonly indorsed in blank and transferred from one person to another as if such transfer were protected by the same rules of law. For this reason the courts in the United States generally protect an innocent purchaser for value, on the ground of estoppel. The English courts do not go so far in this respect, and the only safe course there is for a purchaser of stock to have the transfer entered on the books of the corporation immediately. Dividends are paid to the record owner of stock irrespective of who holds the certificates. A record owner of stock is called a stockholder. See Cook, *Stock and Stockholders* (New York, 1887); Dos Passos, *The Law of Stock Brokers and Stock Exchanges* (New York, 1882); also CORPORATIONS and authorities there cited.

STOCK (so called from its woody stem), GILLIFLOWER, or GILLYFLOWER (*Matthiola*). A genus of about thirty species of herbs or half shrubs of the natural order Cruciferæ, natives of the Mediterranean regions. Most of the species are thickly clothed with white or grayish stellate hairs; the fragrant, generally beautiful flowers are in racemes; the pods are cylindrical or compressed. *Matthiola incana,* indigenous in Southern Europe, is probably the parent of the greater number of the cultivated hoary-leaved kinds known as Brompton stock, etc., while those

STOCK (*Matthiola incana*).

with smooth leaves, called ten-week stock, German stock, etc., are referred to *Matthiola fenestralis*, which, perhaps, is a mere variety of the one species *Matthiola incana.* The sandy shores of Wales and of Cornwall produce a species (*Matthiola sinuata*), the large purple flowers of which are fragrant only at night, a characteristic also of several other species. Stocks are generally raised by gardeners from seed. The hoary-leaved stocks are usually treated as biennials, although they may almost be reckoned perennial. The smooth-leaved stocks are treated as annuals.

STOCKADE. A means of defence consisting of stakes, logs, timbers, tree trunks, etc., firmly set in the ground and adjoining each other, and provided with loop holes through which the fire of the defenders may be delivered. Stockades are one of the oldest forms of fortifications, having done duty since the time of arrows and javelins, and are still useful as a protection against musketry fire under certain circumstances, though of course valueless when subject to attack by artillery. As the logs, etc., are usually considerably higher than a man's head and are sharpened on the top, stockades are also valuable as obstacles and can be defended readily. It is essential that the logs or timber should be firmly planted and bound together and reinforced by horizontal timbers or logs, earth, rails, or other material at the engineer's command, while the loopholes must be advantageously placed. Stockades may be useful where timber is plentiful, but their construction involves considerable labor and skillful working of timber. For details of construction of stockades and other field defences, consult Beach, *Manual of Military Field Engineering* (3d ed., Kansas City, 1897). See FORTIFICATION.

STOCK'BRIDGE. A North American Indian tribe. See MAHICAN.

STOCKBRIDGE. A town, including two villages, in Berkshire County, Mass., 17 miles south of Pittsfield, on the Berkshire Division of the New York, New Haven and Hartford Railroad (Map: Massachusetts, A 3). It is picturesquely situated in the Berkshire Hills. Noteworthy features are the Bell Tower, commemorating the early Indian Mission; a fine park, the gift of Cyrus W. Field; the Edwards Monument, the Indian Burial Ground, Williams Academy, and the Jackson Library and Reading Room. In the vicinity are Ice Glen, a narrow gorge, with caves whose sides are coated with ice all the year; Prospect Hill, commanding an extended view; and Lake Mahkeenac, near which are the remains of the house where Hawthorne wrote the *House of the Seven Gables* and other works. Population, in 1890, 2132; in 1900, 2081.

An Indian mission was established here in 1736, and three years later the place was incorporated as a town under its present name (from Stockbridge, England). Jonathan Edwards was a missionary here from 1750 to 1758, and here he wrote his most famous works. In 1785 the Indians moved to New Stockbridge, N. Y. Consult: Jones, *Stockbridge Past and Present* (Springfield, 1854), and *History of Berkshire County* (New York, 1885).

STOCKBRIDGE, HENRY (1822-95). An American political leader, born at North Hadley, Mass. He graduated at Amherst College in 1845 and was admitted to the bar in Maryland in 1848. He remained loyal to the Union during the Civil War, and in 1864 became a member of the State Legislature. He was a member of the Constitutional Convention which met to decide the question of the abolition of slavery in the State, was active in securing the adoption of the Constitution framed by its members, and defended it before the courts. It was largely by his exertions that the indentures of apprenticeship, which threatened to take the place of slavery, were omitted from the statutes, and enfranchisement secured, without possibility of evasion, to the negroes of Maryland.

STOCKDOVE (so called either because formerly regarded as the parent stock of the domestic pigeons, or because it breeds in the trunks of trees). A wild pigeon (*Columba œnas*), of Europe, gray, with a burnished metallic purple breast, scarlet eyes, orange-colored bill, and red legs. It is about fourteen inches in length.

STÖCKER, stẽ'kẽr, ADOLF (1835—). A German theologian and politician, born in Halberstadt. He studied theology and philosophy in Halle and Berlin, entered the ministry, and in 1874 became cathedral preacher and Court pastor in Berlin. In 1879 he was elected to the Prussian Chamber of Deputies, and from 1881 till 1893 he was a member of the Reichstag. During this period he was a leader of the agitation against the Jews. In 1890, because of his activity as a Socialist agitator, he was removed by the Emperor from his position as pastor of the Court. Six years afterwards, with a considerable number of followers, he seceded from the Conservative Party, to which he had hitherto belonged, and organized the Christian Socialists. In 1892 Dr. Stöcker became the editor of the *Deutsche evangelische Kirchenzeitung.* Among his published works are: *Christlich-Social* (1884 and 1890); *Wach' auf evangelisches Volk!* (1893); and *Dreizehn Jahre Hofprediger und Politiker* (1895).

STOCK EXCHANGE. An institution where sales and purchases may be made of securities of corporations and municipalities, and in some cases of certificates representing commodities of trade, such as silver bullion, petroleum, etc. In their origin stock exchanges appear to have been free to the use of any one who wished to buy or sell, and it was probably with this function in view that some of the older exchanges, notably the Paris Bourse, were located in buildings erected at the public expense. It was very quickly discovered, however, that in order to enforce bargains some formal organization was necessary. Membership in stock exchanges therefore came to be limited on the general basis used by clubs or other associations. As the profits of the use of the exchange became large possession of a membership became a valuable privilege.

The London Stock Exchange has for many generations occupied the most conspicuous place in the history of finance, for the reason that transactions on its floor were conducted by the great aggregation of capital, home and international, which made its abiding place in that city. Originally confining its dealings to British Government stock, the London Exchange became active, at the opening of the nineteenth century, in securities of other nations which applied to

London capitalists for the placing of their public loans. To this class of securities were later added railway shares. After 1888 stocks of incorporated industrial enterprises, and more recently of mining and exploration companies, grew into high favor, the Stock Exchange merely acting as the medium for the transfer of such shares from the hands of the capitalists behind the enterprise to those of the general public.

The New York Stock Exchange devoted itself during most of its history almost exclusively to securities of railway enterprises, even the dealing in United States Government bonds and in other American public securities being chiefly conducted outside of the Exchange. In recent years, however, along with the development of the London movement of industrial incorporation, the New York Stock Exchange has been largely utilized for the exploiting of shares of American companies of this nature. This movement, which flagged during the hard times of the early nineties, was renewed in enormous volume during the great 'boom' in trade which followed 1897. In the course of this time listing of industrial securities on the New York Exchange attracted an immense business to that branch of its activities. The New York Stock Exchange has never dealt to any noteworthy extent in foreign securities, thereby reflecting the general tendency of American investors. Even the large purchases of British consols by American bankers during the Exchequer's loan issues of 1900, 1901, and 1902 were disposed of privately, and were never allowed a place in the formal trading of the Stock Exchange.

There has been some rather notable diversity in the business of the New York Exchange and other American exchanges. For example, the Philadelphia Stock Exchange has long been noted as the market for various street railway securities. This was because Philadelphia capitalists had interested themselves particularly in that form of investment. For similar reasons the Boston Stock Exchange, though not an organization which commanded the resources and capital of New York, monopolized for many years, and largely controls now, the trading in shares of copper-mining companies.

Stock exchanges of Continental Europe have in general devoted themselves to transportation enterprises of their own countries, to their own Government's securities, and to securities of other European governments which came to those markets to raise capital. More recently the stock exchanges of Paris, Berlin, and Vienna have followed London's example in taking up on a large scale shares of incorporated industrial enterprises. This has been particularly true of Berlin, where the iron industry has been extensively exploited in this form.

History. Stock exchanges as an institution had their origin at the time of the creation of public debts on the modern plan, at the close of the seventeenth century. The incorporation of the East India Company in London further developed the possibilities of the raising of public capital for corporate uses through the medium of stock-exchange trading. In 1720 the enormous public speculation in the shares of the South Sea Company in London and of the Mississippi Company in Paris brought stock-trading to a height never before conceived of. No city at that time, however, possessed a stock exchange in the sense now attached to the term. In London transactions in stocks were conducted through stock brokers, whose headquarters were at Jonathan's and Garraway's Coffee Houses in 'Change Alley. There does not appear to have been any formal organization among these brokers. Addison in the *Spectator* speaks humorously of having been taken for one of their number by the stock-jobbers at Jonathan's. The London Stock Exchange Building was not erected until 1801; the Paris Bourse not until 1826. The New York Stock Exchange membership, even after it had become a formal organization, conducted its business in hired rooms until December, 1865, when the building was erected on Broad and Wall Streets, which has been replaced by the new structure on the same site, dedicated in April, 1903. The history of stock exchanges is very largely a mirror of the financial history of the community in which they are situated. The New York Stock Exchange rose to a position of real prominence only after the Civil War. Even at that time the fact that it did not deal in gold as a commodity threw a great part of the community's highly speculative business over to the Gold Exchange, which was formed for that purpose exclusively. The dramatic incident of this period was the gold panic on Black Friday in September, 1869, when a combination of several unscrupulous speculators, among them James Fisk, Jr., and Jay Gould, attempted to corner and put to extravagant figures the gold supply of the market. Operations on the Stock Exchange proper at that time were largely made up of the personal struggles of rival capitalists, notably in connection with the Erie and New York Central railroads.

The completion of the Pacific Railway (1869) caused extensive speculation in shares of the two transcontinental railways, and as capital increased and the railway mileage of the country extended the transactions of the Exchange became of a national rather than provincial character. The leading operators of that time were Gould, Fisk, Daniel Drew, Cornelius Vanderbilt, and their associates. None of the capitalists named was accustomed to trade personally on the Stock Exchange; indeed, such a practice has always been the rare exception among active financiers.

The crisis of 1873 was felt in its full force on the New York Stock Exchange, which was obliged to close for two days at the height of the panic in order to stem the tide of liquidation in securities. With the great trade revival which followed the resumption of specie payments and the profitable grain harvests of 1879 the New York Stock Exchange entered upon a period of renewed activity. During the year 1880, which marked the climax of the 'boom' of that period, trading on the Exchange reached an enormous volume, and the value of seats in the Stock Exchange rose to an unprecedented figure. In 1881, when a reaction in the tide of prosperity began, the New York Stock Exchange reflected the change by a contraction in the volume of business done and by an extensive fall in prices. Speculation by the general public was again rife in 1882, but was checked with great violence by the sudden fall in railway and industrial profits at the close of the year. The severe reaction of 1883 was followed by the panic of May, 1884, in which half a dozen Stock Exchange houses failed and two important banks were compelled to close their doors.

The period from 1886 to 1888 inclusive was chiefly marked by the large issues of securities to provide funds for the very extensive railway building then in progress. There were several excited markets on the Stock Exchange, though the tendency at the close of the period was toward depression of values, largely because of the enormous creation of new securities. The year 1890 was again marked by great activity and rising prices on the Stock Exchange. This 'boom' was checked by the Baring panic of November, 1890, in London, which was reflected by a prompt recall of English capital from the United Sates, and by a New York Stock Exchange panic, in the course of which two or three broker houses failed. From then until the outbreak of the more serious panic of 1893, a shrinkage in business was the chief characteristic of the New York Stock Exchange's history.

The panic of 1893 was in many respects one of the most dramatic episodes in the Stock Exchange history. There was, at one time during July of that year, talk of repeating the expedient of 1873 and closing the Exchange. This turned out to be unnecessary, as foreign capital came to the market's relief in the moment of emergency. The following year, 1894, was a period of great depression, when the volume of Stock Exchange business fell to the lowest point since 1878. Recovery followed in 1895, when foreign capital was again commanded in connection with the international syndicate to float the United States Government's bond issue and protect the Treasury gold reserve. A panic of smaller proportions swept over the Stock Exchange at the close of this year, in connection with the collapse of the protective operations and the international clash between America and Great Britain over Venezuela. The two ensuing years were chiefly characterized by the reorganization of the great number of important railways which had failed during 1893 and 1894, and whose new securities, largely increased in quantity, were placed through the medium of the Stock Exchange in 1896 and 1897.

The financial revival which began at the close of the last-named year introduced a new epoch in the history of the New York Stock Exchange—an epoch in all respects the most remarkable of its history. Supply of American capital available for investment purposes seemed suddenly to have become unlimited—largely because of the country's immensely profitable harvests at a time of European famine, but also on account of a wholly unprecedented increase in our general export trade, in manufactures as well as in agricultural products, which gave to our markets a command over foreign capital which they had never before possessed. This increase in capital was made use of by promoters of all kinds of enterprises, and their shares found active reception on the Stock Exchange. A highly excited movement for the rise at the opening of 1899 converged chiefly on shares of industrial companies organized to buy up independent plants. Checked by the excess of the speculators and by an industrial reaction during the Presidential contest of 1900, this movement was renewed with immense force at the opening of 1901. At that time all precedents of every kind in Stock Exchange history were broken. Where, a few years before, transactions of 200,000 shares a day had been regarded as constituting a large market and half a million shares as a day of extreme activity, scarcely a day now elapsed in which the volume of business did not run from one to two million shares, culminating on April 30, 1901, in transactions of 3,200,000 shares. Prices in the meantime were advancing at a rate which brought the entire financial public into the field as a speculator. The real force underlying the movement was the purchase of stock companies by other companies which pledged their credit to raise the funds requisite to provide for the purchase. This movement culminated in the famous Northern Pacific corner of May 9, 1901, when the efforts of two rival groups of capitalists to get hold of that railroad property forced its shares to the price of $1000, the stock having never touched $100 until three weeks before. Apprehension that operators who were unable to deliver stock which they had pledged would be dealt with summarily, caused one of the most violent collapses of values in the Stock Exchange's history. Recovery was prompt, and both 1901 and 1902 were characterized by numerous sensational movements for the advance, the second of those years scoring as a rule the higher values. In general, however, it was recognized that high-water mark in Stock Exchange activity had been reached. In the autumn of 1901 and in the fall of 1902 and the early part of 1903 severe reaction in values supervened.

The noteworthy characteristic of the period was the employment of enormously wealthy syndicates to sustain prices for the newly issued shares on the Stock Exchange until the public could be induced to buy. Such syndicates were remunerated at first by large allotments of stock and later by heavy cash payments, the syndicate formed in March, 1901, to 'underwrite' the billion-dollar stock issued by the United States Steel Corporation to take up the shares of other steel and iron combinations, pledging itself, in case of necessity, to advance $200,000,000 capital for the purpose. The stock issue worked out so successfully, however, that only a small fraction of the guarantee was called for, and two years later the original capital subscribed was returned to subscribers, with an additional cash allotment sufficient to raise profits to 200 per cent. A second syndicate, formed in 1902 to underwrite a $50,000,000 bond issue by the same corporation and the conversion of $200,000,000 of its stock into bonds, fared less fortunately, being obliged to perform the whole of its guarantee at a time of falling prices. In the spring of 1903 it was generally recognized that the extensive employment of the syndicate underwriting plan had 'tied up' immense amounts of capital which were usually available in the general market. The investing public having bought very sparingly and the syndicate banking interests being unable to support prices, a very severe and general decline on the Stock Exchange ensued.

Volume of Business. Stock exchanges keep no official record of transactions on their floor. In New York such records are carefully kept by unofficial chroniclers; but as this is not done in London or on the Continent, comparison is impossible. It is safe to say, however, that in recent years the volume of business done on the New York Stock Exchange has far exceeded that transacted in any other institution of the world. Following is the unofficial record of sales in that institution during a series of years:

	Stocks	Corporation Bonds	Government Bonds	State Bonds
1902	$188,503,000	$879,749,000	$1,378,000	$3,675,000
1901	265,944,000	994,235,000	1,892,000	2,502,000
1900	138,380,000	569,159,000	7,012,000	2,082,000
1899	176,421,000	826,711,000	10,582,000	2,013,000
1898	112,699,000	888,747,000	24,581,000	3,642,000
1897	77,324,000	529,843,000	10,394,000	2,004,000
1896	54,654,000	363,158,000	26,494,000	2,284,000
1895	66,583,000	499,758,000	7,480,000	5,583,000
1894	49,075,000	339,950,000	4,345,000	10,929,000
1893	80,977,000	351,854,450	2,143,000	3,792,000

METHOD OF BUSINESS. Stock exchanges as at present constituted are limited in membership and governed by strict rules which cover both methods of business, rates of commission to be charged, and conduct on the floor. The rules governing methods of business in New York prescribe a minimum commission of one-eighth of one per cent. on the face value of securities purchased for outside customers, one thirty-second of one per cent. for purchases made on account of fellow members, and one-fiftieth of one per cent. for purchases made on the order of another member on the floor.

In London commissions vary from 1s. per hundred to 2s. 6d. per hundred, according to the nature of the security. The Paris *agents de change* charge one-fourth of one per cent. In New York the Stock Exchange member may both transact business on the floor of the Stock Exchange and solicit business from outside customers. In London these functions are divided between the two functionaries known as 'jobber' and 'broker,' which correspond roughly to the divisions in other English professions, as, for instance, the barrister and solicitor in law. Members of the London Stock Exchange are forbidden to advertise; New York Stock Exchange houses advertise freely. *Agents de change* in Paris are forbidden to solicit outside business.

Acceptance of a bid or offer of stock makes the transaction official on a stock exchange and binds each participant to the fulfillment of his bargain. Stocks thus sold must be delivered to the buyer by 2:15 P.M. of the ensuing day. The New York Stock Exchange practices daily settlement of such accounts. In London settlements are made fortnightly, the bargain being carried for the account, that is to say, on credit, during the intervening period.

No security may be dealt in on the Stock Exchange which has not been formally 'listed' by the committee. In New York a statement of the company's condition, with a balance-sheet, is required before listing; also proof that proper facilities for transfer and registry of shares have been provided, and that with bonds the mortgage has been properly drawn and recorded. Corporations unwilling to make public statements have, however, been allowed since 1885 to obtain a place in what was called the 'unlisted department.' Since stocks in this department enjoy all the facilities of 'listed stocks,' the discrimination has been entirely futile. Listings on the New York Stock Exchange in recent years have been as shown in the preceding table, 60 to 70 per cent. being securities issued to replace others formerly listed.

	Stocks	Bonds
1902	$533,519,300	$784,032,595
1901	923,010,100	1,642,013,715
1900	443,713,000	620,935,000
1899	525,384,240	704,172,605
1898	700,064,680	528,153,996
1895	257,275,450	143,373,900

MEMBERSHIP PRICES AND RULES. With the limitation of stock exchange membership title to a seat in the exchange becomes valuable property. In New York the price of Stock Exchange seats has fluctuated with great irregularity. In 1879 their price was $9000; they rose to $20,000 in 1881, and to $37,000 in 1883, but by 1893 had declined to $15,250. From that price they gradually recovered, and in the recent great activity of business reached unprecedented figures. During the 'boom' of May, 1901, they sold for $66,000, and subsequently, in 1902, went as high as $84,000. The price at the opening of 1903 was $80,000. Ownership of a New York Stock Exchange seat does not necessarily imply the privilege of the floor; for that the owner must apply in due form to the committee on admissions. In the London Stock Exchange applicants for admission must be recommended by three members of at least four years' standing, who pledge themselves to the extent of £500 apiece to reimburse his creditors in case of his default within four years. If he is of foreign birth he must have been two years naturalized. In Paris, where the number of *agents de change* is limited to sixty, an applicant must be proposed by his predecessor or that predecessor's heirs, and must be approved by the governing committee and the Minister of Finance.

STOCK EXCHANGE SEAT AS PROPERTY. Owing to the peculiar personal nature of a member's rights and privileges, the exact legal status of a seat as a property right is not settled in all jurisdictions. By the general weight of authority, however, a seat may be considered as a species of incorporeal property held subject to such rules and regulations as may be adopted by the exchange. This gives a seat an anomalous position in the law of property because of the qualified and restricted character of an owner's rights. As it cannot be transferred except with the consent of the exchange, and to a person acceptable to the latter, it is held that it cannot be seized and sold upon an execution, but it seems settled in most jurisdictions where the question has arisen that a receiver appointed in proceedings supplementary to execution may apply to the court for an order requiring the judgment debtor to arrange for a transfer of his seat to a person acceptable to the exchange, and apply the proceeds to the satisfaction of the judgment. This may also be done by a judgment creditor's bill in some jurisdictions. Thus, it will be seen that the courts do not assume to proceed against the seat itself, but attain the desired end through their power over the debtor. The United States Supreme Court has held that the rights of a member to his seat in an exchange pass to his assignee in bankruptcy, and the latter may take such steps as may be necessary to compel the bankrupt to procure a transfer of his seat subject to the rules of the exchange. By the rules of probably all exchanges the claims of members must be first satisfied upon the sale of a seat. A seat cannot be bequeathed or devised by will, nor is it strictly descendible, as the person to whom it might be thus given or descend might not be acceptable to the exchange; but the rules generally provide for the sale of a seat on the death of a member, an application of the proceeds to any claims the other members may have against the deceased, and a distribution of the proceeds to his personal representatives. The courts are loth to interfere with any reasonable rules and regulations of a stock exchange and with any action it may take to maintain discipline or enforce its rules, and their aid could probably only be invoked in cases of gross fraud or imposition upon a member.

Discipline. Strict discipline over the conduct of members is maintained by all the larger exchanges. The penalty is suspension from the privileges of the exchange for a given period or expulsion in the case of serious offense. On the New York Stock Exchange these penalties may be imposed for fictitious sales, for trifling bids, for acceptance of smaller commissions than those prescribed by the Exchange, and for 'obvious fraud.' More recently discipline has been exercised for dealing with a rival exchange contrary to the regulations of the member's own exchange, and for questionable business conduct outside of the exchange. In London the same penalties are made applicable on the general ground of failure to comply with the committee's decision or of dishonorable and disgraceful conduct. The rules of the Paris Bourse prescribe penalties in case the member "does not confine himself strictly to his duties" or "introduces injurious innovations."

Curb Trading. An institution which has grown to considerable proportions in recent years has been the so-called 'curb trading,' so named because the transactions are usually conducted on the street outside the entrance to the stock exchange. In London, Paris, and New York this trading has at times reached very large proportions, though the system which it represents is radically different in the three cities. In London curb trading is utilized for the sake of dealing in foreign shares whose home market is open after the official closing of the London Exchange. For example, trading in American securities is conducted in Shorter's Court, behind the London Stock Exchange, frequently until 6 P.M. or later, the New York Stock Exchange, on account of the five hours' difference in time, being actively at work at that hour. In Paris the curb market, under its French title of the 'Coulisse,' has had a longer history. It has represented virtually a rival exchange, not subject to the numerous and rather vexatious limitations of the older Bourse. The Coulisse has frequently been suppressed by law, but has invariably revived, and has probably conducted a larger total business than the Bourse itself, except, perhaps, in Government securities. At present the Coulisse conducts its operations on the portico of the Bourse and is a recognized institution. In New York curb trading devotes itself exclusively to securities which have not been admitted to the list of the Stock Exchange. In this category are comprised many very important enterprises, including shares of the Standard Oil Company and of the various banks. The curb also provides a market for newly organized enterprises which have not reached a stage where they can apply for a place on the Stock Exchange list, and it gives an opportunity for fixing values of a forthcoming security before the share or bond certificates are formally issued. In the conversions of the United States Steel Corporation stock, for instance, the shares and bonds were bought and sold 'when, as, and if issued' on the curb, and on these terms their values fluctuated in some cases 14 or 15 points before the security itself ever legally existed. There is no restriction of the right to deal in the 'curb' market, but in practice its privileges are limited to regular and responsible parties, whose position or credit is known to the other party to a bargain.

Stock Exchange Clearing House. In recent years the system of 'clearing' stock exchange transactions, on the plan of the bank clearing house, has been generally adopted by stock exchanges. As introduced on the New York Exchange in 1892, the system provides for the offsetting of securities which a broker has contracted to deliver by an equivalent amount of the same securities which he may have contracted to receive. Thus, if broker A has sold 1000 New York Central shares to B and bought 1000 of the same shares from C, the two transactions are settled by the delivery of 1000 shares by C to B. The price may be different in the two transactions, but such differences are adjusted by the clearing house, to which the broker is 'debtor' or 'creditor' on his daily sheet. The same principle is followed even where the amounts bought and sold do not agree. Thus A, in the above case, may have sold only 500 shares to B and bought 1000 from C. In that case C delivers 500 shares to A and 500 to B, and payment is made accordingly. The economy consists in the lessening of the number of individual checks which must be drawn for settlement, and against which bank balances must be maintained. Supposing the price of New York Central, in the transactions last described, to have been 100, the old plan of individual deliveries would have necessitated drawing of checks, for settlement, in the total amount of $150,000. The clearing-house plan requires only $100,000. The aggregate saving in checks drawn, during an ordinary year, has exceeded $500,000,000.

The plan was adopted by the Frankfort Stock Exchange in 1867, at Berlin in 1869, at Hamburg in 1870, at Vienna in 1873, at London in 1876, and by various American stock exchanges between 1880 and 1887.

Stock Exchange Terms. The stock exchange has a dialect or slang of its own, many of the terms in which had their origin at the time of the South Sea speculation in 1720. A 'bull' is a buyer of stocks which he hopes to sell at higher prices. He may buy altogether with his own capital; but if he is merely a stock exchange speculator, he borrows most of the requisite funds, depositing the purchased stock as security. He can usually borrow 80 per cent. of the cost value of his shares the difference, 20 per cent., being his 'margin.' If the price falls, the lender calls on him to 'make good his margin.' If he fails to do so, and the margin continues 'impaired,' he is 'closed out' by the sale of his collateral. A 'boom' is a successful upward movement of prices; this term is of American origin. The opposite of a 'boom,' in stock exchange phraseology, is a 'slump.' The 'bear' is a seller of stocks which he hopes to obtain, later on, at lower prices. He may be selling his own holdings and delivering them to the purchaser. But if a speculator, he may borrow stocks as the 'bull' borrows money. Generally he obtains the stocks by lending their equivalent in money to the owner. He is said to be 'short' of stocks, where the bull is 'long.' The bull 'realizes' when he sells to take his profits; similarly, the bear 'covers' when he buys on the market the stock in which he has been speculating, and returns the shares which he has borrowed. Stocks are said to be 'carried' when they are accepted as security from a bull speculator. A 'manipulated' market is one in which speculators have caused an artificial appearance of real buying or selling. A 'rigged' market is much the same thing, though in a more intensified form. 'Puts' are contracts sold at a fixed percentage by capitalists to bull speculators, whereby the capitalist undertakes to pay a set price for a given number of shares within a stipulated time. This insures the speculator against more than a certain amount of loss if he buys stocks. 'Calls' are contracts similarly sold by capitalists, who agree within a given time, and at a set price, to deliver the shares agreed upon to the speculator. This is a guarantee against losses on a falling market. Both sorts of contracts are classified as 'privileges.' 'Wash sales' are transactions in which buyer and seller are employed by the same person, with a view to creating a semblance of activity. They are prohibited under severe penalties by the stock exchanges, but are rarely detected and are very frequently utilized.

STOCKHOLDER. In the strict sense of the term, a person who owns one or more shares of stock in a corporation, and who has been recognized by the latter as having the rights commonly incidental to such ownership. Entry of a person's name on the books of a corporation as the owner of stock is the best evidence of his standing as a stockholder, and as long as his name remains there he may generally exercise all a stockholder's privileges. However, a person to whom shares of stock have been transferred, but whose name has not yet been entered on the books, is sometimes treated as if he were a stockholder and spoken of as such. A corporation is protected in paying dividends to a person whose name remains on its books as a stockholder, even if he has transferred his shares of stock, provided the purchaser has not given notice of that fact. A stockholder of record has the right to vote in certain meetings, the most important of which, perhaps, is one for the election of officers. Each stockholder may vote the number of shares he owns, and thus one person owning the majority of the stock of a corporation may control its elections and policy against the wishes of a great number of holders of a small number of shares aggregating less than the majority. Among the rights of a stockholder are: the right to protest and invoke the aid of the courts against a misuse of the funds of the corporation, or against fraud by the majority stockholders or the officers; to object to a change in the kind of business which the charter authorizes it to carry on; the right to inspect all or any of the books of the corporation at reasonable times and places; and to receive dividends out of the earnings, when a surplus has accumulated, which is not needed for running the business, or for improvements. In many States a stockholder is only liable for the debts of the corporation to the amount of his stock, that is, he only loses what he has paid in, assuming he has paid in the par value of his stock, in case of insolvency of the corporation. If a subscriber to the stock of a corporation has not paid in the full par value of the amount of stock subscribed for by him, creditors of the corporation may hold him for the balance remaining unpaid. A stockholder is not strictly a creditor of the corporation to the amount of his stock, as he is deferred to corporate creditors on a final distribution of assets; but he may become a creditor by a loan of money or sale of goods, and thus stand on an equal footing with the others as to such claims, in most jurisdictions. See CORPORATION; STOCK; and consult authorities there referred to.

STOCKHOLM, stŏk'hōlm. The capital of Sweden, situated at the outlet of the Mälar Lake into the Baltic Sea, in latitude 59° 20′ N., longitude 18° 3′ E. (Map: Sweden, H 7). The situation is extremely picturesque, the city being built partly on a number of islands, partly on peninsulas cut off from the mainland by deep fiords, while the waterways both toward the Mälar and toward the sea lead through labyrinths of fiords and islands. Stockholm has been called the 'Venice of the North,' but its aspect is entirely different from that of Venice. Both the islands and the mainland are rocky and hilly, with granite knolls exposed on all sides, while a primæval forest penetrates almost to the heart of the city. The old nucleus, known as Staden (The City), is built on an island lying across the mouth of the Mälar channel, and connected by bridges with the northern and southern shores and with the little Riddarholm (knight's island) on the west. It has narrow streets falling steeply on all sides from the central Stortorget. Skeppholmen, to the east of Staden, is almost wholly occupied by military and naval depots. The remaining parts of the city, Södermalm on the south shore, Norrmalm and Oestermalm on the north shore, and Kungsholmen in the northwest, are for the most part regularly laid out with broad and straight streets. Here are also a number of handsome squares, parks, and promenades, such as the Gustaf Adolfs Torg, with an equestrian statue of Gustavus Adolphus, the Kungsträdsgård on the water front with a handsome fountain, and the Humlegård, a large and beautiful pleasure garden, containing a colossal bronze statue of Linnæus. From Oestermalm a bridge leads to the easternmost part of the city—an island about two miles long and three-fourths of a mile wide, known as Djurgården from its having formerly been a deer park. It is now laid out as a city park.

The principal churches are the Storkyrka (great church), founded in the thirteenth century, rebuilt in the eighteenth and restored in 1892; the Riddarholms Kyrka, a Gothic structure with a perforated iron spire 290 feet high, and the burial place of Swedish kings; the Tyska Kyrka (German Church), a German Renaissance building of the seventeenth century; and the conspicuous Katarina Kyrka crowning the heights of Södermalm. The royal palace, on the northeastern corner of the Stadsholm, was begun in 1697 in the Italian Renaissance style, and is a large and beautiful rectangular building with four wings inclosing a quadrangle. At the western end of the island stands the Riddarhus (knight's house), containing portraits and armorial bearings of Swedish nobles. Noteworthy also are the new opera house, finished in 1898; the handsome Renaissance building of the National Museum, built in 1850-66, opposite the royal palace on the Blasieholm; and the large and imposing new building of the Northern Museum, begun in 1898, in the Djurgård.

Although Stockholmn has no university, it has numerous establishments for higher technical and popular education and an excellent elementary school system. The Royal Library had in 1899 381,900 volumes and 11,000 manuscripts. There are the National Museum, containing fine art collections and a collection of Swedish antiquities; the Northern Museum (Nordiska Museet) for Scandinavian ethnology and archæology; a museum of natural history; a biological museum showing groups of Scandinavian mammals in their natural surroundings; an astronomical observatory; and numerous scientific and literary associations, the principal of which are the Swedish Academy, the Academy of Sciences, and the Academy of Fine Arts, History, and Archæology.

Stockholm is the largest industrial centre of Sweden next to Göteborg. There are iron foundries and machine shops, breweries, sugar and cotton mills, and tobacco factories, and manufactures of furniture, soap, food products, and miscellaneous articles, while shipbuilding is also carried on. The city ranks first among Swedish ports in the value of imports, and third in exports; the imports in 1897 amounted to $3.307,-520, and the exports to $866,680. The chief exports are iron and timber. In 1900 the shipping at the port amounted to 2255 entries and clearings with a total of 964.367 tons, but in the number and tonnage of its home vessels the city is exceeded by Göteborg. The approaches to the harbor are intricate and rendered somewhat dangerous by rocky reefs, but the harbor itself is good and provided with dry docks and extensive wharfage accessible for large ships. Up to 1895 the harbor was closed by ice about twenty-five days in the year, but recently a new ice-breaker has been put into service to keep it open. The city is, in general, very progressive in the matter of public works. The population increased slowly during the first half of the nineteenth century, having been 75,000 in 1780 and 93,000 in 1850. In 1890 it was 246,454, and in 1901 303,356.

Stockholm was founded in 1255 by Birger Jarl, and was for centuries confined to the Stadsholm and Riddarholm, which were fortified. It was several times besieged and taken by Danish armies, and its wooden buildings were often destroyed by fire until they were supplanted by stone structures. In 1520 the city was the scene of the 'Stockholm Blood Bath,' when the Danish King Christian II., in order to strengthen his position in Sweden, had a large number of Swedish nobles decapitated on the Stortorg. Consult Wattenbach, *Stockholm, ein Blick auf Schwedens Hauptstadt* (Berlin, 1875).

STOCKING FRAME. See KNITTING.

STOCKINGS. See HOSIERY.

STOCK'PORT. A manufacturing town in Cheshire, England, on the Mersey, at the junction of its main feeders, 6½ miles southeast of Manchester (Map: England, D 3). Its prosperity is of modern date. The streets lie on the slopes of a narrow gorge, and are irregular and occasionally precipitous; to the south they rise in terraces above the river. The principal buildings are the court-house, market hall, mechanics' institute, infirmary, and the institution for the blind, deaf, and dumb. The free grammar school was founded and endowed in 1487. The town possesses seven fine parks, the chief of which is Vernon Park, which contains a museum. Stockport owns an electric lighting plant, street railways, sewage works, gas, water supply, and markets. It has extensive manufactures of cottons, woolens, silks, machinery, brass and iron goods, shuttles, and brushes. Population, in 1881, 59,544; in 1891, 70,263; in 1901, 78,871.

STOCKS. An apparatus of wood, much used in former times for the punishment of petty offenders. The culprit was placed on a bench, with his ankles fastened in holes under a movable board, and allowed to remain there for an hour or two. The period of the first introduction of the stocks in England is uncertain, but in the second statute of laborers, 25 Edward III. (1350), provision is made for applying the stocks to unruly artificers. Combined with the stocks was often a whipping-post for the flagellation of vagrants. The use of stocks was general in the English colonies of North America and was employed frequently for the punishment of common scolds.

STOCK'TON. The county-seat of San Joaquin County, Cal., 78 miles east by north of San Francisco; on an arm of the San Joaquin River, at the head of navigation, and on the Atchison, Topeka and Santa Fe and the Southern Pacific railroads (Map: California, C 3). It is in a region noted for its great natural beauty and equable climate and is very attractive. The State Hospital for the Insane is here, and there are also a public library with over 36,500 volumes, the San Joaquin County Law Library, Saint Mary's College, and Saint Agnes Academy. The county court-house, constructed at a cost of $300,000, the high school ($150,000), the post-office, county jail, opera house, Masonic Temple, Saint Joseph's Home, and the County and the Pacific hospitals, are also noteworthy features. In addition to possessing large grain, live stock, and fruit interests, Stockton has considerable industrial importance. Agricultural machinery and implements, flour, foundry products, window glass, lumber, leather, beer, fuel briquettes, canned goods, and woolens constitute the leading manufactures. The government, under the charter of 1889, is vested in a mayor, chosen biennially, and a unicameral council. Stockton was founded in 1849 by Charles M. Weber, the owner of a large Mexican grant, and was named in honor of Robert

Field Stockton, of the United States Navy, who took possession of California for the United States. In its early days it was the starting and outfitting point for miners bound for Calaveras, Tuolumne, and Mariposa counties. Population, in 1890, 14,424; in 1900, 17,506.

STOCKTON, Francis Richard (1834-1902). A popular American writer of humorous tales, born in Philadelphia. In early life he was a wood-engraver and designer, in which capacity he contributed pictures to periodicals. Meanwhile he busied himself also with literary and journalistic work. He was first employed on the Philadelphia *Morning Post*, and in 1872 gave up designing definitively to join the New York *Hearth and Home*. Soon he joined the staff of the *Century Magazine* (then *Scribner's Monthly*) and in 1873 was made assistant editor of the newly founded magazine for children, the *Saint Nicholas*, remaining here till about 1880. He was a prolific writer. His books for children include: *Ting-a-Ling Stories* (1870); *Roundabout Rambles* (1872); *What Might Have Been Expected* (1874); *Tales Out of School* (1875); *A Jolly Fellowship* (1880); *The Floating Prince* (1881); *The Story of Viteau* (1884); and *Personally Conducted* (1889). Even more numerous are his longer works; they are well known for the agreeable impossibility of the situations they narrate. The chief are: *Rudder Grange* (1879), which brought him into prominence; *The Lady or the Tiger?* (1884), perhaps his most popular story; *The Late Mrs. Null* (1886); *The Christmas Wreck* (1886); *The Casting Away of Mrs. Lecks and Mrs. Aleshine* (1886); *The Bee-Man of Orn* (1887); *The Hundredth Man* (1887); *The Dusantes* (1888); *Amos Kilbright* (1888); *The Great War Syndicate* (1889); *The Stories of Three Burglars* (1889); *The Merry Chanter* (1890); *Ardis Claverden* (1890); *The House of Martha* (1891); *The Squirrel Inn* (1891); *The Clocks of Rondaine* (1892); *The Watchmaker's Wife* (1893); *The Adventures of Captain Horn* (1895); *The Great Stone of Sardis* (1897); *The Girl at Cobhurst* (1898); *Afloat and Ashore* (1900); and *The Captain's Toll-Gate*, with memoir by his wife (1903). In the character of his humor Stockton stands alone. His situations are whimsical and his characters grotesque; usually, however, the eccentricity is not merely superficial, and the story, quietly rather than boisterously amusing, and told with apparent sincerity, produces an illusion that pleasingly conceals its absurd premises and its logical though equally absurd conclusions.

STOCKTON, Richard (1730-81). An American lawyer, and a signer of the Declaration of Independence. He was born near Princeton, N. J., graduated at the College of New Jersey (Princeton) in 1748, was admitted to the bar in 1754, visited England in 1766-67, where he made the acquaintance of many distinguished men, and in 1774 became a judge of New Jersey's Supreme Court. He at first advocated a reconciliation between the colonies and England, and in December, 1774, wrote to Lord Dartmouth, proposing a scheme of colonial self-government; but he soon began to take an active part in the opposition to the British Ministry and as a member of Congress in 1776 voted for and signed the Declaration of Independence. In September, 1776, he was sent by Congress, with George Clymer of Pennsylvania, to inspect the northern army.

STOCKTON, Robert Field (1795-1866). An American naval officer, grandson of Richard Stockton (q.v.). He was born at Princeton, N. J., studied for a time at Princeton, and in 1811 became a midshipman in the United States Navy. He joined Commodore Rodgers on the frigate *President* in 1812, was for a time an aide to the Secretary of the Navy, took part in the defense of Baltimore, and was promoted to be lieutenant in September, 1814. In 1815 he distinguished himself in the Algerine War on board the *Spitfire*. He returned to the United States in command of the *Erie* in 1821, and in the fall of the same year sailed in the *Alligator* for the African coast, where he negotiated successfully for the land upon which the American Colonization Society founded Liberia (q.v.). During the early part of the Mexican War he commanded the Pacific Squadron. To his energy, and that of General Frémont, with whom he coöperated, was largely due the success of the American operations on the coast. He captured Los Angeles and San Diego, fought several battles, organized a civil government for California, and installed Frémont as Governor, relinquishing the command to Shubrick in 1847. He resigned from the navy in 1850, and was a United States Senator from New Jersey in 1851-53. Having resigned in 1853, he was for some time president of the Delaware and Raritan Canal Company. Consult *Life and Speeches of Robert Field Stockton* (1856).

STOCKTON-ON-TEES. A seaport in the County of Durham, England, 11 miles east-northeast of Darlington, on the left bank of the Tees (Map: England, E 2). The broad and handsome High Street is nearly a mile in length. A new town known as South Stockton has sprung up on the right bank of the river, the two being connected by an iron bridge of three arches, built in 1887. Shipbuilding, chiefly in iron, is carried on; and blast furnaces, foundries, engine works, extensive potteries, and iron works are in operation. Sailcloth, ropes, and linen are manufactured; and there are corn mills and spinning mills. At Stockton the Tees is navigable for vessels of large tonnage. The moated Norman castle, long an episcopal residence, was taken for the Parliament in 1644, and totally destroyed by the Roundheads in 1652. At the Restoration it had become so poor a place that it contained only 120 houses. Its growth and prosperity date from the development of the iron and steel industry. The Stockton and Darlington Railway, the first to commence the conveyance of passengers and goods, was opened September 27, 1825. Population, in 1891, 49,700; in 1901, 51,500.

STOD'DARD, Charles Augustus (1833—). An American Presbyterian clergyman, born in Boston, Mass. He was educated at Williams College, at the University of Edinburgh, at the Seminary of the True Church of Scotland, and at the Union Theological Seminary, where he graduated in 1859. He was pastor of the Washington Heights Presbyterian Church, New York City, until 1893. In 1869 he became connected with the New York *Observer*, and in 1885 succeeded Samuel I. Prime as editor. His publications include: *Across Russia from the Baltic to the Danube* (1891); *Spanish Cities, with*

Glimpses of Gibraltar and Tangier (1892); and other books of travel.

STODDARD, CHARLES WARREN (1843—). An American traveler and author, born at Rochester, N. Y. As a youth he was in business in San Francisco, Cal., and in 1864 visited the Hawaiian Islands, where he subsequently lived for long periods. He traveled much about the world from 1873 to 1878 as correspondent of the San Francisco *Chronicle*. In 1885 and 1886 he was professor of English at Notre Dame College, Ind., then spent some time in travel, and became lecturer on English literature in the Catholic University at Washington, D. C. His books were chiefly poetry and sketches of travel, and include: *Poems* (1867); *South Sea Idyls* (1873); *Summer Cruising in the South Sea* (1874); *Mashallah! A Flight into Egypt* (1880); *The Lepers of Molokai* (1885); *A Troubled Heart, and How It Was Comforted at Last* (1885); *Hawaiian Life;* or. *Lazy Letters from Low Latitudes* (1894); *The Wonder Worker of Padua* (1896); *A Cruise Under the Crescent* (1898); *Over the Rocky Mountains to Alaska* (1899); *In the Footprints of the Padres* (1902); *Exits and Entrances* (1903).

STODDARD, RICHARD HENRY (1825-1903). An American poet, critic, and journalist, born at Hingham, Mass. He was educated in the public schools of New York City, worked in an iron foundry, gained attention in 1849 by a privately printed volume of verse, *Footprints*, obtained a place in the Custom House (1853-70), and was confidential clerk to George B. McClellan (1870-73), pursuing meantime literature as an avocation as literary reviewer, especially for the *World*, the *Mail*, and the *Mail and Express*. Noteworthy among his numerous publications are: the juvenile *Adventures in Fairyland* (1853); verses collected in *Songs of Summer* (1857); *The King's Bell*, a poem (1862); *The Story of Little Red Riding Hood*, verse (1864); *The Children in the Wood*, verse (1865); *Abraham Lincoln*, a commemoration ode (1865); *Putnam the Brave* (1869); *The Book of the East*, verse (1867); *The Lion's Cub and Other Poems* (1890); and *Under the Evening Lamp* (1892). A collected edition of his verses was issued in 1880. Stoddard also edited several noteworthy anthologies, among them *Melodies and Madrigals* (1865); *Poets and Poetry of America* (1872); *Female Poets of America* (1874). For many years he was an important figure in the literary life of New York.—His wife, ELIZABETH (BARSTOW) (1823-1902), collaborated with him in editorial work and wrote three novels, *The Morgesons* (1862), *Two Men* (1865), *and Temple House* (1867). Her *Poems* were collected in 1895. Consult Stoddard's *Recollections Personal and Literary*, ed. by R. Hitchcock (New York, 1903).

STODDARD, WILLIAM OSBORN (1835—). An American author and journalist, born at Homer, N. Y., and educated at the University of Rochester, where he graduated in 1857. After three years of farming and newspaper work in Illinois, where he edited the Chicago *Daily Ledger* and the *Central Illinois Gazette*, and three months' service as a volunteer at the outbreak of the Civil War, he acted from 1861 to 1864 as private secretary to President Lincoln and then engaged in literary work. His publications include: *The Heart of It* (1880); *Life of Abraham Lincoln* (1884); *Lives of the Presidents* (10 vols., 1888-89); *Table Talk of Lincoln* (1892); *Quirt Ten Eyck* (1893); *The Swordmaker's Inn* (1896); *With the Black Prince* (1898); *Lincoln at Work* (1899); and *Jack Morgan* (1901).

STOD'DART, JAMES HENRY (1827—). An American actor, born in Yorkshire, England. He was the son of an actor and during his youth in Glasgow he often took juvenile parts with his father. At seventeen he began an independent career, winning at length in Liverpool considerable success as a comedian. He came to the United States in 1854 and became a member of Wallack's company. Afterwards for a time he played with Laura Keene; then with Dion Boucicault; and subsequently for twenty years was under the management of A. M. Palmer. Even in comparative youth, Stoddart was best known in 'old man' parts. Among his most popular characters were Mr. Moneypenny in *The Long Strike*, Colonel Preston in *Alabama*, the curate in *Saints and Sinners*, and, later, Lachlan Campbell in *The Bonnie Brier Bush* (1901). Consult: Stoddart's own *Recollections of a Player* (New York, 1902); McKay and Wingate, *Famous American Actors of To-day* (New York, 1896).

STOD'DERT, BENJAMIN (1751-1813). An American soldier and Cabinet officer. He was born in Charles County, Md., joined the Continental Army in 1776, became a captain in January, 1777, and was severely wounded at Brandywine in September, resigning his command in April, 1779. He then served as secretary of the Board of War until 1781, and from 1798 to 1801 was Secretary of the Navy, being the first to discharge the duties of this office, though George Cabot (q.v.), who resigned within a few weeks, was the first to be appointed. His services in connection with the organization of the department were very valuable.

STOHMANN, stō'mȧn, FRIEDRICH KARL ADOLF (1832—). A German agricultural chemist, born in Bremen, and educated at Göttingen and London. He was Graham's assistant at University College from 1853 to 1855, and afterwards assisted Henneberg at Celle. In 1862 he started the station for agricultural experiments at Brunswick. He was called to Halle in 1865 and to Leipzig in 1871, where he was director of the agricultural physiological institute of the university. His principal investigations had to do with the nourishment of animals. He wrote: *Beiträge zur Begründung einer rationellen Fütterung der Wiederkäuer* (1860); *Biologische Studien* (1873); *Handbuch der technischen Chemie* (1872 and 1874); *Handbuch der Zuckerfabrikation* (1878); and *Die Stärkefabrikation* (1878).

STOICS (Lat. *stoicus*, from Gk. *στωϊκός*, *stōikos*, *στοϊκός*, *stoikos*, relating to a colonnade, stoic, from *στόα*, *stoa*, colonnade). The name of the school of ancient moralists opposed to the Epicureans in their views of human life. The stoical system dates from the end of the fourth century B.C.; it was derived from the system of the Cynics, whose founder, Antisthenes, was a disciple of Socrates. Indeed, the doctrines, but still more the manner of life, and most of all the death of Socrates, were the chief foundations of the stoical philosophy.

The founder of the system was Zeno (q.v.), from Citium in Cyprus, who opened his school in a portico called the Stoa Pœcile ('painted porch') at Athens, whence the origin of the name of the sect. Zeno had for his disciple Cleanthes, from Assus, in the Troad (died c. 220 B.C.), whose Hymn to Zeus is the only fragment of any length that has come down to us from the early Stoics, and is a remarkable production, setting forth the unity of God, His omnipotence, and His moral government. Chrysippus, from Soli in Cilicia (c. 280-207 B.C.), followed Cleanthes, and, in his voluminous writings, both defended and modified the Stoical creed. He was regarded as a second founder of the school, and it was a saying in antiquity that without Chrysippus there had been no Stoa. Chrysippus was succeeded by Zeno of Tarsus and Diogenes of Babylon; then followed Antipater of Tarsus, who taught Panætius of Rhodes (died B.C. 112). Panætius introduced Stoicism to Rome, and also made such modification in the system that it is customary to regard Stoicism as entering with him upon a second period, characterized by a "nearer approach to the Peripatetic and Platonic teaching" (Windelband). Among the most prominent Stoics of this period are to be mentioned Boëthius of Sidon and Posidonius of Apamea in Syria. The third period of Stoicism is the Roman period, represented by L. Annæus Cornutus, L. Annæus Seneca, Epictetus, and the Emperor Marcus Aurelius Antoninus.

Stoicism was mainly an ethical theory, but it had a logic and a physics as well. Under logic it included both dialectic and rhetoric. Dialectic was predominantly a theory of knowledge. The main question here was: How can we test truth? In answer to this question the Stoics worked out a sensationalistic epistemology. The soul is originally like a blank wax tablet. Things cause alterations or impressions on the soul, and those alterations or ideas which refer to particular things compel assent. These impressions are kept in memory, and, partly without and partly with conscious intention, concepts arise. These are entirely subjective; thus in ancient times we find the germ of nominalism (q.v.). The highest value is attached to the involuntarily formed concepts, for these compel assent from all men (*consensus gentium*). Physics included, for the Stoics, cosmology, psychology, and theology. All reality is corporeal, but falls into two classes, the active and the passive, which, however, are inseparable. The active principle is sometimes represented as fire, sometimes as spirit. The spirit-fire is God, and is self-conscious. Out of it is developed air, water, earth, the whole universe of separate beings, and all nature is rational. Every individual soul is a part of the universal world-soul for a time individualized, but ultimately to be absorbed into the world-soul again, at the time when all the differentiation of the universe is consumed in all-devouring fire. This process takes place by Fate, i.e. in accordance with irreversible laws, but is also purposeful, i.e. mechanism is conceived of as compatible with teleology. When one cycle of differentiation and absorption is complete, another begins.

The Stoic ethics was the ethics of apathy. The soul or the divine principle in man should not allow itself to be carried away by the passions aroused in it by external things. A man must be self-controlled. The passions are due to false judgments and mental disturbances, hence they can be overcome by wisdom and by a refusal to assent to their dictation. A man is not, indeed, master of his fate, but he can keep his self-control and proud self-complacency through all the vicissitudes of life. The Stoic formula was a life in accordance with nature. As we have seen that for Stocism nature is all rational, to live in accordance with nature was to live in accordance with reason. Such a life is happy. Pleasure is an accessory, not an end, of a reasonable life. The Stoics took a very rigorous view of virtue, which they claimed admitted of no degree. One may be virtuous, but if he is not thoroughly so he is not so at all. There may be approximation to virtue, short of virtue, but such approximation is not virtue. Only very few men are virtuous; the vast majority are fools. The four cardinal virtues of the Stoic system are insight, courage, temperance, and justice, a classification which in essence does not depart from the Platonic. One very distinctive feature of Stoicism was its cosmopolitanism. Because all men are manifestations of the one universal Spirit, they should live in brotherly love and readiness to help each other. Differences of rank and wealth are external, and should not interfere with social relations. Thus, long before Christianity taught that there is neither Greek nor Jew, nor male nor female, nor bond nor free, Stoicism had recognized and lived up to the brotherhood of man.

Consult: Capes, *Stoicism* (London, 1880); Zeller, *Die Philosophie der Griechen* (3d ed., Leipzig, 1880; Eng. trans. by Reichel, London, 1880).

STOKES, stōks, GEORGE THOMAS (1843-98). An Irish divine and author, born in Athlone, Westmeath, Ireland. He was educated at Queen's College, Galway, and Trinity College, Dublin, and, after acting as curate in Killaloe and Newry, he became, in 1869, vicar of All Saints, Blackrock, which position he retained until his death. In 1883 he was called to the chair of ecclesiastical history in Dublin University, and in 1893 he became canon of Saint Patrick's in Dublin. Among his publications are: *Ireland and the Celtic Church* (1886); *Sketch of Mediæval History* (1887); *Ireland and the Anglo-Norman Church* (1889); *Bishop Pocock's Tour Around Ireland in 1752* (1891); *The Acts of the Apostles* (1891); and *Greek in Gaul and Western Europe Down to A.D. 700* (1892).

STOKES, Sir GEORGE GABRIEL (1819-1903). An English mathematician and physicist, born in Skreen County, Sligo, Ireland. He was educated at Cambridge, and became fellow of Pembroke College in 1841, and was elected in 1849 to fill the Lucasian chair of mathematics in Cambridge. In 1885 he was appointed president of the Royal Society. Stokes was the first to explain in his lectures the scientific principles on which spectrum analysis depends, while to him is due also the first thorough study and explanation of the phenomena of fluorescence, in his paper *On the Change of the Refrangibility of Light* (*Philosophical Transactions* for 1852-53), for which he received the Rumford Medal. He greatly extended and improved the application of mathematics to physico-mathematical treatment of questions connected with the distortion of elastic solids, the motion of waves in water, the undulatory theory of light, the summation of series, the internal friction of fluids, and other subjects in hydrodynamics, etc. He also discussed the variation of gravity over the surface of the earth and wrote an important paper on the nature of Röntgen rays. For his work in optics Stokes stood preëminent among the scientists of the nineteenth century, and he did much to mold current thought and theory in this field. He published the *Burnet Lectures on Light* (1892); *Mathematical and Physical Papers* (3 vols., 1880-1902); and *Gifford Lectures on Natural Theology* (1891-93). He was made a baronet in 1889.

STOKES, Henry Newlin (1859—). An American chemist. He was born in Moorestown, N. J., and was educated at Haverford College and Johns Hopkins University, after which he studied chemistry in Munich and in Zurich. In 1889 he became an assistant chemist in the United States Geological Survey, which office he relinquished in 1892 to accept the place of assistant professor in the University of Chicago, where he remained until 1893, when he returned to the service of the Geological Survey. He accepted an appointment with the Bureau of Standards in 1903. His researches include studies in organic chemistry, especially on phosphimic and metaphosphimic acids.

STOKES, Whitley (1830—). A distinguished Celtic scholar and authority on Anglo-Indian law, born in Dublin, Ireland. He was educated at Trinity College, and became a barrister of the Inner Temple in 1855. In 1862 he went to India, where he occupied various legal positions under the Government. He drafted the present *Code of Civil Procedure* and did other important legal work, but became best known, and is likely to be longest remembered, for his contributions to Celtic scholarship, a branch of research which he took up before he went to India, and continued during his governmental service there. The greater part of his work deals with early Irish, but his studies included the other Celtic languages, investigations of Cornish and British monuments, and contributions to Celtic grammar. It has been said that his researches have done more than those of any other scholar to make accessible the literary and historical monuments of the ancient Irish language. His writings are intended mainly for scholars, but his texts usually are accompanied by translations, and some of these possess high literary worth. Conspicuously good are his renderings of the "Death of the Sons of Usnach" (*Irish Texte*, vol. ii.), and of the "Briden Da Derga" (*Revue celtique*, vol. xxii.). His principal publications are: *Irish Glosses* (1860); *Three Irish Glossaries* (1862); *The Play of the Sacrament* (1862); *The Passion, a Middle-Cornish Poem* (1862); *The Creation of the World: A Cornish Mystery* (1863); *Three Middle-Irish Homilies* (1871); *Goidelica* (2d ed. 1872); *Beunans Meriasek* (1872); *Middle-Breton Hours* (1876); *The Calendar of Œngus* (1880); *The Tripartite Life of Saint Patrick* (1887); *The Old Irish Glosses at Würzburg and Carlsruhe* (1887); *Lives of Saints from the Book of Sismore* (1889); *Urkeltischer Sprachschatz* (1894); *The Martyrology of Gorman* (1895).

STOKE-UPON-TRENT. A manufacturing town in Staffordshire, England, 15 miles north of Stafford (Map: England, D 4). The principal public buildings are the town hall, New Market hall, and Minton Memorial building. There are statues to Wedgewood, Minton, and Colin Minton Campbell. The town is the centre of the 'Potteries' district, and owes its importance to porcelain and earthenware manufactures, carried on in about 200 factories. It has manufactures of iron, engines, machinery, and bricks, and in the vicinity are numerous coal mines. The town, incorporated in 1874, is of modern growth. Population, in 1891, 24,000; in 1901, 30,450. Consult Ward, *Stoke-upon-Trent* (London, 1843).

STOLBERG, stôl′bĕrk, Christian, Count (1748-1821). A German poet, born at Hamburg, of an ancient family, originally from Thuringia. Christian studied at Göttingen (1769-74), where he and his brother joined the literary Hainbund, was twenty-three years in the public service, and lived from 1800 till death near Eckernförde, Schleswig. He translated Sophocles (1787), and wrote several volumes of poems (*Gedichte*, 1779, 1782, 1787, 1810) noteworthy for their pictures of family life.

STOLBERG, Friedrich Leopold, Count (1750-1819). A German poet and translator, brother of Christian. He was born at Bramstedt, Schleswig, studied at Halle and Göttingen, and from 1777 to 1780 was Ambassador of the Prince-Bishop of Lübeck at Copenhagen. He became Ambassador of the Danish Court at Berlin in 1789, and filled other official positions until in 1800, with his whole family, he became a convert to Roman Catholicism, an event which caused much excitement throughout Protestant Germany. During his later years he lived in comparative retirement, devoted mainly to literary work of the most varied kind, ranging from verse of great facility and boldness of imagery, through translations of Greek authors, prose romance, and travels, to a fifteen-volume history of Christianity from his later standpoint (1807-18). He died at Sondermühlen, near Osnabrück. Consult biographical studies by Menge (Gotha, 1862), Hennes (Frankfort, 1876; Mainz, 1875), and Janssen (Freiburg, 1900).

STOLE (Lat. *stola*, from Gk. *στολή*, *stolē*, long robe, from *στέλλειν*, *stellein*, to array, despatch). A narrow band of silk worn over the shoulders by the clergy of the Roman Catholic and Anglican communions, corresponding to a vestment known as *orarion* in the Eastern churches. See Costume, Ecclesiastical.

STOLEN GOODS. In law, chattels which have been the subject of larceny and have not been restored to the possession of their owner. Inasmuch as the larceny does not divest the owner of his property in the stolen goods, a buyer cannot acquire title to them even if the purchase be made in good faith. In England, however, this rule does not apply if stolen goods were bought in market overt (q.v.), and the owner had not prosecuted the thief, in which case the *bona fide* purchaser acquires valid title. In the United States there are no markets overt, and any person buying stolen goods acquires no better title to them than the thief has. That is, the owner has a right to take them wherever he may find them. This rule is subject to the qualification that current money and negotiable papers payable to bearer or indorsed in blank may pass to and become the absolute property of a *bona fide* purchaser even if they have been stolen from their lawful owner. See Negotiable Paper.

To constitute the crime of receiving stolen goods, the goods must have been stolen and not acquired by embezzlement or false pretenses. The receiver must either know that they have been stolen or have reasonable grounds for believing that they have been unlawfully taken from their owner. The crime becomes complete when the receiver takes them into his possession or they are taken for him with his knowledge by a servant or agents. If the goods after being stolen come back into the possession of the owner or are delivered to the receiver by the owner's authority, they cease to be stolen goods, and the crime of receiving cannot be committed with reference to them.

In England it early became the law that if goods were stolen in one county and carried into another by the thief, he was deemed to have committed larceny in both counties, and could be indicted and placed on trial in either. As the offense, wherever committed, was an offense against the same sovereignty, this rule as to larceny amounted simply to a convenient method of determining the place of trial. The English courts refused to apply the rule where goods were stolen in a foreign country and brought to England. Courts in many of the United States have somewhat illogically applied this rule to the several States, holding that if goods are stolen in a sister State and then brought within the State larceny is committed in both States, notwithstanding the fact that the original offense was committed against an independent sovereignty so far as the administration of the criminal law is concerned, and that the having in possession of stolen goods is a very different offense from the larceny of the goods. A few States, as Ohio, have refused to follow this rule, and one, Vermont, has applied the rule to goods stolen in other States and brought within the State, but has declined to follow it in case of goods stolen in foreign countries. (See Larceny.) The crime of receiving stolen goods is now generally defined by statute and the punishment imposed varies in the different States. In most States the offense is deemed a felony. See Crime; Jurisdiction.

STOLP, stōlp. A town in the Province of Pomerania, Prussia, on the Stolpe, 12 miles from the Baltic Sea, and 65 miles west by north of Danzig (Map: Prussia, G 1). The fourteenth-century Marienkirche, with its lofty tower, is worthy of note. The town has an old castle. Its most important industries are amber turning and carving, and linen weaving. Machinery, furniture, leather, and cigars are also manufactured. Stolp was a member of the Hanseatic League, and belonged to the Dukes of Pomerania until 1637, when it passed to Brandenburg. Population, in 1900, 27,272. At the mouth of the Stolpe lies Stolpmünde, the port of Stolp, with a population of about 2000.

STOLTENBERG-LERCHE, stōl′ten-bĕrk-lĕrk′e, Vincent. See Lerche, Vincent Stoltenberg.

STOLZ, stôlts, Friedrich (1850—). An Austrian classical philologist, born at Hall, in Tyrol, and educated at Innsbruck and Leipzig. He established himself as docent at the University of Innsbruck in 1879, and was appointed professor in 1887. Besides his great work, the first volume of the *Historische Grammatik der lateinischen Sprache* (1894-95), he wrote *Zusammengesetzte Nomina in den homerischen und hesiodischen Gedichten* (1874); *Die lateinische Nominalkomposition* (1877); *Studien zur lateinischen Verbalflexion* (1882); *Lateinische Laut- und Formenlehre* (in Müller's *Handbuch*, 3d ed. 1899); *Homeri Odysseæ Epitome* (1893); *Entwickelung der indogermanischen Sprachwissenschaft* (1899); and an ethnographical study, *Die Urbevölkerung von Tirol* (2d ed. 1892).

STOMACH (Lat. *stomachus*, from Gk. *στόμαχος*, throat, gullet, stomach, from *στόμα*, *stoma*, mouth). The principal organ of digestion, receiving the food through the œsophagus, and, after certain digestive changes have taken place, emptying it into the intestines, where the process is completed. The stomach is irregularly conical, curving somewhat upon itself so that the lower curvature is much greater than the upper curvature. The size varies according to the amount of food recieved, but when empty the walls are in apposition. It lies in the left hypochondriac and epigastric regions, behind and partly protected by the ribs and in close relation with the left lobe of the liver and the diaphragm. The stomach has an external peritoneal coat, a muscular coat consisting of longitudinal, circular, and oblique fibres, a submucous or areolar layer, and a lining mucous membrane. In this mucous membrane are the so-called pyloric and peptic glands, which secrete the gastric juice necessary for the digestive processes carried on here. The main blood supply is through the gastric artery, and the nerve supply is derived from the pneumogastric nerves and the sympathetic system. See Alimentary System; Digestion; Food; Gastritis; Ruminant.

STOMACH, Diseases of the. The organic diseases of the stomach with constant lesions include gastritis (q.v.), ulcer, erosions, and cancer. The 'functional' diseases, with variable lesions, include hyperchlorhydria, gastrosuccorhœa, achylia gastrica, and ischochymia.

Ulcer of the stomach is usually characterized by a deep circumscribed loss of substance of the mucous membrane lining the stomach, refusing to heal, and occasioning pain, vomiting, and hemorrhage. The cause cannot always be assigned, although the affection is of so frequent occurrence as to be found, either active or cicatrized, in about 5 per cent. of all persons who go to autopsy for all diseases (Brinton). It is twice as frequent in females as in males, and occurs most generally during middle life. Its mortality is most frequent between the ages of forty and sixty. While anæmia seems to play some part in the causation of ulcer, it is deemed more probable that hyperacidity of the gastric juice is more often accountable. Ulcers generally occupy the posterior surface, the lesser curvature, and the pyloric sac. When they heal they leave behind depressed scars with contractile tendency, producing, when at the pylorus, a stricture. When they do not heal, corrosion of neighboring bloodvessels may ensue, with hemorrhages, possibly fatal; or there may arise adhesions to neighboring organs, or perforations. The symptoms named increase in severity till death occurs from perforation, hemorrhage, or starvation; or, they gradually disappear and the patient recovers. The prognosis is only fair. About half of the cases recover, about 13 per cent. die of perforations and peritonitis, about 20 per cent. die of tuberculosis, about 5 per cent. die of starvation, and about 5 per cent. die of hemorrhage. The treatment of ulcer includes rest, diet by mouth and by rectal enemata, correction of acidity by proper alkalies, the administration of nitrate of silver or bismuth, and the proper management of the accidents: hemorrhage, peritonitis, and collapse.

Erosions of the stomach consist really of small, superficial ulcers of the mucous lining. They occur commonly in chronic gastritis; often their cause is unassignable. The symptoms include pain, a feeling of weakness, and emaciation. The emaciation is progressive to a certain point, during the earlier part of the attack, but after reaching a certain level the patient grows no thinner, and does not present a cachexia.

The patient may suffer from erosions for many years. The treatment consists of the use of nitrate of silver, intra-gastric galvanization, diet, general hygiene and out-of-door exercise, condurango, nux vomica, and iron.

Cancer of the stomach is more frequent than cancer of any other organ. It is apparently on the increase. Gastric cancer occurs more frequently at the age of fifty; it is rare before thirty. It is probably equally divided between the sexes. The tendency to cancer is possibly hereditary. It follows trauma and ulcers, and it is probably also due to primary infection with the suspected bacillus which bacteriologists hope to discover as the cause of cancer. The new growth may be an epithelioma, a medullary carcinoma, a scirrhus, or a colloid carcinoma. See Tumor.

The general symptoms of cancer of the stomach are pain, loss of appetite, vomiting, hemorrhage, tumor, fever, constipation, and a decided cachexia. Examination of the blood reveals a leucocytosis in some cases during fasting, and an absence of the normal leucocytosis of digestion. Little can be argued from the urine, although in some cases the chlorides are diminished and indican is increased, and rarely peptonuria is present. Examination of the stomach contents after a test meal reveals decrease of the free hydrochloric acid as well as of the total acidity, and the presence of lactic acid. The prognosis is hopeless for cure. If the disease be of slow progress, the patient may gain relief enough from surgical interference to live along several years. When the neoplasm invades the pylorus, resection of this part of the stomach may be made; or excision, if in other parts of the organ. Among palliative operations are gastrotomy and gastro-enterostomy. The former is suitable in cases of cancer of the œsophagus or of the cardiac orifice, the latter in cases of pyloric stenosis. The medical treatment consists of diet, the iodides, condurango, methyl blue, chloral, and such analgesics as may be expedient.

Of the 'functional' diseases, *hyperchlorhydria* is a condition in which the gastric juice possesses more acidity and ferments than it should. A test of the stomach contents decides the diagnosis, and the condition is met by hygiene, diet, alkalies, bromides, and in some cases opiates and electricity.

Gastrosuccorrhœa is a periodical and continuous production of the normal gastric juice, causing vomiting and intense pain, restlessness, nausea, and a feeling of pressure in the epigastrium. Analysis of the contents of the stomach is the best diagnostic test. The treatment of this rare affection is largely by the use of atropine, nitrate of silver, galvanization, and lavage.

Achylia gastrica is a condition in which there is a constant absence of gastric juice, accompanied by atrophy of the stomach, and following severe catarrhal disease of that organ. The gastric contents decide the diagnosis. Lavage, faradization of the stomach, and attention to diet constitute the treatment.

Isochymia is a distressing condition in which food is always found in the stomach, even when fasting. The stomach is dilated and the mechanical insufficiency of the organ is so great as to fail of emptying the chyme into the intestines. Paresis of the gastric muscular coat or contraction of the pylorus is the cause of this condition. Indifferent appetite, thirst, dryness of the throat, oppression, pain, and eructation of gas, together with vomiting of chyme, are among the notable symptoms. Constipation is present and emaciation becomes pronounced. Ulcer may be the cause of the pyloric stenosis. The course of the condition varies with the etiology. Lavage, diet, nitrate of silver, rectal alimentation, massage, and the administration of alkalies may all be of advantage, as also the galvanic current. See Cardialgia; Indigestion; Sarcina. Consult Einhorn's *Diseases of the Stomach* (New York, 1903).

STOMACH-PUMP. An instrument used to remove poisons from the stomach, to feed persons who cannot swallow, or who attempt to starve themselves, or to wash out the stomach during disease. It is a syringe with a flexible tube, inserted into the stomach through the œsophagus, by which fluid is injected and removed.

STOMATA (Neo-Lat. nom. pl., from Gk. *στόμα*, *stoma*, Av. *staman*, mouth). The so-called breathing pores especially numerous in foliage leaves and developed in any epidermis overlying green tissue. Each stoma consists of two crescentic guard cells whose concave surfaces face one another, leaving a slit which is opened or closed as required by the plant, hence the name 'automatic gateway.' See Leaf.

STOMATITIS. See Mouth, Diseases of the.

STOM'ATOP'ODA. See Crustacea; Mantis-Shrimp.

STONE. See Building Stone.

STONE. See Weights and Measures.

STONE. See Calculus.

STONE, Artificial. The name given to various artificial compositions of which the basis is hydraulic cement, which are plastic when first made and assume with age a stone-like hardness and consistency. Some of these compositions possess undeniable merit for certain kinds of work and are considerably used. The chief stones of this character are Béton-Coignet, Portland stone, McMurtrie stone, Ransome stone, and Sorel stone. *Béton-Coignet* was invented by Coignet, a Frenchman, and as made by him was composed of Portland cement, siliceous hydraulic cement, and clean sand very thoroughly mixed with a small amount of cold water. This plastic mixture is then placed in molds to harden for use. *Portland stone* is a mixture of Portland cement and sand or sand and gravel wet to make a plastic mixture and rammed into molds to harden. Under various trade names Portland stone has quite an extensive use in the United States. It is molded into blocks of numerous forms and sizes, with or without ornament, for buildings and other structures. *Sand bricks* are an artificial stone made by mixing sand and lime into a moist paste, molding this paste into bricks or blocks, and setting the molded blocks to harden in heated chambers. McMurtrie stone is formed by adding alum and potash soap to the mixture for Portland stone. These ingredients form compounds of alumina in the pores of the stone, which reduce the capacity of the stone to absorb water and add somewhat to its strength. Ransome stone is made by mixing sand and silicate of soda, molding the mixture into blocks or slabs, and setting them to harden under pressure in a hot solution of chloride of calcium. This material is used mostly in England, where it is applied to a variety of purposes. *Sórel stone* is a French product, and is made by adding to oxide of magnesium a solution of chloride of magnesium. It is used mainly in making emery wheels. Consult Baker, *Treatise on Masonry Construction* (New York). Excellent articles on the manufacture of sand brick are contained in the *Transactions of the American Ceramic Society*, vols. iv. and v. See CONCRETE; PAVEMENT.

STONE, AMASA. (1818-83). An American railroad builder and philanthropist. He was born at Charlton, Mass., and early engaged in the building of railroads and bridges, being made superintendent of the New Haven, Hartford and Springfield Railroad in 1845. He was one of the contractors for building the Cleveland, Columbus and Cincinnati and the Cleveland and Erie railroads, and during the Civil War he was often an adviser of the Government in matters of transportation of men and material. Stone gave $600,000 to Adelbert College of the Western Reserve University at Hudson, on condition of its removal to Cleveland, and also made many charitable benefactions in the city of Cleveland.

STONE, CHARLES POMEROY (1825-87). An American soldier, born at Greenfield, Mass. He graduated at West Point in 1845, entered the ordnance department, and served under General Scott during the war with Mexico. On the outbreak of the Civil War he organized the District of Columbia Volunteers, and in May, 1861, was made brigadier-general. He participated in several actions during June and July, 1861, took part in General Patterson's operations in the Shenandoah Valley, and commanded at the disastrous affair at Ball's Bluff (q.v.). Though charges were never preferred against him, he was arrested and confined for six months in military prisons. In August, 1862, he was released, and in May, 1863, he was assigned to the Department of the Gulf. He participated in the siege of Port Hudson in 1863, and then for nearly a year served as chief of staff to Major-General Banks. On August 21, 1864, he was given command of a brigade before Petersburg, and on September 13, 1864, resigned his commission. In 1870 he entered the service of the Khedive of Egypt as chief of staff and with the rank of brigadier-general. He was later appointed general aide-de-camp to the Khedive. In 1883 he returned to the United States.

STONE, EDWARD JAMES (1831-97). An English astronomer, born in London. He received his education at Queen's College, Cambridge, and in 1859 was elected fellow of his college. In 1860 he became chief assistant at the Royal Observatory at Greenwich. From 1866 to 1870 he was secretary of the Royal Astronomical Society, and its president (1882-84). In 1870 he was appointed her Majesty's astronomer at the Cape of Good Hope, and in 1879 Radcliffe observer at Oxford, which position he retained till his death. From observations made in 1862 Stone deduced a value of the solar parallax, which fixed the solar distance as slightly over 91,000,000 miles. The reversal of the Fraunhofer spectrum, a confirmation of Young's spectroscopic discovery of the reversing layer of the sun, was observed by him during the solar eclipse at Klipfontein in 1874.

While at the Cape Observatory he prepared a catalogue of 12,441 stars (1880), containing all stars down to the seventh magnitude between the South pole and 25° S. declination, for which he was awarded the Lalande prize of the French Academy in 1881. This survey of the southern heavens was completed in the *Radcliffe Catalogue* for 1890, in which he gives the places of 6424 stars to the seventh magnitude between the equator and 25° S. declination. Consult Royal Society's *Catalogue of Scientific Papers*.

STONE, SAMUEL JOHN (1839-1900). An English hymn-writer, born at Whitmore, in Staffordshire. He was educated at the Charterhouse and at Pembroke College, Oxford. He became curate of Windsor (1862-70) and of Saint Paul's, Haggerston (1870-74), vicar of Saint Paul's, Haggerston (1874-90), and rector of All Hallow's on the Wall, London (1890). He is widely known for his many hymns, as "Round the Sacred City Gather," "The Church's One Foundation," and "Lord of Our Soul's Salvation." Consult his *Hymns* (1886), also his *Lyra Fidelium* (1866), *The Knight of Intercession and Other Poems* (1872), *Sonnets of the Sacred Year* (1875), and *Lays of Iona* (1897). For bibliography of hymns, consult Julian's *Dictionary of Hymnology* (London, 1892).

STONE, THOMAS (1743-87). A signer of the Declaration of Independence. He was born in Charles County, Md., studied law at Annapolis, began practice at Frederickton in 1764, and was a delegate to the Continental Congress in 1775-77, and again in 1783-84, being president *pro tem.* in 1784. He was a member of the Committee on Confederation in 1776-77, and, returning to Maryland in 1777, urged the State Convention to ratify the Articles of Confederation. Consult Sanderson, *Signers of the Declaration of Independence*, vol. ix. (Philadelphia, 1823-27).

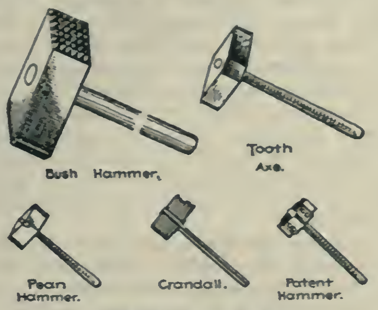
STONE, WILLIAM LEETE (1792-1844). An American journalist and historical writer, born at Newpaltz, N. Y. After editing several provincial journals he became editor of the New York *Commercial Advertiser* in 1821. He earnestly furthered a plan for collecting the colonial documents of New York, and was defendant in a famous suit brought by the novelist Cooper for criticisms that had appeared in his journal on that novelist's *Home as Found* and the *History* *of the Navy.* (See COOPER, J. F.) He was active in furthering benevolent institutions for the deaf and dumb and for juvenile delinquents. Among his many publications the revolutionary *Tales and Sketches* (2 vols., 1834), *Maria Monk and the Nunnery of the Hôtel Dieu* (1836), and a social satire *Ups and Downs in the Life of a Distressed Gentleman* (1836) are still of interest. Better known probably are his *Life of Joseph Brant* (1838); *Life of Red Jacket* (1840); and *Uncas and Miantonomeh* (1842). An account of his other works is given in *Life and Writings of Col. William L. Stone* (1866) by his son, WILLIAM LEETE STONE, JR. (b. 1835), himself the author of many works of antiquarian research connected with the Revolutionary epoch, among which the more noteworthy are: *The Life and Times of Sir William Johnson, Bart.; Revolutionary Letters; Burgoyne's Campaign; History of New York City; Reminiscences of Saratoga and Ballston.* He edited also *Ballads of the Burgoyne Campaign and Other Revolutionary Memorials.*

STONE AGE. A term commonly used to denote the earliest recognized stage in the development of human culture as defined by the materials used by man for weapons, utensils, etc. The phrase is somewhat misleading, however, since it is quite probable that primitive man made use of wood and other perishable materials to a far greater extent than of stone, and as a consequence the stage is defined by the prevailing material of the relics rather than by that of the actual implements in common use.

The term Stone Age represents in no sense a chronological division of human progress, but is a loose equivalent for a stage of cultural development varying widely in duration in different parts of the world. There are, for example, tribes still in the Stone Age, while, on the other hand, some groups had progressed beyond it before the dawn of history. It is also worth noting that some tribes commonly classed as belonging to the Stone Age produced objects of a superior artistic and industrial merit to those of peoples who had advanced to the use of metals. The evidence for the existence of such an age in most parts of the world is conclusive, but it is from the prevalence and character of the relics in certain parts of Europe rather than in America that the idea and the term have come into general use.

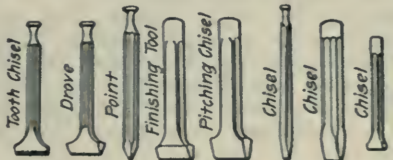
A very common and well-recognized subdivision of the Stone Age is into the *paleolithic* and *neolithic* periods. In the paleolithic period man's best tools were extremely crude, and he is considered to have understood how to chip stone into shape, but not how to grind or polish it. In the neolithic period both these advances had been made. The terms *protolithic* and *technolithic* have also been proposed to indicate the earlier and later periods of the Stone Age, but have not come into general use. Relics of the Stone Age abound in practically all parts of the world, and are found in great numbers in all archæological museums. The most characteristic types are knives, scrapers, arrow-points, spear-heads, celts, axes, mortars, and pestles. See ARCHÆOLOGY, AMERICAN.

STONE CUTTING AND DRESSING. Processes employed in preparing quarried stone for structural and ornamental purposes. These processes range in character from the rough shaping of the stone into squared blocks, which is generally performed at the quarry, to the cutting and polishing of carefully modeled and ornamental pieces such as columns, cornices moldings, and balustrades, and they may be carried out either by means of hand tools or by stone-working machines. The hand tools used in stone cutting and dressing are various shaped hammers and chisels and simple forms of measuring instruments, templates, and gauges.


Bush Hammer.
Tooth Axe.
Pean Hammer.
Crandall.
Patent Hammer.

STONE-WORKING HAMMERS.

After a block is broken from its quarry bed by one of the methods described in QUARRYING, it is trimmed to the desired size and shape by a variety of means according to the hardness of the stone and the kind of finish desired. By means of the pitching chisel the rough block is trimmed down to a line, then the irregular surface is worked down by the point, after which it is finally dressed. If the stone is to be polished it is first scoured with wet sand. Small blocks are now usually ground with wet sand on a revolving iron bed, while large blocks are ground by dragging a slab of stone back and forth across them with wet sand as the abrading material. For securing a finer polish emery, hones, pumice stone, and polishing putty (oxide of tin) are used. A high grade of polish can be secured by skilled workmen only, and each man usually has his own peculiar methods for securing the result desired.



STONEWORKING CHISELS.

In most large establishments *grinding and polishing* machines are much employed. For flat surfaces a circular horizontally revolving iron plate or grating, attached to the lower end of a vertical shaft, with an elbow joint, is used, the workman guiding the plate to various parts of the surface, and using sand or emery as the abrading material. By attaching felt to the plate the same machine is used for polishing. Blocks of such small size as can be handled by the workmen are usually ground upon horizontally revolving iron beds some eight or ten feet in diameter. Pendulum machines are used for polishing simple moldings. The molding being first cut as smoothly as possible with the chisel, a plate of cast iron, fitted as accurately as possible, is made, by means of a long arm, to travel back and forth along the molding, with sand, emery, putty powder, or other abrasive.

For turning posts and pillars *lathes* are now generally used. For the softer stones a simple pointed cutting tool similar to that used in turning metals and held and operated by a similarly constructed machine is employed. In turning hard stones like granite the cutting tool is in the form of a thin steel disk some 6 inches or 8 inches in diameter, so arranged as to revolve with the stone when pressed against it at a sharp angle. Lathes of this type are used, which are capable of turning a block 25 feet long and 5 feet in diameter to a perfect column. *Planers* for rough work, such as flagstone, resemble the same machine for planing metals. See METAL-WORKING MACHINES.

Stone-sawing machines are made in various forms. The most familiar form consists of a smooth flat blade of soft iron which is given a reciprocating motion by machinery and fed with sharp sand and water. Such saws are commonly worked in gangs of ten or a dozen blades set parallel the desired distances apart and operated by a single saw frame. This method of sawing is not applicable to cutting granite, on account of its hardness. Frequently, in place of sand, use is made of small globules of chilled iron or of crushed steel as an abrasive. Circular saws set with diamonds have proved very efficient tools, but their use is generally prohibited by their expense. Slate is sawed by circular saws such as are used for sawing lumber. In Europe considerable use has been made of twisted cords of steel made to run around pulleys like a band saw. Among other machines for stone cutting and dressing mention may be made of pneumatic hammers and the sand blast.

BIBLIOGRAPHY. The literature relating to stone cutting and dressing is somewhat scattered. Two books which may be consulted with advantage, however, are: Merrill, *Stones for Building and Decoration* (New York, 1891), and Baker, *Treatise on Masonry Construction* (New York, 1900).

STONE-FLY. One of the aquatic insects of the family Perlidæ and order Plecoptera—flat-bodied insects with two pairs of wings. The hind wings are very broad and when folded lie flat on the back of the insect. The larvæ live in water, clinging to the under sides of stones, and in general appearance are much like the adult insects, except in the lack of wings and ocelli; they are carnivorous, living largely upon the nymphs of May flies (q.v.). The well-aërated water in which the nymphs live is correlated with a peculiar rudimentary tracheal system for breathing. The eggs are produced in enormous numbers and a single female may deposit more than 5000; they are small, and are probably dropped during flight upon the surface of the water as with the May flies.

STONEHAM, stōn′am. A town in Middlesex County, Mass., 8 miles north of Boston, on the Boston and Maine Railroad (Map: Massachusetts, E 3). It has a public library with 10,000 volumes, and a high school building which cost $50,000; also a public park, included in the system of the Metropolitan Park District. Boots and shoes, boxes, and automobiles are the principal manufactures. The government is administered by town meetings. Population, in 1890, 6155; in 1900, 6197. Settled about 1670, Stoneham was under the jurisdiction of Charlestown and was called Charlestown End until 1725, when it was incorporated under its present name. Consult Stevens, *History of Stoneham* (Stoneham, 1890).

STONEHENGE (AS. *Stanhengist*, hanging stones). A celebrated stone circle, or cromlech, the ruins of which stand on Salisbury Plain, 10 miles from Amesbury, in Wiltshire, Southern England. When entire it consisted of two concentric circles of monoliths, the outer 100 feet in diameter, inclosing two smaller rows in form of a horseshoe, the opening to the northeast. Within there is a block of blue marble 15 feet long which is called the 'Altar Stone.' On a northeast line from the altar is a flat stone on the edge of the trench surrounding the whole ruin, and the line prolonged cuts another large stone some distance away called the 'Friar's Heel.' This arrangement, also observed in numerous other stone circles, points to a means of determining the time of the summer solstice, and it is thought for this reason that Stonehenge was connected with sun-worship. In any case the monument, whether it was a temple, a court of justice, or a battle ring, has been designed with reference to the northeast. Modern research clearly proves that the structure dates from at least as early as the Bronze Age. The tumuli in the vicinity of the cromlech yield Bronze Age remains. Consult Flinders Petrie, *Stonehenge: Plans, Descriptions, Theories* (London, 1881).

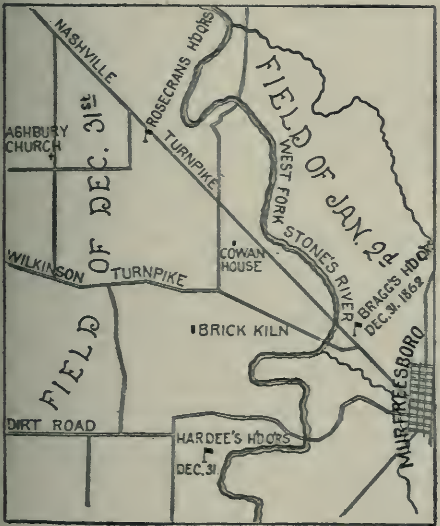
STONE′HOUSE, EAST. See EAST STONEHOUSE.

STONE′MAN, GEORGE (1822-94). An American soldier and Governor of California. He was born at Busti, Chautauqua County, N. Y., and graduated at West Point in 1846. Just before the outbreak of the Civil War he was in command of Fort Brown in Texas, and was ordered by his superior officer, General Twiggs, to surrender to the Confederates, but refused to do so, and escaped with his troops on a steamer to New York. After some service in West Virginia he was appointed chief of cavalry in the Army of the Potomac. By overtaking the Confederate troops after the evacuation of Yorktown in May, 1862, he brought on the battle of Williamsburg. On November 15, 1862, he was made commander of the Third Army Corps, which he commanded at Fredericksburg on December 13th. During Hooker's Chancellorsville campaign he led a cavalry raid toward Richmond. In April, 1864, he was put in command of a cavalry corps in the Army of the Ohio, and in the Atlanta campaign undertook a raid against Macon and Andersonville. He was captured with a part of his force at Clinton, Ga., and was kept a prisoner for three months. In December, 1864, he led a raid from East Tennessee into southwestern Virginia, and destroyed the salt works at Saltville. In the following March he again entered southwestern Virginia, destroyed a part of the Virginia and Tennessee Railroad, and did much other damage. In the following month he moved into North Carolina, took Charlotte and other towns, and at Salisbury captured about 1400 prisoners. In 1871 he retired from the army and settled in California.

There he served for six years as a railroad commissioner, and in 1883 was elected Governor by the Democrats.

STONE MARTEN. See MARTEN.

STONE RIVER, BATTLE OF, or MURFREESBORO, BATTLE OF. An indecisive battle fought near Stone River, in the vicinity of Murfreesboro, Tenn., on December 31, 1862, and January 2, 1863, between the Federal Army of the Cumberland, numbering about 41,000 effective men, under General Rosecrans, and the Confederate Army of Tennessee, numbering about 35,000 effective men, under General Bragg. Soon after replacing General Buell on October 30, 1862, in command of the Army of the Cumberland, General Rosecrans occupied Nashville, while General Bragg, after having been manœuvred out of Kentucky by General Buell, took up a position in and near Murfreesboro, Tenn. On December 26th Rosecrans advanced from Nashville against Bragg, and on the 30th, after having encountered considerable resistance along the way, arrived in the immediate vicinity of Murfreesboro. Both generals arranged to attack on the following morning, and by a singular coincidence both adopted the same general plan of battle, each issuing orders for an attack by his left, heavily reënforced, upon his opponent's right. As the two armies faced one another, Crittenden, commanding the Federal left, was opposed to Breckenridge, commanding the Confederate right; Thomas, commanding the Federal centre, was opposed to Polk, commanding the Confederate centre; and McCook, commanding the Federal right, was opposed to Hardee, commanding the Confederate left. At 6 A.M. on the 31st, while Crittenden was preparing to cross the river and advance against Breckenridge, Hardee vigorously and with vastly superior numbers attacked McCook, who seems to have made an unwise arrangement of his line, and who, though he had assured Rosecrans of his ability to hold his position for three hours, soon gave way, his three divisions under Johnson, Davis, and Sheridan, after having offered a stubborn resistance, being gradually forced back to the Nashville Pike, in the rear of the Federal left and left centre. The Federal centre, however, under Thomas, successfully beat back the attacks of the Confederate centre and parts of the Confederate left, and, though a realignment of the troops in this part of the field had to be made, the Federals held their position. Meanwhile the Federal left, which, in pursuance of Rosecrans's plan of battle, had begun at 8 A.M. to advance against the Confederate right, had been recalled when the defeat of the Federal right became known, and was instrumental in beating back the final Confederate attacks. The fighting virtually ceased at dark. At the close of the day the advantage was decidedly with the Confederates, who, besides capturing 28 guns and a large number of prisoners, had driven part of the Federal army from its position and had forced Rosecrans to act on the defensive instead of carrying out his own plan of battle. On January 1st the two armies retained their positions, and there was little fighting, except along the skirmish lines. Van Cleve's division of Crittenden's Federal corps was, however, sent across the river to occupy a position on high ground opposite one of the fords of the river. On the following day, the 2d, at 4 P.M. Breckenridge's Confederate division made a furious assault upon this position, the capture of which was necessary to prevent the enfilading of the Confederate line; but, after being at first successful, it was finally driven back with great loss. On the night of the 3d Bragg evacuated Murfreesboro and retreated toward Tullahoma, 36 miles distant. For some months thereafter the Army of the Cumberland remained at Murfreesboro. Throughout the North the battle was claimed as a Federal victory, as it was strategically, though tactically it may be considered to have been drawn. The Federal loss in killed, wounded, and missing was about 12,900; that of the Confederates, about 11,700. Consult: Johnson and Buel (eds.), *Battles and Leaders of the Civil War*, vol. iii. (New York, 1887); Ropes, *Story of the Civil War*, vol. ii. (ib., 1894-98); Cist, *The Army of the Cumberland* (ib., 1882), in the "Campaigns of the Civil War Series;" Nicolay and Hay, *Abraham Lincoln: A History* (ib., 1890); Van Horne, *History of the Army of the Cumberland* (Cincinnati, 1875); and the *Official Records*, vol. xx., parts i. and ii.



STONE RIVER.

STONE-ROLLER, or STONE-LUGGER. One of two fresh-water fishes of the Mississippi Valley: (1) A small and worthless sucker (*Catostomus nigricans*), which inhabits clear streams throughout the West. It usually rests quietly on the bottom, but darts swiftly away when alarmed, scattering the pebbles. It is olive green with brassy sides, and has a flattened, concave head and thick lips. (2) A small brown cyprinoid (*Compostoma anomalum*), remarkable for the fact that in the nuptial season the males become covered about the head and often over the whole body with large rounded tubercles. They frequent the deep pools of small streams.

STONES OF VENICE, THE. A treatise on the art and architecture of Venice by John Ruskin (1851-53), undertaken to record the vanishing glories of the city. It had great influence on the appreciation of Venetian art and on the Gothic revival of that day, and especially on

William Morris, though it was sharply criticised from an art standpoint.

STONEWARE. A kind of pottery distinguished by an advanced vitrification of the whole mass. It is for this reason that stoneware has been employed for jugs and flagons and vessels of all shapes and size intended to hold valuable liquids. The decoration of these vessels was often very elaborate. The color of this ware, when finished, was a nearly uniform soft gray, to which was added on many occasions a certain amount of blue. The ware is also very strong. The French word *grès* is commonly applied in the trade and by collectors to such pieces of stoneware as are of decorative character.

STONEWORK. Structural and decorative work in stone, whether for buildings of an architectural or of all engineering character; including, therefore, all kinds of masonry (q.v.) for foundations, piers, walls, vaults, etc., and all kinds of stone-cutting, both constructive and decorative. As other varieties are treated under the appropriate titles, it remains only to treat in this article, very briefly, of the artistic applications of stonework. These applications, as distinguished from sculpture and carving, are found chiefly in decorative details of works of architecture, including such engineering works in stone as are treated with decorative intent, like moldings, columns, bases and caps, pilasters, pedestals, pediments, finials, rustications, balustrades, parapets, and the like. On the technical side, the treatment of these details varies with the material and the design. All such stonework is first 'roughed out,' either at the quarry or at the stone-cutting yard, into blocks rudely approximating the intended form. If the stone is soft and friable, and the decorative detail complex or delicate, it is usually built into the structure in this rough form, and finished afterwards. The harder kinds of stone-blue-stone, granite and hard marble, and all moldings and blocks of simple form, are cut at the yard, carefully crated or packed and delivered finished at the building. The carved detail of the softer stones is executed 'in place' with the chisel by carvers specially trained for this. On the artistic side stonework is treated with greater or less fineness of finish according to the grain of stone, and the decorative effect sought. The harder granites and marbles are often highly polished, when used as shafts or panels. In heavy work, as on bridges, embankments and the basements of buildings, a rough fractured surface, called 'rock-face' or 'quarry-face' is often left on each block.

STONINGTON, stŏn′ĭng-ton. A town, including the borough of Stonington, in New London County, Conn., 50 miles southwest of Providence, R. I., on Long Island Sound, and on the New York, New Haven and Hartford Railroad (Map: Connecticut, H 4). It is attractively situated and has some reputation as a summer resort. A good harbor makes it also of considerable commercial importance. There are the shops of the New York, New Haven and Hartford Railroad, machine shops, printing press works, thread mills, and manufactories of silk machinery, cotton, woolen, and silk goods, velvets, and fertilizers. The government is administered by town meetings, convening annually. Population, in 1890, 7184; in 1900, 8540.

In 1649 William Chesebrough of Plymouth Colony made the first permanent settlement at Stonington and called it Poquatuck. At first within the bounds of Massachusetts, whose General Court chartered it as Southertown in 1658, it passed to Connecticut in 1662, was named Mystic in 1665, and Stonington in 1666. In 1775 it was attacked by a British fleet under Commodore Wallace, and in 1814 it was bombarded for four days by Admiral Hardy, Nelson's favorite officer. For many years Stonington was prominent for its participation in the seal-catching and whale-fishing industries. It was the early home of Roger Sherman. Consult Wheeler, *History of the Town of Stonington from 1649-1900* (New London, 1900).

STONO FERRY, Battle of. An engagement near a ferry over the Stono River, a short distance from Charleston, S. C., on June 20, 1779, during the Revolutionary War, between a small force of British, strongly intrenched, under Lieutenant-Colonel Maitland, and a superior American force under General Lincoln. General Prevost, on withdrawing from his invasion of South Carolina, left temporarily a small force of about 800 men at Stono Ferry and another small force on John's Island. In the early morning of June 20th General Lincoln attacked the British at Stono Ferry, but, owing to the failure of General Moultrie properly to coöperate with Lincoln, the garrison was reinforced from John's Island, and the American attack was repulsed. Lincoln then withdrew, beating off the attacks of the British, who followed for a short distance. The loss of the British in killed, wounded, and missing was about 130; that of the Americans was about 200.

STO′NYHURST COLLEGE. A leading Catholic college, situated at Stonyhurst Lane, England. It had its inception in the English college at Saint Omer, in the Province of Artois, France, founded by Robert Person, S.J., in 1592, under the protection and patronage of Philip II. of Spain, to which country that province then belonged. The school, in spite of many difficulties, prospered, and when Artois was ceded to France in 1659 a special article in the capitulation insured the safety of the institution. In 1760 it obtained from Louis XV. the much-desired title of 'Collège Royal.' At the expulsion of the Jesuits from France the college with all its movable belongings was removed to the city of Bruges in the Austrian Netherlands. When the Society of Jesus was suppressed by Pope Clement XIV. in 1773 an attempt was made by the Austrian Government to conduct the school with the aid of English Dominicans, but such was the attachment of the pupils to their old teachers that the college had to be closed owing to their rebellious attitude. Some of the masters and pupils then took refuge in Liège, where the authorities were more kindly disposed toward the Jesuits. In 1794, when the Revolutionary armies were marching upon Liège, the college was offered a final resting place by Thomas Weld, who gave it his estate at Stonyhurst, England. In 1808 the attendance outgrew the accommodation, and the construction of the first of a series of five buildings was begun. In 1832-36 a church was erected and in 1837 the college library was presented with the famous Arundell collection. The well-known observatory was erected in 1838.

In 1840 it became affiliated with University of London. Henceforth the sciences were introduced and the curriculum which was based on the Ratio Studiorium (q.v.) was generally enlarged. The regular course of study covers a period of seven years.

STONY POINT. A town in Rockland County, N. Y., 35 miles north of New York City, on the Hudson River, and on the West Shore Railroad (Map: New York, G 4). Population, in 1890, 4614; in 1900, 4161. Stony Point was fortified by the Americans early in the Revolutionary War and was captured on May 31, 1779, by Sir Henry Clinton. On July 16th it was recaptured by General Anthony Wayne, who, with 1200 men, stormed the works and took 543 prisoners, the American loss being 15 killed and 83 wounded, and the British 63 killed besides the prisoners, among whom the wounded were included. Two days later the fortifications were dismantled and the place abandoned, the British reoccupying it soon afterwards. The site of the Revolutionary fort and battlefield has been converted into an historical reservation which was formally opened in 1902. Consult Johnston, *The Storming of Stony Point* (New York, 1900).

STOPPAGE IN TRANSITU. The stoppage by an unpaid seller of goods while on their way from him to the buyer, after title has passed to the latter. The right so to stop goods is not founded on any contract between the parties, nor upon any principle of equity, but upon mercantile usage. Its first recognition in the judicial reports of England appears in an equity case decided in 1690. Prior to this it was a well-established rule of the law merchant (q.v.). From courts of equity it was adopted by the courts of common law, and for three centuries has been a recognized rule of English jurisprudence. The term 'unpaid seller' is here employed in a broad sense. It includes not only the ordinary seller, but the factor of the buyer, who has paid for goods placed to his credit for the price—any one, indeed, whose position can be shown to be analogous to that of an ordinary seller, who is unpaid either wholly or in part.

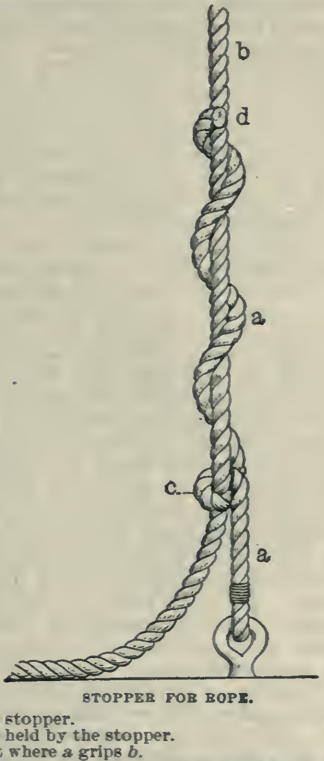
The second requisite is that the buyer shall have become insolvent, and that the knowledge of this insolvency shall have come to the seller after dispatching the goods. Insolvency, in this connection, is used in its popular sense, meaning the financial condition of one who cannot pay his debts as they fall due in the ordinary course of business; and if he lets his commercial papers go to protest, or by other conduct affords the ordinary opponent evidence of insolvency, the unpaid seller is safe in treating him as insolvent.

The third requisite is that the goods shall have left the possession of the seller, but shall not have reached the possession of the buyer—that they shall be in transit. The transit begins as soon as they have left the seller's possession for transportation to the buyer. It continues as long as they are in the possession of a carrier, or other middleman, on their way to the buyer. "Such middleman may be the buyer's agent for certain purposes; and yet if, by the agreement of the parties or by the usage of trade, he is not a mere servant of the buyer, but is a person interposed between the seller and the buyer, having a possession of his own and liable, in his capacity as bailee, to an action by the buyer, in case the goods are carelessly lost or misdelivered, the goods are still in transit." Such transit may be intercepted by a new and distinct agreement between the carrier and the buyer, under which the carrier is thereafter to hold the goods subject to new orders from the buyer. It is not intercepted, however, by the levy of an execution or an attachment on the goods on behalf of a creditor of the buyer. Such a levy gives the creditor only the right of the buyer; and that right is subject to the unpaid vendor's right to stop the goods. If a bill of lading (q.v.) has been given to the buyer by the seller, its transfer to a *bona fide* purchaser cuts off the seller's right. This comes from the *quasi* negotiable character of the bill of lading under the law merchant.

Although no particular form of notice is required, a valid stoppage *in transitu* cannot be made without a notice of some kind to the carrier. If the goods are in the hands of an agent of the carrier, notice that the seller stops the goods may be given to either the agent or the principal. If given to the latter it must be given at such time and under such circumstances that the principal, by the exercise of reasonable diligence, may communicate it to the agent in time to prevent a delivery to the buyer.

The exercise of this right restores to the seller the possession of the goods, but does not revest title in him. The buyer or his transferree is entitled to the goods upon paying cash for them, but not otherwise.

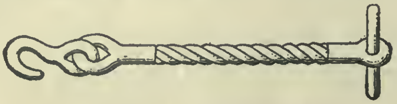
STOPPER. A short length of rope or chain or an iron contrivance used on board ship for checking the running of a rope or chain, or for holding it firmly. A stopper for ropes is a short



STOPPER FOR ROPE.

a, Rope stopper.
b, Rope held by the stopper.
c, Point where *a* grips *b*.
d, Loose end of *a*. This is usually held in place by a man until the stopper *a* is removed from *b*.

length of soft manila secured at one end to the structure of the ship; the other end is passed around the rope to be stoppered with a jamming hitch. It is used to keep the rope from slipping while it is being belayed or secured. A stopper for a chain cable is usually of wire rope and four to six feet long. At one end it is spliced into the eye of a hook, and at the other has an eye formed around a short bar of iron. The hook is placed in a ringbolt in the deck, and the body of the stopper lashed to the chain by two 'tails' of soft manila rope. When ships are at anchor the chain is held by such stoppers.



STOPPER FOR CHAIN CABLE.

STORAGE (from *store*, OF. *estorer*, *estaurer*, from Lat. *instaurare*, to renew, make, provide, from *in*, in + **staurare*, to set up; connected with Gk. *σταυρός*, *stauros*, stake, Skt. *sthāvira*, firm, AS. *stēor*, rudder, and ultimately with Eng. *stand*). Since most plants absorb or produce food in excess of their immediate needs, they provide for temporary or long-continued storage. These foods are transformed for permanent storage and mobilized for subsequent translocation by specific activities of the cell, self-regulated through irritability (q.v.). The chief regions of storage are spores, seeds, fleshy fruits, roots, tubers, bulbs, leaves, and stems. As a rule the regions of the higher plants specially adapted for storage are thick, fleshy, and abundantly supplied with thin-walled parenchyma cells. (See HISTOLOGY.) Storage occurs only in living cells. Occasionally the cell walls in storage regions are thick and woody, and in some cases, e.g. in the endosperm of seeds, the walls themselves are made up mainly of the stored material, reserve cellulose. The chief forms in which reserve food is stored are as follows:

(1) CARBOHYDRATES. Reserve carbohydrates are either soluble, such as sugars (saccharose, glucose, fructose, mannose, and galactose) and inulin, or insoluble, as starch and cellulose (qq.v.). Starch is organized into granules by the leucoplasts (q.v.) Reserve cellulose is deposited upon the cell walls as a complex carbohydrate, whose composition is unknown, though it seems to have somewhat the same relations to ordinary cellulose as the most complex of the dextrins, amylodextrin, holds to starch. It is found especially in the endosperm, or in various parts of the embryo, in bud scales, etc.

(2) FATS. Fats occur in the form of minute droplets (oil) in the protoplasm, not infrequently accumulated by special organs of the cell, the leucoplasts. They are found in the endosperm or embryos of seeds (probably in the seeds of nine-tenths of all seed plants), in spores, tubers, and the wood of trees.

(3) PROTEIDS. Proteids are found either as amorphous grains, the so-called aleurone, or as crystals, which are not infrequently associated with or imbedded in aleurone grains. These are sometimes formed by leucoplasts, but at other times appear to be deposited in the sap cavity (vacuoles) of cells, where the proteid appears to accumulate in increasing concentration until it solidifies in the form of the vacuole, or in one or several crystals. (See ALEURONE.) Crystals of proteid are also found in chromatophores, nuclei, and even in the cytoplasm itself. They are often distinguished as crystalloids, because they have the capacity of swelling (see IMBIBITION), a rare quality among inorganic crystals.

(4) AMIDES. Amides are nitrogenous compounds intermediate in complexity between proteids and carbohydrates and readily crystallizable. Most nitrogenous materials are ordinarily translocated as amides. They are rare in seeds, but especially abundant in the sappy reservoirs, such as bulbs, tubers, rhizomes, etc., where they constitute 40 to 70 per cent. of the total food.

The different kinds of storage materials are more or less definitely associated. Thus the reserve food may consist of proteids and sugar (e.g. the pea and onion); proteids and starch (e.g. the potato, the embryo of beans, pea, etc.); proteids and oil (e.g. the endosperm of the castor bean and the cotyledons of the soja bean); or proteids, oil, and reserve cellulose (e.g. the endosperm of the date and coffee); or proteids, with oils in the cotyledons and mucilage in the endosperm walls (e.g. clover). The reason for the special association of reserve foods is not known. Insoluble reserve foods are only transportable after digestion (q.v.).

STORAGE BATTERY. An accumulation of energy which is able to produce directly an electric current. The term is a misnomer, as electricity itself cannot be stored. A so-called storage battery or accumulator when acted upon by a current undergoes certain chemical changes. The chemicals which are thus separated recombine again when the circuit of the battery is closed, and in uniting give off a current of electricity about equal to that by which they were decomposed. Lead is the metal most commonly used in accumulators, the positive plate having a coating of lead peroxide, PbO_2, and the negative plate a surface of spongy lead.

The idea of the storage cell may be traced back to 1801, at which time Gautherot showed that platinum wires used in the electrolysis of saline solutions developed secondary currents. Later, in 1803, Ritter constructed a secondary pile of copper disks separated by cloths moistened with a solution of sal ammoniac. By charging this a few moments with a powerful galvanic battery the pile gave a strong shock. Volta, Becquerel, and others discovered that platinum and other metals—gold, silver—gave secondary electric currents when subjected to electrolytic action in certain solutions. In 1842 Grove produced his celebrated gas battery, which gave a current by means of the difference in polarity of oxygen and hydrogen, the constituents of water. In Faraday's *Researches* he mentions the high conductivity of peroxide of lead at the negative pole. Gaston Planté was the first to apply this principle, and constructed in 1860 his cell with coiled plates, the first practical storage battery, which was afterwards developed and modified by Faure, Metzger, Brush, and others.

Storage batteries may be divided into two general classes: Those in which the active material (peroxide of lead) is formed on the surface of the plates by chemical or electro-chemical action, and those in which some easily reducible salt of lead is applied mechanically. The former are known as the Planté type, and the latter as the 'pasted' or Faure type.

The Planté cell is the simplest form of storage battery. The earliest cells were formed of two lead plates immersed in dilute sulphuric acid in water. The solution should have a specific gravity of 1.17 before charging, and as the charge proceeds the specific gravity increases to 1.195 at full charge. At each successive charge the peroxide formed on the positive plate sinks deeper into the metal, and this action continues until the metal is covered to a sufficient thickness to protect the lead from electrolytic action. There is no difficulty in forming the positive plate in a Planté cell, but with the negative plate the action is very slow. The latter is the great difficulty with all Planté cells. The usual method of forming the spongy lead is to charge the cell, allow it to rest, then reverse the charge through the cell. At each reversal of current the peroxide is liberated at the surface, leaving metallic lead in a very finely divided state. The voltage of a lead-sulphuric acid cell is about two volts. The above description is applicable in a general way to all cells of the Planté type, of which there are a great many varieties. Most of the modifications introduced by the different manufacturers are mechanical changes with a view to exposing more surface of lead to the action of the electrolyte. The Planté accumulator is a very efficient cell when once formed, but the great amount of time it requires for forming is its chief drawback. To avoid the great loss of time consumed in forming the Planté cells, Faure in 1880 devised the method of pasting a layer of chemically prepared oxide of lead to the surface of the plates. This was done by spreading the plates with minium, or litharge, made into a thick paste by the addition of acidulated water. After drying these plates were placed in a bath of dilute sulphuric acid, and then subjected to an electric current. A piece of felt was placed between the plates to prevent the lead salts from disintegrating. After charging, the salt on the positive plate is reduced to peroxide of lead, while that on the negative plate is converted into porous lead. The chief fault of the early Faure cells was the disintegration of the active material, which would drop away from the plate. Many methods have been devised for holding the active material on the plates, the most common of which is to cast a grid, or plate with cells or perforations, into which the active material is pressed. All the modern cells are made with perforated plates of this description. Besides these two types of accumulators, which are the most important ones, there are a number of others, in which the elements are composed of lead, zinc, copper, etc., none of which are in very extensive use.

Storage batteries are employed in many central stations to aid the dynamos at the time of the maximum output and to act as equalizers or reservoirs of electrical energy. The efficiency varies from 80 to 85 per cent. in laboratory tests, but in commercial practice it is about 70 per cent. or less. The depreciation, however, may be very rapid if the batteries are not operated with care. It is very important not to discharge accumulators faster than the rate for which they are built, as it results in the speedy destruction of the plates. They are not well adapted to traction purposes, as the motion of the car jars out the active material from the plates, and in starting the car a high rate of discharge is required. The weight and bulk of accumulators is also against their use on cars. With light vehicles, as well as with delivery wagons and trucks, accumulators have been employed very successfully, while for telephone and telegraph work in large cities they are rapidly supplanting primary cells, the change being attended not only with economy, but also with increased cleanliness and available space. Consult: Benjamin, *Voltaic Cell* (New York, 1893); Treadwell, *The Storage Battery* (ib., 1898).

STORAX (Lat. *storax*, styrax, from Gk. *στύραξ*, sort of fragrant resin, from Heb. *ṣŏrī*, heart of the mastic or of the turpentine-tree). A fragrant resinous substance, the styrax of the ancients, obtained from the storax-tree (*Styrax officinale*) of the natural order Styracaceæ, native of the Mediterranean region. Storax, which exudes from wounds in the bark and hardens in the air, appears in the form of reddish-yellow, opaque, soft, adhesive tears about the size of a pea, or in dry, brittle masses, wrapped in the leaves of a kind of reed. It has a fragrant odor and an aromatic taste, and was formerly much used in medicine. Benzoin (q.v.) is the product of a species of Styrax. Liquid storax is doubtfully regarded either as produced by *Styrax officinale* or by a species of liquidambar (q.v.). It seems probable that there are two kinds.

STO'RER, David Humphreys (1804-91). An American physician and naturalist. He was born in Portland, Me., and graduated at Bowdoin in 1822. After studying medicine he settled in the practice of his profession in Boston and continued there until his death. In 1854 he was called to the chair of obstetrics and medical jurisprudence in the Harvard Medical School. Storer was for many years associated with Louis Agassiz in his studies of zoölogy and herpetology. He published: *Report on the Ichthyology and Herpetology of Massachusetts* (1839); *Synopsis of the Fishes of North America* (1846); and a *History of the Fishes of Massachusetts* (1853-67).

STO'REY, Moorfield (1845—). An American lawyer, born in Roxbury, Mass. He graduated at Harvard in 1866, studied at the Harvard Law School, and in 1869 was admitted to the bar. In 1867-69 he was private secretary to Senator Charles Sumner, and in the latter year began the practice of his profession in Boston. An Independent in politics, he was prominent in the 'Mugwump' movement of 1884, and after the Spanish War became an ardent Anti-Imperialist and was defeated for Congress in 1900. He published the *Life of Charles Sumner* (1900) in "American Statesman Series."

STORK (AS. *storc*, OHG. *storah*, Ger. *Storch*, stork; connected with Gk. *τόργος*, *torgos*, vulture). The popular name for a family of birds, the Ciconiidæ, allied to the herons and ibises. They are large birds, with long legs, half-webbed toes; the bill longer than the head, straight, strong, pointed, and without any groove; the nostrils pierced longitudinally in the horny substance; the eyes surrounded by naked skin. The species are about twenty-five in number and are of very wide geographic distribution. The common white stork (*Ciconia alba*), a migratory native of the greater part of the Old World, is about three and a half feet in length. The head, neck, and whole body are pure white; the wings partly black; the bill and legs red. The neck is long, and generally carried in an arched form; the feathers of the breast are long and pendulous, and the bird often has its bill half hidden among them. The stork frequents marshy places, feeding on eels and other fishes, batrachians, reptiles, young birds, and small mammals. It makes a rude nest of sticks, reeds, etc., on the tops of tall trees, or of ruins, spires, or disused chimneys. The stork has no voice. Its flight is powerful and very high in the air. The flesh is rank, and not fit for food. Another species, the black stork (*Ciconia nigra*), rather smaller, the plumage of the upper parts glossy black, the under parts white, is also common in many parts of Europe, Asia, and Africa. The South American stork (*Dissoura maquari*) is very similar to the common stork.

The only birds of this family occurring in North America are the wood ibises of the Southern States and the jabiru (q.v.). They are large birds, three and a half feet long, with the head and neck bare, wings and tail black, and rest of plumage white. They are found in large flocks and nest in colonies. See ADJUTANT; MARABOU; SHOE-BILL, etc.; and Colored Plate of WADERS.

STORM (AS. *storm*, OHG. *sturm*, Ger. *Sturm*, storm; probably connected with Gk. ὁρμή, *hormē*, attack, Skt. *sar*, to flow, hasten). Any unusual, severe, or destructive atmospheric phenomenon, such as a windstorm, sandstorm, tornado, typhoon, or hurricane, in which the wind is the destructive agent; a rainstorm, hailstorm, or snowstorm, monsoon, cloudburst, or flood, in which the precipitation is the prominent feature; a thunderstorm in which the thunder is impressive and the lightning is destructive; a blizzard, in which the combined cold wind and snow is the prominent feature. All these storms attend the flow of air from areas of high to those of low barometric pressure, or so-called storm centres or 'lows.' In general the winds blow around and in toward these low areas, thereby producing still lower barometric pressures near the centre. The lower air, being forced to rise above the earth's surface, expands, cools, and precipitates its excess of moisture, thereby giving us rain, snow, or hail.

Storms are often classified as attending areas of low pressure, namely, cyclonic storms; or as attending areas of high pressure, namely, anticyclonic. In all cases the flow of the air is primarily due to differences of density; the denser air is impelled to the earth's surface by the force of gravity and is also pushed by it toward the equator. But the centrifugal force due to the diurnal rotation of the earth also pushes the

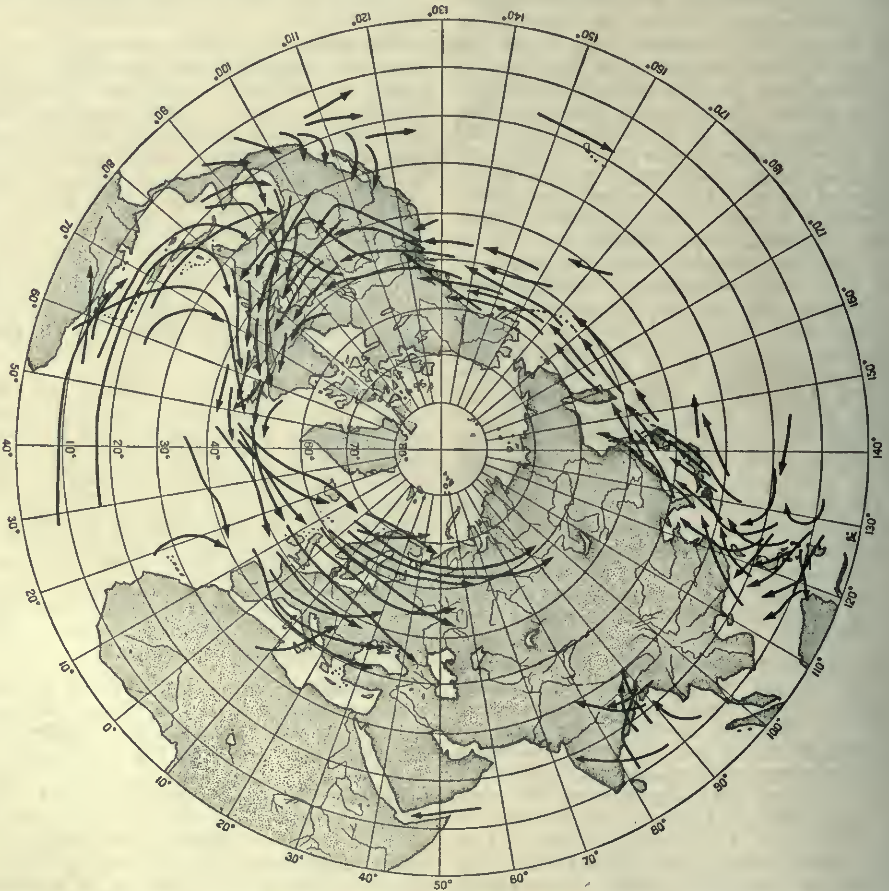


FIG. 1. CHART SHOWING STORM PATHS.

the lighter moist air. For both reasons, therefore, the lighter is raised up by the denser air, and overflows toward the pole. Now a body on the earth's surface and in motion relative to it, while at the same time rotating with it, will appear to an observer on the earth to be deflected toward the right hand as it moves forward in the Northern Hemisphere, but to the left hand in the Southern Hemisphere. By virtue of this deflection the winds that are blowing toward a region of low pressure acquire, each for itself, a deflection toward the right or the left respectively, so that instead of meeting at the centre they whirl around it in an inflowing spiral curve. By reason of this circulation an outward centrifugal pressure is produced, and the barometric pressure in the central region is much smaller than it would be if the winds flowed directly to the centre, without any spiral circulation. In extensive storm areas this general tendency of the lower winds to circulate around a centre may exist over a region a thousand miles or even more in diameter.

The mechanical and thermal problems connected with the generation and maintenance of storms are set forth without technical mathematics by Professor William Ferrel in his *Popular Treatise on the Winds* (1st ed., New York, 1889). They are discussed most elaborately in a technical manner by Prof. F. H. Bigelow in his *Report on International Cloud Work* (published as vol. ii. of the *Report of the Chief of the Weather Bureau for 1898*). A full presentation of the work that has been done upon this subject by all students during the past century will be found in the *Lehrbuch der Meteorologie*, by Prof. Dr. Julius Hann (Leipzig, 1901), of which an English translation is promised in the near future.

As far as possible the paths pursued by storm centres during past years are platted upon charts, then they are classified according to their general characteristics and studied with reference to their relations to the topography of the continents and the general distribution of the barometric pressure, temperature, and moisture, and especially to the so-called general circulation of the atmosphere. The frequency of storms and the general types of storm paths are, of course, best known for the continental portions of the Northern Hemisphere, but there is also sufficient data for the oceanic regions to justify an attempt at presenting the accompanying sketch chart of the Northern Hemisphere showing the general character of the storm paths and the locations where they most frequently occur. (See Fig. 1.) This chart shows by its numerous lines and arrow heads the occurrence and the direction of motion of storm centres along the lines of greatest frequency, so far as now known. The Arctic region, Northern Africa, and Central Asia must be considered as blanks; we have no daily maps for these regions, and only know that general cyclonic storms are infrequent in Africa and Asia. The chart shows that storm centres move slowly westward when within the tropics and also slowly toward the pole, but move more rapidly eastward between the tropics and the Arctic Circle, as well as more rapidly northward. The zone of greatest storm frequency lies between latitudes 45° and 55°. In general the path of any observed storm may be predicted on the basis of a simple study of this chart of storm tracks. But individual temporary departures from average conditions are so great that in actual weather forecasts it is necessary to allow these general maps of types and averages to have only a very slight influence upon the work. It is, in fact, always necessary to consider what the special individual storm has been doing during the preceding few days, and to what extent it is normal, and to what extent it is abnormal, as to the direction and velocity of its motion, and

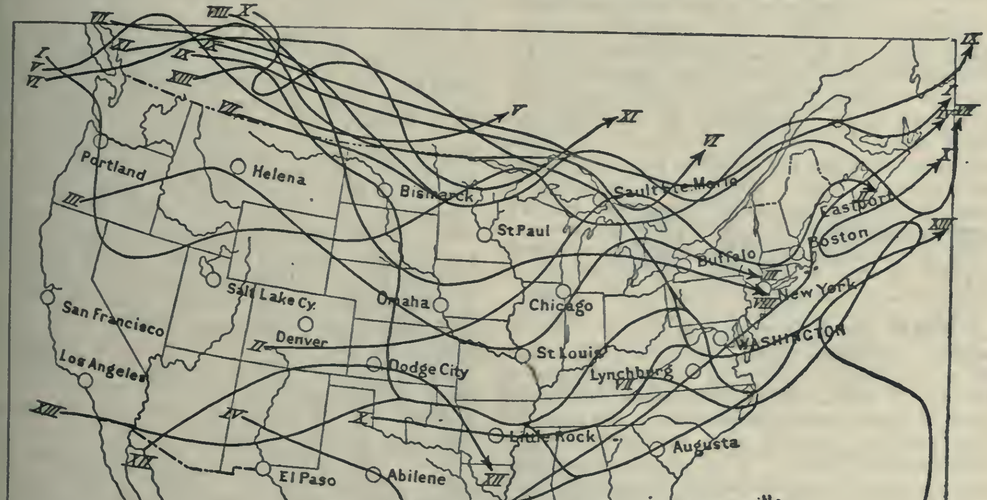


FIG. 2. TRACKS OF CENTRES OF LOW AREAS, JANUARY 1901.

the rate of its increase or decrease in intensity. This can only be done by a careful comparison of several successive weather maps. As these maps are made up at least twice a day and sometimes more frequently, the forecaster is in a position to say how fast the storm is moving and whether it is growing more intense or rapidly dying away.

The great irregularities in individual storm paths may be appreciated by studying the accompanying chart (Fig. 2) showing the tracks of all the centres of low pressure which passed over the United States during January, 1901. The storms in that month were unusually severe over the North Atlantic Ocean. Of the thirteen tracks that are here charted four moved with a velocity of over one thousand miles daily; one of them at a velocity of less than five hundred miles daily; and one was stationary for one day. Further details in regard to these storms are given in the text of the *Monthly Weather Review* for the month in question. More than one-half of the cyclonic storms that pass over the United States have been developed somewhere in the Pacific Ocean. Perhaps one-quarter originated within the United States. The others are first perceived off the coasts of the West Indies or on the Gulf of Mexico. The most severe storms are the hurricanes that begin in the tropical portion of the Atlantic, move westward and northward into the South Atlantic or Gulf States, then turn toward the northeast and disappear while still moving toward Europe. The paths pursued by general cyclonic storms are apparently determined by the so-called general circulation of the atmosphere, but are modified considerably by the formation of cloud and rain or snow attending the storm.

The most extensive condensed collection of data relative to American storms is found in the "Contributions to Meteorology," by Professor Loomis, as revised and published in the *Memoirs of the National Academy of Sciences*, vols. iii., iv., and v. (Washington, 1885, 1887, and 1889). The details of current storm phenomena are published regularly by the Weather Bureau in the *Monthly Weather Review*. The physical-mathematical theories founded by Espy and Ferrel have been further developed in numerous memoirs, some of which will be found in a collection of translations published by the Smithsonian Institution in 1891. The current literature is contained in the successive volumes of the *Meteorologische Zeitschrift* (Berlin). A general summary of our knowledge of the mechanics of storms is given by Prof. F. H. Bigelow in his *Report on International Cloud Work* (Washington, 1900).

STORM, stôrm, GUSTAV (1845-1903). A Norwegian historian, born at Lom. He studied at Christiania, where he became professor of history in 1887. His publications, which include a large number of articles in German and Scandinavian journals, deal chiefly with early Scandinavian history. They include *Sagnkredsene om Karl den Store og Didrik af Bern* (1874), *Kritiske bidrag til vikingetidens historie* (1878), and a translation of Snorre Sturlasson's *Kongesagaer* (1897), on which he had previously written his *Snorre Sturlassöns historieskrivning* (1873). He also edited the important *Monumenta historica norvegica* (1880). In 1900 the Norwegian Storthing appropriated twenty thousand kroner for a popular edition of Storm's Dano-Norwegian rendering of the *Heimskringla*, which had appeared in 1886-89.

STORM, THEODOR (1817-88). A German poet and novelist, one of the great masters of that peculiarly German creation, the short story of character and sentiment. He was born at Husum, Schleswig, on September 14, 1817, studied jurisprudence at Kiel and Berlin, and, returning to Kiel in 1839, became intimate with the brothers Theodor and Tycho Mommsen, poetry being the bond of union, especially their mutual admiration for the Swabian poet Mörike. The result was the publication of the *Liederbuch dreier Freunde* (1843), now a great rarity, which contained Storm's first essays in poetry. For ten years he practiced law in his native town and returned to it as Landvogt in 1864, having entered the Prussian civil service in 1853, and occupied judicial offices at Potsdam and Heiligenstadt, near Göttingen. In 1880 he retired and settled at Hademarschen, in Holstein, where he died on July 4, 1888.

Storm began his literary work at Husum by collecting the popular sagas and stories of Schleswig-Holstein, then assisted Biernatzki in editing his *Volksbuch*, in which, besides some exquisite lyrics, his first three important stories, *Martha und ihre Uhr* (1848), *Im Saale* (1849), and *Immensee* (1850), saw the light. The last-named novelette, the author's most popular and perhaps also his most characteristic work, was the crowning achievement of his first period; it is the best specimen of that retrospective type of story with which Storm's name is most intimately associated, and deservedly occupies a place in the front rank of the short stories of any land or age. Through various translations it has become familiar also to English readers. Of about a dozen stories written during the eleven years of absence from his native soil, *Im Sonnenschein* (1854) and *Angelica* (1855) are sketches of by-gone days, tinged with the elegiac melancholy which forms the key-note of most of the author's stories; *Im Schloss* (1861) and *Von jenseits des Meeres* (1864) boast of happy endings, and *Auf der Universität* (1862) is the most ambitious story of this period, in which scenes from Storm's own student life are charmingly interwoven. *Die Regentrude* (1864) is the best of several delicious fairy-tales. With Storm's return to Husum in 1864 his work enters an essentially new phase, in which the passive retrospective novel gives place to a more active and dramatic form of romance. On the one hand is here to be considered a series of chronicle-novels, written in an archaic style, comprising *Der Spiegel des Cyprianus* (1865), a romantic tale of the Thirty Years' War, *Aguis submersus* (1876), *Renata* (1878), *Zur Chronik von Grieshuus* (1884), and *Ein Fest auf Haderslevhuus* (1885); on the other hand some artist-novels, such as *Ein stiller Musikant* (1874), and *Psyche* (1875). On psychological lines are *Viola tricolor* (1873), *Carsten Curator* (1878), *John Riew* (1885), *Ein Bekenntnis* and *Der Schimmelreiter* (1888). Nor should the delightful children's story *Pole Poppenspäler* (1874) be forgotten. Consult the biographies by Schütze (Berlin, 1887) and Wehl (Altona, 1888); also Erich Schmidt, *Charakteristiken*, I. (Berlin, 1886); Stern, *Studien zur Litteratur der Gegen*denser air toward the equator harder than it does *wart* (Dresden, 1895); Robertson, in *The Gentleman's Magazine* (London, 1895); and Remer, *Theodor Storm als norddeutscher Dichter* (Berlin, 1897).

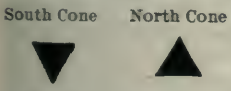
STORM AND STRESS (Ger. *Sturm und Drang*). The name of an emancipatory movement in German literature. It received the title from that of a typical drama by Klinger (1776), who wrote under the influence of Rousseau, with 'originality' and 'genius' as his watchwords. To this movement belong Goethe's *Götz von Berlichingen*, Schiller's *Die Räuber*, and countless works of similar striving but inferior worth. See German Literature.

STORM AND WEATHER SIGNALS. Flags, semaphores, lanterns, steam whistles, and other devices exhibited or sounded to inform mariners and others of storms or weather conditions. The display of such warnings resulted from the personal studies in more or less coöperation about the middle of the nineteenth century. Storm and weather signals, properly so called, began to be displayed about 1863 in England by Captain Fitzroy; in France by Leverrier; and in Belgium by Buys-Ballot. The American system of observations began in 1870 and storm signals were first displayed in the autumn of 1871. At the present time every civilized nation and every port of any importance has some method of signaling or otherwise informing navigators of approaching storms. Among the systems that are now in use are the following:

The *semaphore* is a simple vertical post having two or more arms attached that can be set at different angles with the vertical. The semaphore was introduced as a telegraphic apparatus about 1790, and numerous semaphore stations are still maintained in Europe and in various colonies. See Signaling and Telegraphing, Military, for illustration.

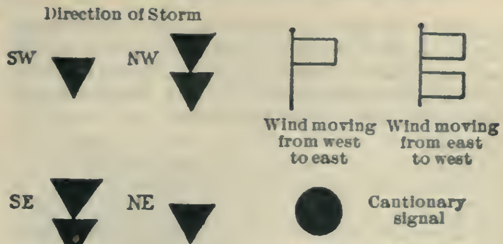
The Dutch and Belgian *aëroklinoscope* (q.v.), is a modified semaphore, in which the position of the arm indicates the direction of the barometric gradient and consequently of the wind that is nearly perpendicular to that.

The British system of storm warnings utilizes a cone by day and three red lights, arranged as a triangle, by night. If the cone point downward it indicates a storm wind from the southeast, veering through south to the northwest. If the cone point upward it indicates a northwest gale veering through the north to northeast.



BRITISH STORM SIGNALS.

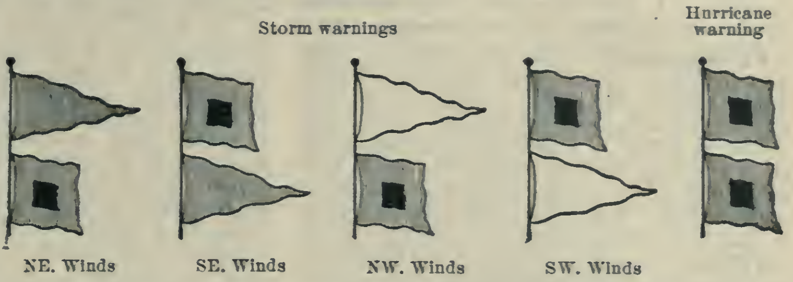
The German system consists of cones and double cones by day, and a single red lantern by night. The accompanying diagram shows the arrangement of the cones. The change in direction of the wind is indicated by red flags. If the wind is expected to vary from west of north to east, a single flag is raised; if the movement is in the opposite direction, two flags.



GERMAN STORM SIGNALS.

The symbols and signals used at the ports of the Orient depend upon the nationality of the port.

The arrangement of flags used in the United States by the United States Weather Bureau for storm warnings differs from that for weather forecasts and is shown in the accompanying illustrations.



EXPLANATION OF UNITED STATES WEATHER BUREAU STORM AND HURRICANE WARNINGS.

Storm Warning. A red flag with a black centre indicates that a storm of marked violence is expected.

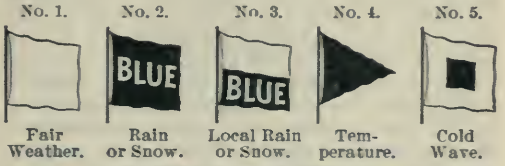
The pennants displayed with the flags indicate the direction of the wind; red, easterly (from northeast to south); white, westerly (from southwest to north). The pennant above the flag indicates that the wind is expected to blow from the northerly quadrants; below, from the southerly quadrants.

By night a red light indicates easterly winds, and a white light above a red light, westerly winds.

Hurricane Warning. Two red flags with black centres, displayed one above the other, indicate the expected approach of a tropical hurricane, or one of those extremely severe and dangerous storms which occasionally move across the lakes and northern Atlantic coast.

No night hurricane warnings are displayed.

Signals for the weather forecasts are as follows:



INTERPRETATION OF DISPLAYS.

No. 1, alone, indicates fair weather, stationary temperature.

No. 2, alone, indicates rain or snow, stationary temperature.

No. 3, alone, indicates local rain or snow, stationary temperature.

No. 1, with No. 4 above it, indicates fair weather, warmer.

No. 1, with No. 4 below it, indicates fair weather, colder.

No. 2, with No. 4 above it, indicates rain or snow, warmer.

No. 2, with No. 4 below it, indicates rain or snow, colder.

No. 3, with No. 4 above it, indicates local rain or snow, warmer.

No. 3, with No. 4 below it, indicates local rain or snow, colder.

When a steam whistle is used for weather signals a warning blast of from 15 to 20 seconds' duration is first sounded and then the longer blasts (4 to 6 seconds), which refer to weather, and the shorter blasts (1 to 3 seconds), which refer to temperature, the former being sounded first. The signals are as follows:

BLASTS	Indicate
One long	Fair weather
Two long	Rain or snow
Three long	Local rain or snow
One short	Lower temperature
Two short	Higher temperature
Three short	Cold wave

These signals may be repeated to avoid error.

STORM KING. A rocky peak of the Highlands of the Hudson, 1530 feet in height, 4 miles north of West Point. Its Dutch name was Boterberg, Butter Mountain. At its foot lies the town of Cornwall.

STORMS, Cape of. See Cape of Storms.

STORM VAN 'SGRAVESANDE, vän sgrä′ve-zän′de. A name sometimes applied to the Dutch mathematician Willem Gravesande (q.v.).

STOR′NOWAY. The chief town of Lewis with Harris (q.v.), an island of the Outer Hebrides, Scotland (Map: Scotland, B 1). Its chief feature is the palatial Stornoway Castle, completed in 1870. It is an important fishing station, exporting large quantities of fish to home and Baltic ports, and has a fine harbor, covering a square mile. Urban population, in 1901, 3711; of parish, in 1901, 12,983.

STORRS, Charles Backus (1794-1833). An American Congregational minister. He was born at Longmeadow, Massachusetts, and entered Princeton College, but, owing to ill health, did not graduate. He studied theology at Andover and was ordained in South Carolina in 1821. He was pastor in Ravenna, Ohio, 1822-28, was chosen professor of divinity in Western Reserve College in 1828, and president, 1831.

STORRS, Richard Salter (1821-1900). An American Congregational minister, born at Braintree, Mass. He graduated at Amherst College, 1839, and Andover Theological Seminary, 1845; was ordained pastor of the Harvard Congregational Church, Brookline, Mass., the same year; pastor of the Church of the Pilgrims, Brooklyn, N. Y., 1846, and so remained till his death. He was much sought after as an orator on special occasions and as lecturer, and his best known works were composed in answer to such demands. But he united learning with oratorical power, and his works have permanent elements. Among them are: *The Wisdom, Power, and Goodness of God as Manifested in the Constitution of the Human Soul* (the Graham Lectures, 1857); *The Conditions of Success in Preaching Without Notes* (1875); *The Early American Spirit and the Genesis of It* (1875); *The Declaration of Independence and the Effects of It* (1876); *John Wycliffe and the First English Bible* (1880); *The Recognition of the Supernatural in Letters and Life* (1881); *Manliness in the Scholar* (1883); *The Divine Origin of Christianity Indicated by Its Historical Effects* (1884); *The Puritan Spirit* (1890); *Bernard of Clairvaux, the Times, the Man, and His Work* (1892).

STORRS, William Lucius (1795-1861). An American jurist, born at Middletown, Conn. He graduated at Yale College, 1814; studied law at Whitestown, N. Y.; was admitted to the bar in 1817; resided and practiced law in Middletown; and was a member of Congress 1829-33 and 1839-40. He was a Whig in politics. In the latter year he was appointed associate judge of the State Supreme Court of Errors; Chief Justice, 1856; and was professor of law in Yale College, 1846-47. His decisions are printed in the Connecticut *Reports.*

STORTHING, stôr′tĭng. The legislative assembly of Norway (q.v.).

STO′RY, Joseph (1779-1845). An eminent American jurist and judge, born at Marblehead, Mass. He graduated from Harvard College in 1798, studied law, and was admitted to the bar in 1801. For a time he gave considerable attention to general literature and poetry. In 1804 he published *The Power of Solitude,* and other poems, which were not favorably received. He was discouraged by this failure, which he always felt keenly, and thereafter devoted himself to law and politics. He was elected to the State Legislature in 1805 and became a leader of the Republican, or, as it was afterwards called, the Democratic Party, and defended the measures of Jefferson. In 1808 he was elected to Congress, and although he was not in sympathy with the administration, President Madison, in 1811, appointed him associate justice of the Supreme Court of the United States. He was then only thirty-two years of age. In 1820, as a member of the Massachusetts Constitutional Convention, he advocated a property basis for the Senate. In 1829 he was appointed professor of law at Harvard, and taught law very successfully for sixteen years, at the same time serving on the Supreme Court bench. He was opposed to slavery, and was accordingly very unpopular in certain sections of the country. He presided as acting Chief Justice of the Supreme Court for some time after the death of Marshall, and probably only his attitude toward the administration prevented his selection as the permanent Chief Justice. During his long service on the bench he decided many admiralty and patent law cases which are authority at the present time, and he shared with Chancellor Kent the distinction of molding American equity jurisprudence. He wrote the opinion in the celebrated Dartmouth College case, which has been the subject of much criticism, although recognized as an able effort. He received the degree of LL.D. from Brown in 1815, from Harvard in 1821, and from Dartmouth in 1824. He continued his labors on the bench and in the law school until his death at Cambridge in 1845. His legal writings and decisions are still frequently quoted in the highest courts of the United States and England. He published the following legal works: *Commentaries on the Law of Bailments* (Boston, 1832); *Commentaries on the Constitution of the United States* (1833); *Conflict of Laws* (1834); *Commentaries on Equity Jurisprudence* (1835-36); and works on *Bells and Notes, Partnership, Agency, and Equity Pleadings,* at later dates. All of his works have gone through many editions, and are still used. See *Life and Letters of Joseph Story,* by W. W. Story (Boston, 1851).

STORY, William Wetmore (1819-95). An American author and sculptor. He was born at Salem, Mass., the son of Justice Story of the United States Supreme Court. After studying law at Harvard College, and under his father's direction, he was admitted to the bar, and practiced his profession in Boston. He published several legal books, among them: *Reports of Cases Argued and Determined in the Circuit Court of the United States* (1842-47); a *Treatise on the Law of Contracts* (1844); and a *Treatise on the Law of Sales of Personal Property* (1847). In 1848 he gave up law and went to Italy, where he made his home, residing principally at Rome, and died at Vallombrosa. The list of his works as a sculptor includes monuments, statues, ideal figures, and portrait busts. In the Metropolitan Museum, New York City, are the statues of Cleopatra (1864) and Semiramis (1874); other works by him include a statue of his father (Mount Auburn Cemetery); Edward Everett (Boston Public Gardens); a bronze statue of George Peabody, erected in London (replica, Baltimore, 1888); and the monument of Francis Scott Keys in the Golden Gate Park, San Francisco. His last work was the "Angel of Grief," a monument erected to his wife, whom he survived but a year. His work is done in the classical style, showing, however, some slight tendency toward realism. Story was prolific in literature as well as in art. He published *The American Question* (1862); *Roba di Roma* (1862); *Proportions of the Human Figure* (1866); *Graffiti d'Italia* (1869); five volumes of his poems; and the *Life and Letters of Joseph Story* (1851). Story was United States commissioner on fine arts to the World's Fair at Paris (1879), and received decorations from France and Italy. An admirable *Life* of Story by Henry James appeared in 1903 (London and New York).—His son, Julian Story, a portrait painter, was a student of Duveneck, Boulanger, and Lefebvre. He received a gold medal in Berlin in 1891, was elected a member of the Society of American Artists in 1892, and won a silver medal at the Paris Exposition of 1900. Among his sitters were King Edward VII. and Emma Eames, whom he married.

STOSCH, stôsh, Albrecht von (1818-96). A German general and naval administrator, born at Coblenz. He received a military education and was commissioned lieutenant in 1835. He entered the general staff in 1855, and became chief of staff of the Fourth Army Corps in 1861 and major-general in 1866. In the Seven Weeks' War he was quartermaster-general of the Second Army. In the same year he was appointed director of the commissary department with the rank of lieutenant-general, and was chief of staff with the army left in France after the conclusion of peace. In 1872 he was appointed chief of the admiralty, and in 1876 received the title of admiral. While holding these offices he greatly increased the power and efficiency of the German navy. He retired in 1883 and died February 29th, 1896.

STOSS, stôs, Veit (c.1440-1533). A celebrated German sculptor and engraver, the chief master of wood-carving in Germany. Beyond the fact that Nuremberg was his birthplace, nothing certain is known of his parentage, his youth and apprenticeship, but very probably he was reared in the school of Michel Wohlgemuth. The first definite mention of him dates from 1477, when he removed to Cracow, where he was held in great esteem and whence he returned in 1496, a well-to-do man, since in 1499 he bought a stately mansion at Nuremberg and made other investments besides. As to his subsequent life, we are informed that he caused much distress to the honorable council of Nuremberg, involved the city in litigation, and forged an obligatory bill, a crime which was then punishable by death. The council, however, by a special act of mercy, commuted the sentence to having him branded (1503), both his cheeks being pierced with a hot iron by the executioner. For breaking his oath not to leave the city, he subsequently had to suffer imprisonment, and in 1533 died, it is said, totally blind, at the age of ninety-five. This restless and graceless citizen, this forger and perjurer was nevertheless an artist of the most tender and feeling conception, whose works display the youthful purity of the Madonna and other saints as few of the masters of his time have done.

His earliest work on record is the "High Altar," in Saint Mary's at Cracow, executed in 1477-89, with the "Death of the Virgin" and the "Assumption" in the middle shrine, a work praised as a wonder of art by the master's contemporaries and to this day reckoned among the most perfect creations of its kind, exhibiting the artist's chief characteristics: vivid description, varied and animated figures, and rich drapery. Next followed, in 1492, the "Monument of King Casimir IV.," in the Cross Chapel of the Cathedral, a work of solemn splendor and withal of dignified simplicity. The earliest of his sculptures executed at Nuremberg are the three stone reliefs of the "Last Supper," "Christ on the Mount of Olives," and "Taking of Christ" (1499), in the ambulatory of Saint Sebaldus; over the high altar in the same church rises the "Crucifix and Figures of Mary and Saint John," designated as his last work (1526). Of the main altar in the Frauenkirche, only the heroic size statue of the "Madonna" (1504) is preserved, besides two reliefs. The taper-bearing angels in the choir of this church are also by Stoss. In the Germanic Museum may be seen the noble high-relief of the "Crowning of the Virgin by God and Christ," clear in composition and executed with masterly perfection; and the wooden paneling known as the "Rose Garland," in the centre reliefs of the Last Judgment and of the Heavenly Host grouped around a cross of Saint Anthony within a garland of roses, the whole framed by twenty-three minute reliefs of scenes from biblical history. Seven more reliefs, which formed part of this work, are now in the Berlin Museum. Noteworthy is the large "Pietà" in the Jacobskirche, which also contains several smaller but very able works of the master, but his best-known and chief work in carved wood is "The Angel's Salutation" (1518), in the Church of Saint Lawrence, the central group of heroic size surrounded by a chaplet of roses in which are set seven medallions with the Joys of the Virgin in bas-relief, a work unique in beauty and conception. He executed the superbly carved altar-pieces in the parish church at Schwabach (1506) and in the upper parish church at Bamberg (1523). His engravings, scenes from the Passion, severe in style and dating from his early period, are now very rare. Consult: Bergau, *Der Bildschnitzer Veit*

Stoss und seine Werke (Leipzig, 1877); Reé, in *Allgemeine deutsche Biographie*, xxxvi. (ib., 1893); Bode, *Geschichte der deutschen Plastik* (Berlin, 1887); and Lübke, *History of Sculpture*, trans. by Bunnett, ii. (London, 1872).

STOTHARD, stŏth′ẽrd, Charles Alfred (1786-1821). An English antiquarian draughtsman, the second son of the painter Thomas Stothard. He was born in London, studied at the Royal Academy Schools, and exhibited his best painting, "The Death of Richard II.," in 1811. Afterwards he worked on the *Magna Britannia* (1815), and became historical draughtsman to the Society of Antiquaries. In that capacity he made drawings of the Bayeux tapestry, which were published in the society's *Vetusta Monumenta* (1821-23). His most important work was the *Monumental Effigies of Great Britain* (1811-21), which was completed by other artists, and republished in 1876. His drawings are all of remarkable accuracy.—His widow, Ann Eliza Kempe (1790-1883), who afterwards married Edward Atkyns Bray, was a well-known author. She wrote *Memoirs of C. A. Stothard* (1823). See Bray, Mrs. Ann Eliza Kempe (Stothard).

STOTHARD, Thomas (1755-1834). An English illustrator and painter, born in London. In 1777 he entered the schools of the Royal Academy, and exhibited his first picture, the "Holy Family," in 1778. In 1779 he entered upon his career as an illustrator of books. More than 3000 of his designs were engraved, the greater number of which are to be found in the British Museum. Although lacking in temperament, his illustrations are characterized by grace and charm and by a sympathetic touch, especially when he depicted the loveliness of childhood. Stothard illustrated the novels of Fielding, Richardson, and Sterne; *Don Quixote, Gil Blas, Robinson Crusoe, Gulliver's Travels*, the *Arabian Nights, Clarissa Harlowe*, and *Tristram Shandy;* he also made designs to Milton (1792-93), Pope's *Rape of the Lock* (1798), and Shakespeare's *Seven Ages of Man* (1790). As a painter he is less important. He designed decorations for the staircase at Burghley (1799), the cupola of the upper hall of the Signet Library (1822) at Edinburgh, and the decorations of the drawing-room, throne-room, and great staircase of Buckingham Palace. Of his easel pictures, the National Gallery possesses "Venus and Cupid Attended by the Graces" (1824), the 'Woodland Dance," and the "Myth of Narcissus" (1793). Consult Mrs. Bray, *Life of Thomas Stothard* (London, 1851).

STOUGHTON, stō′ton. A town, including several villages, in Norfolk County, Mass., 18 miles south of Boston, on the New York, New Haven and Hartford Railroad (Map: Massachusetts, E 3). It has a public library with over 7000 volumes, and a handsome town hall. Boot and shoe making, and the manufacture of woolens, rubber goods, boxes, and wire are the chief industries. The government is administered by town meetings, convening annually. The waterworks are owned and operated by the town. Population, in 1890, 4852; in 1900, 5442. Stoughton, named in honor of Governor William Stoughton, was set off from Dorchester and incorporated in 1726. Consult Hurd, *History of Norfolk County* (Philadelphia, 1884).

STOUGHTON, Israel (?-c.1645). An American colonist, born in England. He was one of the founders of Dorchester, Mass., and in 1633 he became a freeman of the colony. Though a member of the General Court in 1634 and 1635, he wrote a pamphlet denying the right of the assistants to act as magistrates. As a punishment, the Government debarred him from holding public office for three years, but upon his making a humble submission revoked the sentence. From 1637 to 1643 he himself was chosen an assistant, and in 1637 he was appointed commander of the colony's troops in the Pequot War. In 1639 he was a commissioner in the boundary controversy with Plymouth. Five years later he went to England, where he entered the Parliamentary forces with the rank of lieutenant-colonel and probably fought at the battle of Naseby. At his death he left 300 acres of land in Dorchester to Harvard University. Consult Quincy, *History of Harvard University* (Boston, 1860).

STOUGHTON, John (1807-97). An English dissenting preacher and ecclesiastical historian. He was born in Norwich, and after receiving an elementary education entered a law office. He abandoned the law for the ministry, and after some preparation in Highbury College he was ordained in 1833. In 1872 he was elected professor of historical theology in New College, Saint John's Wood, though he still occasionally preached. In 1862 he published *Church and State, Two Hundred Years Ago . . . 1660-63.* His other important works are: *Ecclesiastical History of England from the Opening of the Long Parliament to the Death of Oliver Cromwell* (1867); *The Church of the Restoration* (1870); *The Church of the Revolution* (1874); *Religion in England Under Queen Anne and the Georges* (1878); *Religion in England from 1800 to 1850* (1884). Though somewhat diffuse, these histories are thorough and impartial: Consult his *Recollections of a Long Life* (London, 1894).

STOUGHTON, William (c.1632-1701). A colonial Governor of Massachusetts. He was born in England, early emigrated to America, graduated at Harvard in 1650, and was a fellow at New College, Oxford, from 1652 until ejected at the time of the Restoration (1660). Returning to Massachusetts, he was a selectman from 1671 to 1674, an assistant from 1671 to 1686—though in 1684 he refused to serve—and a commissioner of the United Colonies from 1673 to 1677, and again from 1680 to 1686. In 1677 he went to England as the agent of his colony in a boundary dispute with New Hampshire. He was a member of Governor Andros's Council, but, nevertheless, served on the Council of Safety that deposed him, and from 1692 until his death was Lieutenant-Governor of Massachusetts, being acting Governor from the recall (1694) of Sir William Phipps until the arrival (1699) of Lord Bellomont. In 1692 he was chief justice of the special court of oyer and terminer by which the Salem 'witches' were tried, and, as such, treated the accused with relentless severity. He was a liberal benefactor of Harvard, and it was for him that Stoughton Hall was named. He published *New England's True Interest Not to Lie*, the election sermon preached by him in Boston in 1668, and a pamphlet entitled *A Narrative of the Proceedings of Andros* (1691).

STOUGHTON MUSICAL SOCIETY. See Choral Societies.

STOURBRIDGE, stẽr'brĭj. A town in Worcestershire, England, 20 miles north-northeast of Worcester, on the Stour (Map: England, D 4). It contains iron, glass, earthenware, and fire-brick factories. 'Stourbridge clay,' upon which the action of fire has less effect than upon most varieties of clay, is an article of export. Conservatory pots, crucibles, etc., are made of it. In the grammar school founded in 1552, and rebuilt in 1864, Samuel Johnson received part of his education. Population, in 1891, 14,891; in 1901, 16,302.

STOURM, sto͞orm, René (1837—). A French economist, born and educated in Paris. He was employed in a department of the Ministry of Finance, became professor of finance in the Ecole Libre des Science Politiques, and in 1896 succeeded Léon Say as a member of the Academy of Political and Moral Sciences. On the history of finance, and more especially of taxation, he wrote *Les finances de l'ancien régime et de la révolution* (1885); *Le budget, son histoire et son mécanisme* (1889); *Systèmes généraux d'impôts* (1893); *Bibliographie historique des finances de la France du XVIIIème siècle* (1895); and *Les finances du consulat* (1902).

STOUT. See Beer.

STOUT, George Frederick (1859—). An English psychologist, born at South Shields, and educated at the Charlotte Terrace School in his native town and at Saint John's College, Cambridge. He was made a fellow at Saint John's College in 1884, and succeeded Croom Robertson as editor of *Mind* in 1891. After holding various academic positions in the field of philosophy and psychology, he was appointed in 1903 professor of logic and metaphysics in the University of Saint Andrews. His chief published works are: *Analytic Psychology* (1896); *Manual of Psychology* (1899); "Truth and Error," in *Personal Idealism* (1902); *Groundwork of Psychology* (1903). As a pupil of James Ward (q.v.), Stout infused into the traditional English psychology something of his teacher's critical spirit. His *Analytic Psychology* is planned, however, as a preliminary to a larger work on genetic psychology, in which especial attention is to be devoted to ethnographic evidence.

STOVE. See Heating and Ventilation.

STOW, John (1525-1605). One of the earliest and most diligent collectors of English antiquities. He was brought up to his father's trade of a tailor, but ultimately abandoned it for antiquarian pursuits. His principal works are his *Summary of English Chronicles*, first published in 1561, and subsequently reprinted every two or three years, with a continuation to the date of each new publication; *Annals of England*, 1580, and reprinted in 1592, to which year the annals are brought down; and *A Survey of London*, the most important of his writings, published in 1598. Besides these original works, Stow assisted in the continuation of Holinshed's *Chronicle*, Speght's edition of Chaucer, Leland's *Collectanea*, etc.

STOWE, stō, Calvin Ellis (1802-86). An American clergyman and author, born in Natick, Mass. He was educated at Bowdoin College and at Andover Theological Seminary. From 1830 to 1832 he was professor of Greek at Dartmouth College, and in the latter year became professor of sacred literature at Lane Theological Seminary, Cincinnati, where in 1836 he married Harriet, the daughter of Lyman Beecher, then president of the seminary. From 1850 to 1852 he was professor of divinity at Bowdoin College, and from 1852 until his retirement in 1864 was professor of sacred literature in Andover Theological Seminary. Among his published works are: *The Hebrew Commonwealth* (1829), from the German of Gahn; *Lectures on the Sacred Poetry of the Hebrews* (1829), from the Latin of Lowth; *Introduction to the Criticism and Interpretation of the Bible* (1835); *Elementary Education in Europe* (1837); *The Religious Element in Education* (1844); and *The Origin and History of the Books of the Bible* (1867).

STOWE, Harriet Elizabeth (Beecher) (1811-96). A famous American novelist, born in Litchfield, Conn. She was the daughter of the Rev. Lyman Beecher, and sister of Henry Ward Beecher. She attended school at Litchfield Academy and later at Hartford. In 1832 her father was called to the presidency of Lane Theological Seminary at Cincinnati, Ohio. While living in that city she gained a personal acquaintance with the ways of slavery, especially in regard to the handling of fugitive slaves and the attitude of the South toward the abolitionists. The impression was strengthened by several journeys into some of the slave States with her husband, the Rev. Calvin E. Stowe, a strong anti-slavery man, whom she married in 1836. In 1843 Mrs. Stowe published her first book, entitled *The Mayflower, or Sketches of Scenes and Characters Among the Descendants of the Pilgrims*. In 1850 her husband was called to Bowdoin College, Brunswick, Maine, and in the interval before his transfer to the chair of sacred literature at Andover (Mass.) Theological Seminary, two years later, she wrote the book by which she is most widely known, *Uncle Tom's Cabin, or Life Among the Lowly*. The novel appeared in the *National Era* of Washington, D. C., between June, 1851, and April, 1852, in which latter year it was issued in book form in Boston. As a serial it attracted no unusual notice, but as a book its success, after a few weeks, was unprecedented. Five hundred thousand copies were sold in the United States in five years, and many more in England, and it has been translated into at least nineteen foreign languages. In the following year Mrs. Stowe, in reply to various inquiries, criticisms, and censures, published *A Key to Uncle Tom's Cabin*. She also write, in the same year, *A Peep into Uncle Tom's Cabin, for Children*.

The health of Mrs. Stowe was impaired by the excitement of her work, and in 1853 she went to Europe. On her return she published (1854) *Sunny Memories of Foreign Lands*, two volumes relating her travels. She then returned to the attack against slavery in *Dred: A Tale of the Great Dismal Swamp* (1856; at one time entitled *Nina Gordon*), but without the unction and success of her former work. Thenceforth her writing consisted chiefly of novels of quiet New England life, with which she was familiar, and except for her polemic book, *Lady Byron Vindi-*

cated: A History of the Byron Controversy (1869), and her article in *Macmillan's Magazine* which had occasioned that discussion, her works were comparatively free from the didactic spirit. The chief titles are: *The Minister's Wooing* (1859); *The Pearl of Orr's Island* (1862); *Agnes of Sorrento* (1862); *Religious Poems* (1867); *Oldtown Folks* (1869); *Pink and White Tyranny* (1871); *Sam Lawson's Fireside Stories* (1871); *My Wife and I* (1871); *Palmetto Leaves* (1873); *We and Our Neighbors* (1875); and *Poganuc People* (1878). Of these, the best are *The Minister's Wooing* and *Oldtown Folks,* which were greatly praised by such critics as Lowell. She removed from Andover to Hartford in 1864, and in 1868 became associated with D. G. Mitchell in the editorship of *Hearth and Home.*

Mrs. Stowe is remembered chiefly as the author of probably the most potent and widely read novel in modern literature. Though, like almost all her novels, loose and rambling in structure, *Uncle Tom's Cabin* has abundant vitality, and is the work of a genuine story-teller. It also has the unusual fortune of being at once a cause and an outcome of a heated national struggle; no novel was ever better timed for an occasion, and few have aroused so much admiration and dislike. Soon after its publication the book was dramatized, and probably no other play has been produced so many times or seen by so many people. Both in its original and in its numerous stage versions it still holds popular favor in spite of occasional protests. The character Uncle Tom was drawn from the life of Josiah Henson (q.v.).

Consult: the *Life* by Charles E. Stowe (Boston, 1889); and *Life and Letters,* by Mrs. Annie Fields (Boston, 1899).

STOWELL, stō′el, William Scott, Baron (1745-1836). A British admiralty and ecclesiastical judge and jurist. He was the eldest brother of Lord Eldon (q.v.). He was born at Heworth, Durham, was educated at Newcastle went to Oxford in 1761, and became a college tutor. In 1779 he removed to London, was called to the bar (1780), and admitted to the faculty of advocates at doctors' commons. In 1788 he was appointed judge in the Consistory Court, knighted, and nominated a privy councilor. In 1798 he became judge of the Court of Admiralty. Both as an ecclesiastical and admiralty judge he won high distinction. He practically created much of the admiralty law of England. He drew on the Roman law, and the maritime law of all nations, ancient and modern, and his opinions, therefore, were very scholarly. He wrote no systematic treatise or text-book, but his judgments were admirably reported, and supply the best evidence of his extensive legal learning, his sagacity, and his great literary ability. He is the highest English authority on the law of nations, and his judgments—those especially relating to the rights of belligerents and neutrals —have been described as the most valuable contribution made by an English judge to general jurisprudence since the time of Lord Mansfield. He represented Oxford in the House of Commons for twenty years, but he took no part in the business of Parliament, although he was a zealous supporter of the Conservative Party and the Established Church. At the coronation of George IV. he was raised to the peerage under the title of Baron Stowell of Stowell Park.

STRABISMUS (Neo-Lat., from Gk. *στραβισμός*, a squinting, from *στραβός, strabos*, crooked, from *στρέφειν, strephein*, to twist, turn about), or Squint. A well-known and common deformity which may be defined as a want of parallelism in the visual axes when the patient endeavors to direct both eyes to an object at the same time. The eye which is directed toward the object looked at is called the fixing eye, the other the squinting eye. The squint is said to be *convergent* when the eye or eyes are directed toward the nose, *divergent* when they are directed toward the temple, and *vertical* when directed upward or downward. The last is often associated with convergent squint. The divergent form is comparatively rare, and occurs most often with myopia.

Squint is of two kinds: (1) *paralytic,* and (2) *concomitant.* Paralytic squint is caused by paralysis of one or more of the ocular muscles. There is inability to move the affected eyeball away from the side toward which it is directed. When both eyes are turned toward the side to which the squinting eye is directed, the squint disappears. The head is held in a characteristic position in every variety of paralysis of the muscles of the eyeball, an attempt of nature to compensate for the squint by turning the head in such a direction that the squinting eye is directed toward objects in front of the body. There is diplopia, double vision, unless the squinting eye is the one fixed on the object. By the position of the double image, it is possible to determine which muscle is affected. The eye involved is often closed in order to avoid the second image, which is confusing in walking. For example, a person with paralysis of the superior oblique muscle while descending stairs sees two steps instead of one, and is often led to attempt to reach the false image, with disastrous results. The paralysis may be due to a lesion at any point between the cerebral cortex and the muscle. Syphilis is the most common cause; others are cold, rheumatism, and acute infectious disease. The treatment is that of the cause, exercise of the muscles, the use of prisms to relieve the diplopia, and operation as in concomitant squint if necessary. In *concomitant squint* there is the same deviation of the eyes in every position, and both eyes possess a normal range of movement. Squint may be *alternating,* in which the patient fixes with either eye; *fixed;* or *unilateral,* in which the squint is confined to one eye; in regard to permanency it may be *constant* or *periodic.* In concomitant squint there is rarely double vision, one image being disregarded. Uncorrected errors of refraction, congenital feebleness of vision, opacities of the cornea or media, or other disease of the eye, combined with weakness of a muscle, leads to concomitant squint, for, as the sight in one eye is imperfect, there is little inducement to make the muscular effort to keep the two parallel. The treatment includes correction of errors of refraction by glasses, exercise of the muscles by prisms, and operative methods. The last may be division of the short tendon or advancement of that of the opposing muscle, or a combination of these procedures.

STRA′BO (Lat., from Gk. *Στράβων, Strabōn*) (c. 64 b.c.-19 a.d.). A famous Greek geographer and historian, born at Amasia, in Pontus. He received his education first at Nysa, on the Meander, from the grammarian Aristodemus and appears to have come to Rome with the Peripatetic Xenarchus and the grammarian Tyrannion, whose pupil he had also been. The date of his arrival seems to have been about B.C. 29. In B.C. 24 he left Rome in the train of Ælius Gallus, traveled in Arabia, and, returning to Rome in B.C. 20, made it his home until his death. Yet during this latter period he must have undertaken great journeys, for he informs us in his own work that he had traveled from Armenia in the east to Sardinia in the west, and from the Pontus Euxinus on the north to the borders of Ethiopia. While we lack certain information with regard to these journeys, Strabo's scanty knowledge of events in Rome in the latter half of Augustus's rule gives basis to the conjecture that he was absent during this period, very probably at the Court of Pythodoris, Queen of Pontus, of whom he makes frequent mention in his work. Strabo is most famous for his *Geography*, extant in 17 books, of which the first two deal with physical geography, books 3 to 10 with the geography of Europe, 11 to 16 with that of Asia, and book 17 with that of Africa. It is quite clear from internal evidence that the author did not complete his original plan. The sources of his knowledge were first of all his own observations made during his long journeys, and secondly the earlier geographers, of whom the most famous were Eratosthenes, Artemidorus, and Apollodorus of Athens. For Spain and Gaul his chief sources were Polybius and Posidonius.

His other work, of which we have but scanty fragments, was his *History*, which comprised 43 books. It was intended as a supplement to the work of Polybius and was divided into two parts. The first part sketched the history down to the period at which Polybius began; the latter treated in greater detail the history from Polybius to B.C. 27. The fragments of this work are published by Müller, *Fragmenta Historicorum Græcorum*, vol. iii. Consult also Otto, "Strabonis *ἱστορικῶν ὑπομνημάτων* Fragmenta," in *Leipziger Studien*, vol. xi. (1889). The *Geography* is edited by Kramer (Berlin, 1844-52); Meineke (Leipzig, 1866-77). English translation by Hamilton in Bohn's Classical Library (London, 1887); translation of selections, with introduction, maps, and plans, by Tozer (Oxford, 1893).

STRACHAN, străK′an, JOHN (1778-1867). A Canadian Anglican bishop. He was born in Aberdeen, Scotland, was educated at King's College in that city and at the University of Saint Andrews, and in 1799 emigrated to Canada. In 1812 he removed to York, now Toronto, and was appointed rector there. In 1839 he was made Bishop of Toronto. The chief cause of the violent opposition his policy aroused was his determined effort to establish the Church of England as a State Church. When the University of King's College was changed from its character as an Anglican institution, Bishop Strachan founded Trinity College in its stead. His personality and work as ecclesiastic and politician did much to bring about the Rebellion of 1837. Consult: Melville, *The Rise and Progress of Trinity College, Toronto, with a Sketch of the Life of the Lord Bishop of Toronto, as Connected with Church Education in Canada* (Toronto, 1852); and Bethune, *Memoir of Bishop Strachan* (1870).

STRACHEY, strā′chĭ, WILLIAM. A colonist and historian of early Virginia. He was a member of Gray's Inn, London. In May, 1609, he sailed for Virginia with Sir George Somers, and was wrecked on the Bermudas on July 28th. Strachey wrote one of the numerous accounts of the colonists' adventures which were widely circulated in manuscript before being printed in 1625, in Purchas's *Pilgrims*. In May, 1610, Strachey reached Virginia, where he became secretary and recorder of the colony. He edited the code of laws drawn up by Gates and Dale, and commonly known by the latter's name. Returning to England in 1612, he began writing his *Historie of Travaile into Virginia Britannia*. It was first printed in 1849, by the Hakluyt Society of London. It is the most reliable single narrative of events during the period of Virginia history with which he deals. Besides the 1849 edition of the *Historie*, consult Brown, *Genesis of the United States* (Boston, 1891).

STRACHWITZ, străG′vĭts, MORITZ, Count (1822-47). A German poet, born in Peterwitz, Silesia, and educated for the law in Breslau and Berlin. His first volume, *Lieder eines Erwachenden* (1842), was mostly written while he was still in the gymnasium. More typical is the collection posthumously published, *Neue Gedichte* (1847), with its sharp attack on Heine and the other revolutionists, its protests against the 'Everlasting No,' and its famous and popular lyrics, "Der Himmel ist blau" and "Germania." A complete edition of his poems appeared in 1850, and in Reclam's *Bibliothek* in 1878.

STRACK, sträk, HERMANN LEBERECHT (1848-—). A German theologian and Oriental scholar. He was born in Berlin and was educated there and at Leipzig. In 1877 he became professor in the theological faculty at Berlin. Among his more notable publications are: *Prophetarum Posteriorum Codex Babylonicus Petropolitanus* (1875); *Einleitung in das Alte Testament* (5th ed. 1898); *Lehrbuch der neuhebräischen Sprache und Litteratur* with Siegfried (1884); *Einleitung in den Talmud* (3d ed. 1900); *Das Blut im Glauben und Aberglauben der Menschen* (8th ed. 1900); *Grammatik des biblischen Aramäisch* (3d ed. 1901); *Das Buch Jesus Sirach im hebräischen Texte* (1903). He also published editions of several Mishma tracts; became editor of the *Porta Linguarum Orientalium* (Berlin), for which he wrote the Hebrew grammar (1883; 8th ed. 1902; Eng. trans., 1886); and, with O. Zöckler, editor of *Kurzgefasste Kommentar zu den Schriften Alten und Neuen Testaments* (Munich, 1886 et seq.). He prepared lexicons to the *Anabasis* (9th ed. 1902) and *Cyropædia* (2d ed. 1892) of Xenophon. In 1885 he began to edit *Nathanael*, a periodical devoted to Christian missionary work among the Jews.

STRADELLA, strȧ-dĕl′lȧ, ALESSANDRO (c.1645-c.1681). An Italian composer, born in Naples. Trustworthy information regarding his life and his works, the oratorios *San Giovanni Battista* (1676), *Susanna* (1681), and the operas *Corispero* (c.1665), *Orazio Cocle sul ponte* (c.1666), *Trespolo tutore* (1667), *La forza del amore paterno* (1678), may be obtained from Richard, "Stradella et les Contarini," in *Le Ménestrel* (Paris, 1865 and 1866). The opera *Stradella*, by Flotow, is founded on Bonnet-Bourdelot's story of an incident in the life of Stradella, in his *Histoire de la musique et de ses effets* (1715). He is thought to have been murdered in Genoa, about 1681.

STRADIVARI, strä′dê-vä′rê, or **STRAD′I-VA′RIUS**, Antonio (c.1644-1737). The most famous violin-maker of the Cremonese School. He was born in Cremona, and was probably apprenticed at a very early age to Nicola Amati, who at that time was regarded as the greatest of all the Cremonese masters. His first instruments were made between 1670 and 1685 and were largely of the Amati model, in consequence of which they are usually described as 'Amatese Strads.' They are distinguished by their lack of symmetry compared with his later works, their plain wood, and generally squatty design. About 1685 his originality began to assert itself, and by the following year he had evidently acquired his own peculiar style, which subsequent makers have largely used as a model. The period known as the 'long Strad' period was from 1690 to 1700, and incidentally it may be pointed out that the instruments made during that time were not any longer in design than those of the following years, from which they differed only in their treatment. For instance, the middle bouts, edges, and corners were longer and more graceful, and were possessed of a contour which has been described as a mingling of the feminine character of Nicola Amati's work and the masculine massive style of Stradivari from 1700 to 1737. In 1684 Nicola Amati died and bequeathed all his wood, models, and tools to Stradivari, thus providing the latter with a large and choice stock of tempered and seasoned wood, which was more than anything else responsible for the improved quality of his instruments dating from 1685. All the work of Stradivari was marked by minuteness of detail; the high quality of the wood and varnish; and the beauty of tone, which has a sympathetic quality altogether distinct from the best work of any other maker. His violins must have numbered fully two thousand, although comparatively few specimens are now in existence. He died at Cremona.—Francesco Stradivari (1671-1743), the second son of Antonio, was born at Cremona. He carried on his father's business, adopting Antonio's model of the period of 1700-1712, and produced instruments of a commanding style and an invariably good tone. Like his father, he was exceedingly careful in the artistic finish of his work, using wood of the finest quality and a rich red-brown varnish.—Omobono Stradivari (1679-1742), the fourth child of Antonio, was chiefly remarkable for his skill in repairing valuable instruments.

Consult: Fétis, *Antoine Stradivari* (Brussels, 1856); Niederheitmann, *Cremona* (Leipzig, 1897).

STRAF′FORD, Thomas Wentworth, first Earl of (1593-1641). An English statesman. He was born April 13, 1593, in London, of an old Yorkshire family. He was educated at Saint John's College, Cambridge, and later (1607) became a student of the Inner Temple. He was married in 1611 and knighted in the same year, after which he traveled on the Continent. In 1614 his father died and he succeeded to the title of baronet and a large estate. He was a member of the last three Parliaments of James I. In the Parliaments of 1621 and 1624 he supported the Crown against those who were trying to force England into a war with Spain. In the first Parliament of Charles I. he opposed Buckingham, who had now adopted the same policy of war with Spain, yet he was not in sympathy with Eliot and the Puritans. In the Parliament of 1628 he became the real leader of the House of Commons, though no formal leadership was recognized in those days. He introduced a bill similar in tenor to the Petition of Right (q.v.), but containing no declaration that the law had been violated in the past. Charles, however, refused to accept it, and Wentworth, unwilling to resist the King further, allowed the opposition to pass into other and more hostile hands. He supported the Petition of Right and was then apparently satisfied that the 'ancient government' of the kingdom had been restored. In June, 1628, he was made baron, on December 10th viscount, and on December 25th president of the Council of the North. On November 10, 1629, he was made member of the Privy Council. As president of the Council of the North he was the royal executive in that region and he exercised his authority vigorously and a little roughly in checking insubordination. His anti-Puritan sympathies had already drawn him into intimate relations with Laud, which ripened into a lifelong friendship. On January 12, 1632, Wentworth was made Lord Deputy of Ireland and he went to Dublin in July, 1633. His administration lasted six years before events in England drew his attention away. His task was a difficult one and his actions were arbitrary and often harsh, but on the whole extremely beneficial. Trade and industry were encouraged, disorders and numerous abuses were suppressed, and Ireland enjoyed unprecedented material prosperity. In 1639 Wentworth visited England. On January 12, 1640, he was created Earl of Strafford, and thenceforth he was the King's most influential adviser. Already the Scottish troubles had reached an acute stage. On account of his long absence, Strafford failed to appreciate the changed temper of the English people, and habits of arbitrary rule had grown upon him. He advocated the strongest measures and hurried back to Ireland to raise money and troops for Charles. This was made the basis of his impeachment on the meeting of the Long Parliament. Charles promised him that if he would come to London to meet the charges, he "should not suffer in his person, honor, or fortune." Inasmuch as the charges against him, even if proved, did not constitute treason as defined by the statute of Edward III., Parliament changed the impeachment into a bill of attainder, though Strafford was still heard in his own defense. His doom was sealed when Parliament discovered that Charles was plotting to rescue him by force. On May 8, 1641, the attainder bill was passed and on the 10th Charles, daring to resist no longer, signed it with Strafford's consent. Strafford was beheaded two days later.

Our estimate of Strafford's character will always rest principally upon his own recorded words. They will be found in *The Earl of Strafford's Letters and Despatches, with an Essay Towards His Life*, ed. by Radcliffe (2 vols., London, 1739). Consult also Gardiner, *History of England 1603-42* (10 vols., London and New York, 1883-84).

STRAIGHT UNIVERSITY. A coeducational institution for negroes exclusively, at New Orleans, La., founded by Seymour Straight and incorporated in 1869. The institution has an endowment of $17,000, and is sustained by voluntary contributions, through the American Missionary Association. Its buildings and grounds are valued at about $100,000. Its library contains about 2500 volumes. In 1903 the faculty numbered 28, and the students about 750 in all departments.

STRAIN, Isaac G. (1821-57). An American naval officer and explorer, born in Roxbury, Pa. He entered the navy as a midshipman in 1837, in 1845 was in command of an exploring expedition that penetrated into the interior of Brazil, and in 1848 explored Lower California. In 1849 he made the overland journey from Valparaiso to Buenos Ayres, publishing an account of the trip entitled *The Cordillera and Pampa: Sketches of a Journey in Chile and the Argentine Provinces in 1849* (1853). He became a lieutenant in 1850, served with the commission to locate the boundary line between Mexico and the United States, and in 1854 was placed in charge of a party sent to survey and explore the Isthmus of Panama and report upon the best route for the construction of an interoceanic canal. In 1856 in the *Arctic* he made soundings in the North Atlantic Ocean to ascertain the feasibility of a submarine cable. Returning to Panama, he died there from exposure in the following year. Consult Headley, *The Darien Exploring Expedition Under command of Lieutenant Strain* (New York, 1885), in the "Franklin Square Library."

STRAITS SETTLEMENTS. A crown colony of Great Britain, comprising some of the British possessions on the Malay Peninsula and a few of the adjacent islands, viz. Singapore (q.v.), Malacca (q.v.), Dindings (q.v.), Penang (q.v.), or Prince of Wales Island, the Province of Wellesley, the Keeling Islands (q.v.), and Christmas Island (q.v.). The total area, excluding Christmas Island and the Keeling group, is 1542 square miles. The colony has little natural wealth. It is important for its extensive transit trade, which passes almost entirely through Singapore and Penang. The total trade amounted in 1901 to nearly $288,000,000, of which the imports represented over $127,000,000. The trade of Singapore alone amounted to about $233,000,000. The principal imports are rice, cotton goods, and opium; the exports consist chiefly of tin (which is brought from the Federated Malay States), gums, and spices. All the ports are free. The total shipping during 1901 was 16,000,000 tons. The Governor is assisted by an executive council, and a legislative council composed of nine official and seven unofficial members, five of the latter being nominated by the Crown and two by the chambers of commerce at Singapore and Penang, and confirmed by the Crown. The Governor is also High Commissioner for the Federated Malay States and Borneo. The population (exclusive of Christmas Island and the Keeling group) was 512,342 in 1891, and 572,249 in 1901. In the latter year the population was composed of 281,933 Chinese, 215,058 Malays, and 5058 Europeans and Americans. There is an extensive immigration from China and India, chiefly coolies, the immigrants from the two countries in 1901 numbering 178,778 and 25,357 respectively. The crown colony was organized April 1, 1867. The capital is Singapore.

Bibliography. Swettenham, *Malay Sketches* (London, 1895); id., *The Real Malay* (ib., 1899); Rathbone, *Camping and Tramping in Malaya* (ib., 1898); Belfield, *Handbook of the Federated Malay States* (ib., 1902); Skeat, *Tribes of the Malay Archipelago* (ib., 1902).

STRAKOSCH, strā′kôsh, Moritz (1825-87). An Austrian composer and pianist, born in Lemberg, Galicia. He was the brother-in-law and teacher of Adelina Patti, and was educated in music at Vienna, coming to America in 1845, where he won considerable success as a teacher and concert pianist. In 1856 he became an impresario and introduced many great musicians to the American public. He was the composer of several salon pieces for the pianoforte and one opera, *Giovanna di Napoli*, which had its first presentation in New York. He died in Paris.—Max Strakosch, brother of the preceding, succeeded him in the management of the various concerts and opera undertakings. He died in New York in 1892.

STRALSUND, strāl′zụnt. A seaport in the Province of Pomerania, Prussia, situated on the Strelasund, which separates the mainland from the island of Rügen, 149 miles by rail north-northeast of Berlin (Map: Prussia, E 1). It is entirely surrounded by water. The natural strength of the place was greatly increased by formidable fortifications, which, however, were converted into promenades in 1873. Stralsund has narrow but regular streets, and many of the houses are finely gabled, giving the town a quaint and ancient appearance. There are three splendid Gothic churches erected in the fourteenth and fifteenth centuries. The handsome town hall contains a picture gallery, a collection of antiquities, and a public library of 60,000 volumes. There is a school of navigation. Stralsund is noted for its manufactures of playing cards. Oil, machinery, arc lights, furniture, and bricks are also produced. There is considerable shipping and a large export trade, chiefly in grain, sugar, fish, and malt. Stralsund, founded in 1209, was in the fourteenth century an important member of the Hanseatic League. The most notable event in its history was its eleven weeks' siege by Wallenstein during the Thirty Years' War (May-August, 1628). It was a possession of Sweden from the Peace of Westphalia (1648) to 1815, when it passed to Prussia. Population, in 1890, 27,814; in 1900, 31,083.

STRAMONIUM (Neo-Lat., of uncertain etymology), Stinkweed, Jamestownweed, Jimsonweed, Thorn-Apple (*Datura Stramonium*). A common weed of the natural order Solanaceæ. De Candolle refers it to countries bordering on the Caspian Sea; others regard it as coming from Northern India. It is a coarse, strong, vigorous, branching weed, from two to six feet high, with ovate toothed or angled leaves, large funnel-shaped flowers followed by prickly globular two-celled pods containing numerous angular black seeds which are reputed narcotic but are little used. All parts of the plant have a disagreeable smell.

STRANAHAN, străn′å-*a*n, James Samuel Thomas (1808-98). An American contractor and philanthropist, born in Peterboro, N. Y. He was successively school teacher, surveyor, and trader, and then became a railroad contractor in Newark, N. J., gradually acquiring large interests in the companies by accepting stock as payment for construction. He removed to Brooklyn in 1844 and until his death was closely identified with the city's commercial expansion and public improvement. From 1860 until 1882 he served as president of the Brooklyn Park Commission. His greatest achievement was the planning and building at an enormous cost of Prospect Park, one of the largest and most beautiful civic parks in the United States. In 1891 Brooklyn erected a statue of him at the main entrance to Prospect Park.

STRAND. See Rope; Knotting and Splicing.

STRAND, The. An important business thoroughfare of London, so named because it led through the marshy land bordering the former banks of the Thames. It extends from Charing Cross to Temple Bar, and in the sixteenth century was bordered by the mansions of the nobility, some of which survive in the names of various streets and buildings. It contains a number of theatres and newspaper offices, and is at all times busy and animated.

STRANDBERG, stränd′bâr-y′, Karl Wilhelm August (1818-77). A Swedish poet, born in Södermanland, and educated at Upsala and Lund. The greater part of his earlier writing was of a patriotic nature. His works show great purity of form and depth of patriotism. Under the pseudonym Talio Qualis he published *Sånger i pansar* (1845); *Vilda Rosor* (1854); and his *Samlade vitterhetsar beten* (1877). He translated Byron's *Don Juan* and selections from Molière.

STRANGE, Sir Robert (1721-92). A Scottish engraver. He was born in Kirkwall, on one of the Orkney Islands. He made an attempt at law, but drawing claimed his chief attention, and he became an apprentice to Richard Cooper, at Edinburgh, for six years. To gain the hand of Isabella Luminsden, he joined the rebel army at the time of the Jacobite uprising, and after its defeat he was rescued by his lady-love, who hid him under her hooped skirt from the officers in search of him, and continued singing over her needlework. After their marriage, in 1847, he went to Paris and studied dry point under Le Bas. He made an improvement upon this process that gave a more beautiful finish to the engravings. He moved to London in 1751, devoting himself to historical engravings, but a refusal to engrave the portraits of the Prince of Wales and Lord Bute in 1759, supposedly for political reasons, was the cause of his departure for Italy. There his welcome was most cordial and he was made a member of the Academies of Rome, Florence, and Bologna, and professor of the Royal Academy at Parma. During a subsequent stay in Paris he was made a member of the Royal Academy of Painting. After his return to London in 1780 he made his peace with the reigning family by his engraving of West's "Apotheosis of the Princes Octavius and Alfred," and was awarded the honor of knighthood in 1787. Strange's engravings are chiefly after the great Italian masters, including Guido Reni, Salvator Rosa, Raphael, and Correggio, and after Van Dyck. Though often defective in draughtsmanship, his work is characterized by grace of line and the excellency of his rendition of the flesh. Consult: Dennistoun, *Memoirs of Sir Robert Strange* (London, 1855); introduction to Marshal Keith's *Memoir* (ib., 1843); and the *Life* by Woodward prefixed to *Twenty Masterpieces of Strange* (ib., 1847).

STRANGE, Robert (1796-1854). An American lawyer. He was born in Virginia; was educated at Hampden-Sidney College; studied law, and after his admission to practice, settled at Fayetteville, N. C. He served as a member of the North Carolina House of Delegates in 1822-23 and 1826, was judge of the Superior Court 1826-36, United States Senator 1826-40, and some time later Solicitor of the Fifth Judicial District. The Indian legends of the region about Fayetteville were attractively related in his novel, entitled *Eoneguski; or, the Cherokee Chief.*

STRANGE CASE OF DOCTOR JEKYLL AND MR. HYDE, The. A story by R. L. Stevenson (1886). It illustrates the struggle between good and evil in a human soul. Dr. Jekyll is a physician of excellent standing, but with concealed propensities which by secret indulgence have developed his lower nature into an almost distinct individual known as Mr. Hyde. By a powerful drug he has learned to transform himself at will into this terrible, debased creature, who commits hideous crimes. At last the power of the evil side of his nature gains the ascendency. Dr. Jeykll, without the intervention of the powder, becomes transformed into Mr. Hyde, and, unable to regain his better self, kills himself in despair.

STRANGLES (from *strangle*, OF. *estrangler*, Fr. *étrangler*, from Lat. *strangulare*, from Gk. *στραγγαλᾶν*, *strangalan*, *στραγγαλίζειν*, *strangalizein*, to strangle, from *στραγγάλη*, *strangalē*, halter; connected with *στραγγός*, *strangos*, twisted, Lat. *stringere*, to draw tight), Distemper, or Colt-Ill. An infectious disease of the horse, ass, and mule, most frequently observed in young animals, especially pure-bred. The animal seems dejected, has a capricious appetite, dry, staring coat, reddish eyes, and accelerated pulse and breathing. After about two days a cough and a nasal discharge are noted. A large puffy abscess is developed under the lower jaw, which opens later to the outside. Abscesses sometimes develop in other parts of the body. Light cases require little treatment except proper care and dieting, the opening of the abscesses, and the alleviating of fever when excessive.

STRANGULATION. The mechanical constriction of the neck so as to prevent the passage of air and to suspend respiration, and consequently life. Strangulation may be produced by throttling or hanging. Death is sudden when the obstruction to respiration is complete, but otherwise it is gradual in its onset. In hanging, especially in judicial executions where a long drop is used, death is probably due to fracture of the cervical vertebræ, with compression of the medulla oblongata, the seat of the nerve centre controlling respiration. When breathing has been interrupted for only a short time, and there is no mechanical obstacle to respiration, nor injury to the medulla, life may sometimes be restored by proper measures, such as artificial respiration, stimulant applications, and a plentiful supply of fresh air. To relieve cerebral congestion it is advantageous to abstract blood, and if this is replaced with normal saline solution by transfusion (q.v.) into the veins, the additional advantage will be gained of diluting the carbon dioxide in the blood.

When death has taken place by hanging, proofs of this, concerning which medico-legal questions may arise, depend upon the position of the body when found, the presence of marks upon the neck, and of the signs of asphyxia in the internal organs, and the absence of any other possible cause of death. The mark on the neck is generally a hard, dry, yellowish, horny furrow running obliquely. The face is turgid, with blood-stained froth about the nostrils and lips; the tongue is swollen and protruding. The right side of the heart and the right lung are engorged with venous blood, while the left side is empty. See Asphyxia.

STRANGURY (Lat. *stranguria*, from Gk. *στραγγουρία*, *strangouria*, retention of urine, from *στράγξ*, *stranx*, drop squeezed out; connected with *στραγγαλίζειν*, *strangalizein*, to strangle + *οὐρεῖν*, *ourein*, to urinate, from *οὖρον* *ouron*, urine). A variety of retention of urine, in which, while urine is present in the bladder and a desire to micturate is present, spasm or painful contraction permits of the passage of but a few drops. The spasm is usually of the urethra, but the rectum may share in the condition. It occurs after the use of cantharides or turpentine internally (both of which are eliminated by the kidneys) or by the use of a large Spanish-fly blister from which a considerable amount of the drug has been absorbed into the lymphatics, or sometimes during gonorrhœa. Hot applications to the genital region, a hot sitz-bath, hot enemata, and the ingestion of bland fluids which render the urine less irritating, will give relief. Opium is a valuable drug in the treatment of this condition.

STRAPAROLA, strä'pȧ-rō'lȧ, Giovan Francesco (?-c.1557). An Italian author, who was born at Caravaggio, near the end of the fifteenth century. Nothing is known of his life, and his name is only a sobriquet signifying loquacity. He published *Sonetti, strambotti, epistole e capitole* in 1508. He is remembered, however, by his *Tredeci piacevoli notti*, "Facetious Nights," which is one of the most amusing imitations of the *Decameron*, and was published in two parts, in 1550 and 1554, at Venice. An English translation of the *Nights* by W. G. Waters appeared in 1894. Consult Dunlop, *History of Fiction* (London, 1851).

STRASCHIRIPKA, strä'shē-rĭp'kȧ, Johann. The correct name of the Austrian painter more commonly known as Johann Canon (q.v.).

STRASBURGER, sträs'bo͞ork-ēr, Eduard (1844—). A German botanist, born at Warsaw, and educated at Bonn and at Jena, where he became professor in 1869 and director of the botanical garden in 1873. With Haeckel he visited the East, and in 1881 he accepted a call to the University of Bonn. In his special field of histology of plants he wrote: *Die Befruchtung bei den Koniferen* (1869); *Ueber Zellbildung und Zellteilung* (3d ed. 1880); *Ueber den Bau und das Wachstum der Zellhaüte* (1882); besides *Das kleine botanische Praktikum* (4th ed. 1902); *Histologische Beiträge* (1888-93); and with Noll, Schenck, and Schimper, *Lehrbuch der Botanik für Hochschulen* (5th ed. 1902). Conjointly with Pfeffer he edits the *Jahrbücher für wissenschaftliche Botanik* (Berlin, 1894 et seq.).

STRASSBURG, sträs'bo͞ork. A city of Germany, the capital of Alsace-Lorraine. It is situated at the junction of the Breusch and the Ill, two miles west of the Rhine, 28 miles east of the French frontier, and 88 miles by rail north of Basel (Map: Germany, B 4). The Ill divides into five arms in the city. Strassburg is a fortress of the first class, and possesses a garrison of 15,000 men. A circle of fourteen forts and an inner rampart defend the city. The centre of the city forms an oval, and is surrounded by two arms of the Ill. Here the streets are narrow and crooked, and the picturesque ancient houses and frequent specimens of pure mediæval architecture, reflect a period when the city was both art-loving and wealthy. In this section, on the southeast, rises the structure for which Strassburg is best known—the cathedral, or Minster. It is said to have been founded about 600. The present edifice dates from 1176. The fore part of the cathedral is Romanesque, and the rest (the nave, 435 feet long) Gothic. The remarkable façade, the work of Erwin of Steinbach, with its galleries and rose window, especially commands admiration. Noteworthy also is the late Romanesque south portal, which is embellished with images. The tower is 465 feet high. A scarcely less celebrated feature of the Minster is its astronomical clock, the mechanism of which was constructed in 1839-42 to replace that of the famous clock of the sixteenth century. (See Clock.) Southwest of the cathedral is the Protestant Saint Thomas Church, a composite edifice embracing the Gothic and Romanesque, begun about 1200. It contains a marble monument to Marshal Saxe, executed by Pigalle. Near the cathedral is the ancient episcopal palace, identified with the Rohans, and now containing the unimportant municipal art museum. In the Grosse Metzig—the market hall—dating from 1588 is the valuable Museum of Industrial Art.

North of the Ill extend the handsome new quarters of the city, where, in the Kaiserplatz, may be seen the splendid Imperial Palace, in Florentine Renaissance. It was completed in 1888, and has a cupola 115 feet high. The modern Hall of the Provincial Diet and the provincial and university library are near by. The library has some 700,000 volumes. Farther on in a northeasterly direction is the Contades Park. Some little distance east of the city, and reached by the fine Ruprechtsauer Allée, lie the beautiful municipal grounds of the Orangerie—a pleasure garden with Oriental features and lovely promenades. South of the town formerly stood the important citadel, built by Vauban, and destroyed during the siege of 1870. Between it and the city is the extensive arsenal. Strassburg has a statue of General Kléber, who was born there, and of Gutenberg; also a bust of Goethe, which marks the house where the poet lived as a student.

The university (see Strassburg, University

OF) is situated across the Ill to the southeast of the city. There are, in addition, the important Protestant Gymnasium, the academy with its collections, a lyceum, a Roman Catholic seminary, a very fine municipal conservatorium of music, a mechanics' school of art, and an industrial art school. The municipal theatre is an admirable institution. The Frauenhaus contains an architectural and sculptural collection. The city archives are very valuable. The numerous excellent hospitals are mostly situated in the southern part of the city.

The city government is administered by the burgomaster, with six associates, and a council of 36 members. The city is divided into four cantons. Strassburg is commercially important, having of late greatly increased its trade, a considerable part of the traffic between France, Germany, and Switzerland passing through the city. The Ill is canalized; the Rhine-Marne and other canals traverse the city; and Strassburg is a railway centre. The new port covers upward of 300 acres, with wharves and quays on the Rhine. Latterly manufactories have grown up to some extent and include foundries, locomotive works, tobacco factories, tanneries, piano factories, chemical works, etc. Much jewelry is manufactured. The population in 1900 was 151,041, of whom one-half or more were Roman Catholics.

HISTORY. Strassburg is the Argentoratum of the Romans. A bishopric appears to have been established before the seventh century, when the name Stratisburgum began to be used. In 1262 its citizens threw off the yoke of the bishop in a battle at Oberhausbergen. The city, free and independent, had reached a high degree of prosperity at the Reformation. The citizens embraced Protestantism at an early date—1520. In 1681 Louis XIV. suddenly took possession of Strassburg, which was fortified by Vauban. It remained a French city until it became a part of the German Empire as a result of the Franco-Prussian War. It was an important military point under the French, and in 1870 held out against the Germans for six weeks under its gallant commander Uhrich, who finally capitulated on September 27th with over 17,000 men. Great damage was wrought during the siege by the bombardment.

Consult: Krieger, *Topographie der Stadt Strassburg* (Strassburg, 1894); Förster, *Strassburg, die Hauptstadt des Reichslandes* (ib., 1894); Euting, *Beschreibung der Stadt Strassburg* (12th ed., ib., 1901); *Beiträge zur Geschichte der Stadt Strassburg* (ib., 1896 et seq.); and Staehling, *Histoire contemporaine de Strasbourg* (Paris, 1884).

STRASSBURG, UNIVERSITY OF. A German university, the outgrowth of an earlier gymnasium, formally founded by privilege of Ferdinand II., in 1621. It flourished greatly in the seventeenth and eighteenth centuries, and, though Strassburg became French territory in 1681, the university retained much of its German character. Goethe and Herder studied here in 1770. It disappeared in the Revolution, rose again in 1802 as a Protestant academy, and in 1808 became a part of the University of France by the university reform of Napoleon I. After the war of 1870 the institution once more became German and was reorganized as a university in 1872. It has since been greatly encouraged by the Imperial Government as a centre of German influence and culture in reclaiming Alsace-Lorraine, and is in consequence in a very flourishing condition. Its budget is more than 1,000,000 marks, and it had in 1901 about 1200 students. Its library contains more than 700,000 volumes. There are various institutes connected with the university.

STRASSER, sträs′ẽr, ARTHUR (1854—). An Austrian sculptor, born at Adelsberg, Carniola. After having studied at the Vienna Academy, in 1871-75, he worked in the studios of Pilz and Kundmann, but soon branched off independently into a line of naturalistic production, first exemplified by statuettes of Japanese jugglers and actresses. The dark complexion and picturesque costumes of the Oriental races next attracted him to fashion terra-cotta figures, which, by skillful coloring, he succeeded in making impressively true to nature, as well in the racial peculiarities of his models as in all material accessories. These qualities are especially apparent in the "Egyptian Snake-Charmer," "The Secret of the Tomb," and the "Hindu at Prayer." His figures in bronze are equally lifelike, witness his "Goose-Girl" and the "Glimpse into Eternity." He also produced animal figures, especially lions, on a large scale, of which the "Triumphal Chariot of Marcus Antonius," in Vienna, is a sterling example.

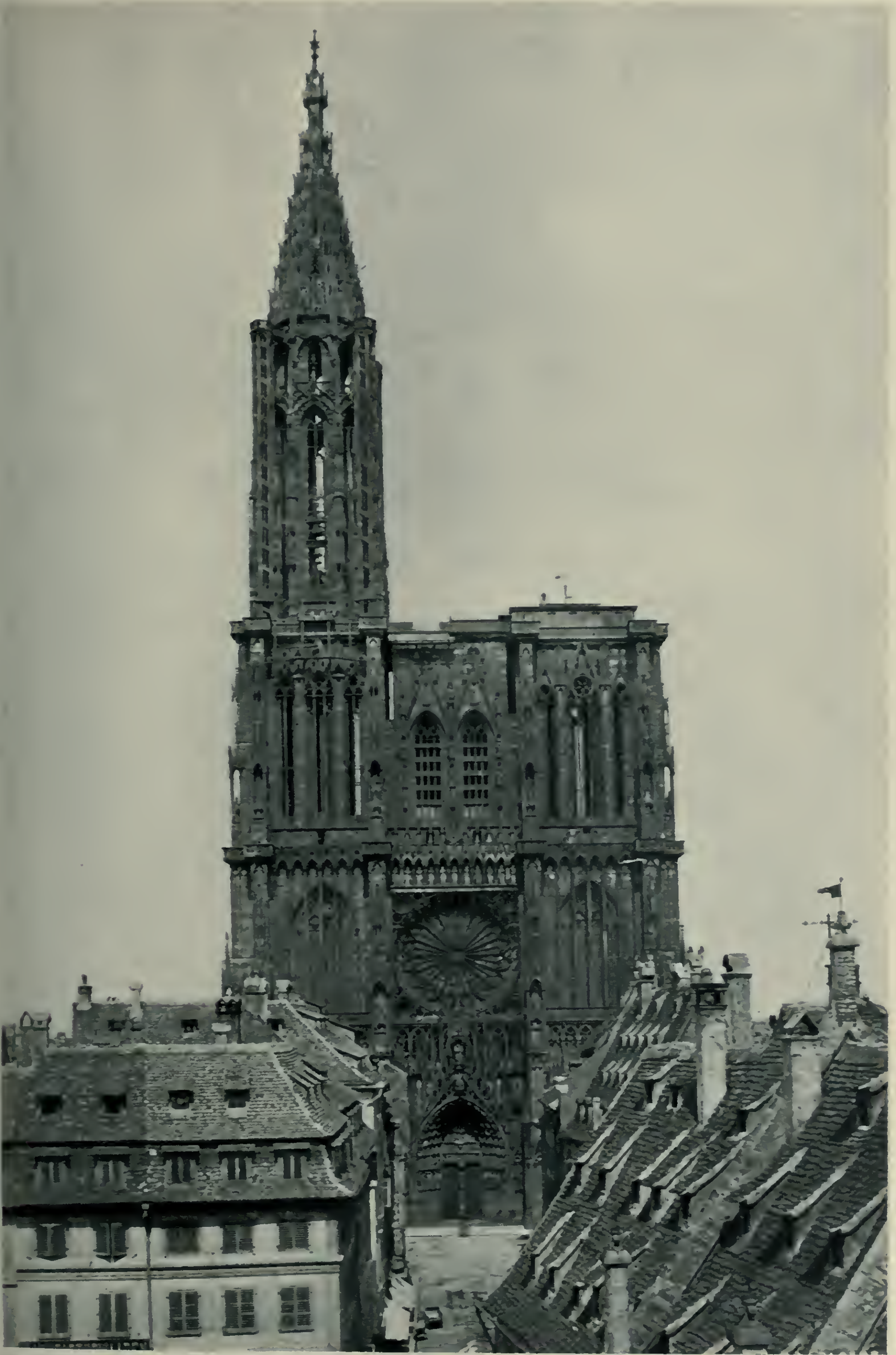
STRATEGY (OF. *strategie*, Fr. *stratégie*, from Gk. *στρατηγία*, *stratēgia*, generalship, from *στρατηγός*, *stratēgos*, general, from *στρατός*, *stratos*, army, encampment, from *στορεννύναι*, *storennynai*, Lit. *sternere*, Skt. *star*, to spread, extend, strew + *αγειν*, *agein*, to lead). Strategy is one of the two great subdivisions of the art of war, and comprises all those larger measures which relate to the grand field of operations, the object of which is to have the troops enter the contest of arms, the *battle*, under the most favorable conditions, involving the direction of the troops toward the battlefield, as well as the measures taken to reap the rewards of success. It has been defined as the use of battles in war, in contradistinction to *tactics* (the other great subdivision of the art of war), which is the use of troops in battle; or, again, as the art of leading armies, while *tactics* is the art of leading the smaller subdivisions of armies and is fully treated under its own head. See TACTICS.

The scope of strategy has been greatly extended with time. Formerly, it did not enter as a factor in war until the armies were actually in the field but to-day *national policy* is also a determining factor, and one of vast importance, in view of the fact that modern wars are conducted on a grand scale and with great rapidity, therefore requiring definite plans to be prepared beforehand, in which questions of statesmanship and diplomacy are necessarily leading factors. Moreover, finance and commerce must also be considered.

Among the principles upon which strategy is based or according to which it is directed are:

(1) National policy and strategy must be kept in perfect agreement in war, and closely allied at every point, to accomplish the best results.

(2) When countries are at war each will probably finally concentrate its troops in a single army, so as to be able to strike decisive blows with its united power; hence the principal ob-



STRASSBURG
THE CATHEDRAL

jective, against which all efforts should be directed at the outset, is the enemy's main army.

(3) Every effort must be made to bring together at the decisive moment all available forces.

These relate to the general objects of the war, the theatre of operations, and the entire field army as a whole. Separate actions may take place in various parts of the theatre, and they, too, will involve strategic principles, similar in character, but of minor importance.

(4) The offensive alone promises decisive results.

(5) The defensive can only avoid defeat; it cannot win victory.

(6) It is impossible to be too strong for a decisive battle.

(7) Concentration of the forces is a necessary condition for decisive action.

(8) No alteration in the plan of operations should be made after the campaign has definitely opened, unless enforced by the enemy or by the elements or unforeseen circumstances.

During the progress of military events certain of the latter will generally have a common object, and will be closely related in other respects. Every such group of events, composed in general of marches, positions, and battles, is designated an *operation*. A group of closely related operations constitutes a *campaign*. To-day the operations of a campaign are practically continuous, but, in order to be so, there must be a *base* of supplies, where ammunition, food, forage, and so on are accumulated for the support and maintenance of the army in its advance. Formerly this base was fixed, and could be fortified and stocked with supplies beforehand, but modern war demands a movable base, usually a network of railroads, but sometimes furnished by a fleet.

The lines along which the army advances from its base toward its objective are called *lines of operation*, and those by which the army obtains its subsistence and supplies, *lines of communication*. The base, the lines of operation, and the lines of communication, being of vital importance to the operating army, are naturally the objects of the enemy's attacks and manœuvres.

The strategic events of a campaign will usually take place in the following order:

Preparation, mobilization, strategic deployment, plan of operations, and the military operations themselves.

The operations may be strategically *offensive* or strategically *defensive*, or finally alternately offensive and defensive. The strategical offensive may be combined with the tactical offensive or the tactical defensive; and the strategical defensive may also be combined with either tactical form. All strategists and tacticians unite in giving the preference to the strategical and tactical offensive combined, but circumstances may force one of the other combinations on an army, at least for a time, or perhaps only in a particular part of the theatre. In that case, however, the offensive must be taken up at the earliest opportunity, if decisive results are desired.

The great principles of strategy apply to naval warfare as well as to wars on land, but certain modifications result from the fact that the lines of communication in the case of a fleet are less clearly marked, and bases and coaling and repair stations which are absolutely essential to success in naval warfare can be improvised and, if need be, changed. Again, combined naval and land operations, the transition from the purely naval contest to extended operations on land, involve some new principles not set forth here: the control of the sea by the attacker's fleet is one of the first conditions for the success of such combined operations.

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STRAT'FORD. A town and suburb of London, in Essex, on the Lea, 4 miles east of Saint Paul's (Map: London, D 8). It has a fine town hall and is the seat of various extensive manufactures. There are flour mills, distilleries, and chemical works. The prosperity of the town has increased through its connection with the Eastern Counties Railway and the extensive works the company established here. Population, in 1891, 38,612; in 1901, 44,825.

STRATFORD. A port of entry and the capital of Perth County, Ontario, Canada, on the Avon River, and the Grand Trunk and the Georgian Bay and Lake Erie railroads, 88 miles west of Toronto (Map: Ontario, B 4). It has good water power, and there are flour, salt, and planing mills, and manufacturers of iron castings, mill machinery, boots and shoes, and farming implements. The Grand Trunk Railroad shops are here. The county buildings are attractive. Population, in 1901, 9959.

STRATFORD DE RED'CLIFFE, STRATFORD CANNING, Viscount (1786-1880). An English diplomat, born in London. The influence of his famous cousin, George Canning, secured for Stratford in 1808 the secretaryship of the Embassy at Constantinople, under Adair, and on the latter's resignation in 1810 Canning was made Minister Plenipotentiary. In this position at a most critical moment in the great struggle against Napoleon, he negotiated the Treaty of Bucharest between Russia and Turkey, in 1812. In 1820 he was made Minister to the United States, where he was successful in the settlement of the difficult questions arising out of the War of 1812. After performing various diplomatic services and holding a seat in the House of Commons he was sent in 1841 as Ambassador to Constantinople. The most dramatic and important event of his service at the Turkish capital was his diplomatic contest in 1853 with Prince Menshikoff, the Russian Ambassador Extraordinary. The result of the struggle—through which Canning obtained the name of 'Great Eltchi.' or '*the* great ambassador'—was a victory for Canning. He remained at Constantinople throughout the Crimean War and until

1858 and exerted great influence upon the Turkish Government with regard to its foreign relations and the inauguration of political reforms. He was raised to the peerage in 1852 under the title of Viscount Stratford de Redcliffe. He was the author of some creditable verse. In 1881 extracts from his papers and correspondence were published, with a preface by A. P. Stanley, under the title, *The Eastern Question.* Consult also: Lane-Poole, *Life of the Right Honourable Stratford Canning, Viscount Stratford de Redcliffe* (London, 1888).

STRATFORD-UPON-AVON, ā′von. A municipal borough and township in Warwickshire, England, 8 miles southwest of Warwick, on the Avon, famous as the birthplace of Shakespeare (Map: England, E 4). The town is neatly built, with wide, pleasant streets, containing numerous quaint, half-timbered houses. The house in which Shakespeare was born is still preserved, and there is a Shakespeare memorial building, including a theatre and a gallery of Shakesperean paintings, and a library of rare Shakespereana. The poet is buried in the parish church of the Holy Trinity, a fine cruciform structure partly early English and Perpendicular, dating from the twelfth century and built on the site of a Saxon monastery which existed before 691. Other interesting remains of Shakespeare's time are the grammar school endowed in 1482, in which he was educated, the guildhall, and the town hall. In the neighborhood at Wilmcote is the cottage of his mother, Mary Arden, and at Shottery, that of his wife, Anne Hathaway. Stratford is annually visited by 30,000 tourists, one-fourth of whom are from the United States. The town is an old free market borough with a governing charter since 1553. Population, in 1891, 11,400; in 1901, 10,600. Consult: Lee, *Stratford-on-Avon* (London, 1890); Savage, *The Registers of Stratford-on-Avon* (London, 1898).

STRATH′CLYDE′. A British kingdom which first appears prominently in the seventh century as one of the strongholds of the original Celtic inhabitants against the invading Anglo-Saxons. It lay in the western part of the island between the Clyde River and the Derwent in what is now Cumberland, though the name is sometimes applied to the entire territory between the Clyde and the Mersey. It was from an early time closely connected with the Scottish crown, to which it was united in 1124.

STRATH′CO′NA AND MOUNT ROYAL, Donald Alexander Smith, first Lord (1820—). He was born at Archieston, Morayshire, Scotland, and after receiving a common school education entered the employ of the Hudson's Bay Company in 1838. After years of work on the coast of Labrador and in the Northwestern wilderness he was promoted to chief factor, and from that position to resident governor and chief commissioner of the company in Canada. In 1870 he was elected to the first session of the Manitoba Legislature, and to the Canadian House of Commons, and was appointed a member of the first executive council of the Northwest Territory. Four years afterwards he resigned from the Provincial Legislature, but, with the exception of the period from 1880 to 1887, he remained a member of the Dominion Parliament until 1896, when he was appointed High Commissioner to London and a member of the Queen's Privy Council of Canada. He became largely interested in railroads, and it was due to him more than to any other man that the Canadian Pacific Railway was completed. For this service Queen Victoria knighted him in 1886, and in 1897 raised him to the peerage as Baron Strathcona and Mount Royal.

STRATH′MORE′. In its most comprehensive sense, an extensive plain in Scotland (q.v.).

STRATH′NAIRN′, Hugh Henry Rose, Baron (1803-85). A distinguished English general, born at Berlin, Germany. He served in 1840-41 under General Michell with the Turkish troops against Mehemet Ali; from 1842 till 1851 was British agent in Syria, and became chargé d'affaires at Constantinople in 1852. During the Crimean War he distinguished himself at Inkermann, and for his services was promoted to the rank of major-general. In the Indian Mutiny he commanded the Central India field force, and gained a great victory on April 1, 1858, over Tantia Topi, with 20,000 men, and captured Jhansi, the strongest fortress in Central India, April 5th; Kalpi, May 23d and Gwalior, June 19th. For these services he received the thanks of Parliament, was gazetted a G.C.B., and in 1860 was promoted to be lieutenant-general. He returned to England in 1865, and was soon after given command of the forces in Ireland, where he prevented the Fenian troubles from becoming formidable. In 1867 he was promoted to be general, and in 1877 became a field-marshal. Consult Low, *Soldiers of the Victorian Age* (London, 1880).

STRATHSPEY, străth′spā′ (so called from *Strathspey* in Scotland). A rapid Scotch dance in $\frac{4}{4}$ time, somewhat resembling the reel (q.v.). Its music is composed of dotted eighths and sixteenths, and the dance itself is of a violent, jerky character. Its history dates from the latter part of the eighteenth century.

STRATIFICATION (from *stratify*, from Lat. *stratum*, pavement, coverlet, neu. sg. of *stratus*, p.p. of *sternere*, to spread, extend, strew + *facere*, to make, do). The term used in geology to define the arrangement of certain rocks into more or less parallel layers. Stratification is a very general characteristic of sedimentary deposits, sandstone, shale, limestone, etc., which for the most part have accumulated on the shores of the sea and the beds of lakes and rivers. The rock materials in each layer are of homogeneous character, due to the uniformity of conditions during the time of deposition, but the passage from one layer to another may be marked by a change in the nature and size of the materials, indicating a variation in the process of deposition. The layers are separated by divisional planes which mark periods of interruption in the desposition. When the layers are very thin, as in shale, for example, they are generally known as laminæ. A stratum is a group of one or more layers of the same mineral substance. See Geology.

STRAT′TON, Charles Sherwood (1838-83). An American dwarf, born in Bridgeport, Conn. Owing to his smallness of stature at the age of fourteen years, he was engaged by P. T. Barnum, and was exhibited throughout Europe and elsewhere, under the name of Gen. Tom Thumb; at the time of his engagement his weight was sixteen pounds, and he was less than two feet high. In 1863 he was married to Lavinia Warren, also a dwarf, and in company with Minnie Warren (q.v.) and 'Commodore' Nutt (q.v.), they exhibited themselves far and wide.

STRATUM (Lat., pavement, coverlet, bed). The term applied in geology to the smallest subdivision of sedimentary rocks, practically synonymous with layer, seam, and bed. The distinctive characteristics of a stratum are homogeneity of composition and separation from adjacent beds or strata by well-marked divisional planes called bedding planes. A stratum represents a single uninterrupted period of accumulation, while the bedding planes are caused by longer or shorter pauses in the process. See GEOLOGY.

STRAUBING, strou'bĭng. A town of Bavaria, Germany, 23 miles southeast of Regensburg, on the right bank of the Danube (Map: Germany, E 4). The late Gothic Church of Saint James contains some notable paintings. The town has important manufactures of brick, lime, and cement. There are breweries and tanneries. Its population, in 1900, was 17,454, mostly Roman Catholic. Straubing stands on the site of the Roman colony *Sorbiodurum*. The present town dates from 1208, when Louis I. erected the Stadt-Thurm, which is still standing.

STRAUS, strous, OSCAR SOLOMON (1850—). An American diplomat, born at Atterberg, in Rhenish Bavaria. He came to the United States in 1854, and lived in Georgia until the close of the Civil War. He was educated at Columbia University. In 1887-89 he was Minister to Turkey, and so distinguished himself that in 1897 he was reappointed to the same position by President McKinley, remaining there till 1900. On January 14, 1902, he was named a member of the Permanent Court of Arbitration at The Hague to fill the place left vacant by the death of ex-President Harrison. His published works include: *The Origin of the Republican Form of Government in the United States* (1886); *Roger Williams, the Pioneer of Religious Liberty* (1894); *The Development of Religious Liberty in the United States* (1896); and *Reform in the Consular Service* (1897).

STRAUSS, DAVID FRIEDRICH (1808-74). A distinguished German theological and philosophical writer, born at Ludwigsburg, near Stuttgart. He was educated in the evangelical seminary of Blaubouren (where F. C. Baur was then teaching), whence he passed to the University of Tübingen. Here his religious convictions became disturbed. The theories of Schelling, of Jakob Böhme, and, finally, of Schleiermacher and Hegel successively claimed his allegiance. He left the university in 1830 to become assistant pastor of a small church and then taught in the seminary at Maulbronn. Here he remained but six months, and then went to Berlin in order to hear Schleiermacher and Hegel. The death of Hegel and Schleiermacher's apparent lack of sympathy determined him to quit Berlin after a very brief stay to take up the work of a 'repetent' at Tübingen (1832). Here his lectures on Hegelianism attracted attention. His skepticism was now quite pronounced, since his view of Hegelianism, which he accepted as the final philosophy, made a miraculous Christianity impossible. His theory of the origins of Christianity was formulated in the work that made him famous, *Das Leben Jesu, kritisch bearbeitet* (1835-36; Eng. trans. by George Eliot, 1846), in which he sought to explain the Gospel history on the mythical theory. The work aroused a storm of opposition, but nevertheless had a widespread influence. In consequence of his views, he was removed from his position and given a subordinate place in the Lyceum of Ludwigsburg. From 1836 until his death Strauss lived a somewhat wandering life, holding no position, though he had accepted, in 1839, an appointment in the University of Zurich, which position, on account of popular opposition, he had not been permitted to fill.

Because of his interest in the political agitations of the times he was elected a member of the Württemberg Diet in 1848. But he was not sufficiently radical for his constituents and so resigned. His second chief work, *Die christliche Glaubenslehre in ihrer geschichtlichen Entwickelung und im Kampf mit der modernen Wissenschaft dargestellt*, was even more skeptical than his *Leben Jesu*. After the publication in 1848 of *Sechs theologisch-politische Volksreden* Strauss turned from theological to literary criticism and biography. He wrote critical biographies of Schubart (1849), Märklin (1851), Frischlin (1855), Ulrich von Hutten (1857, 4th ed. 1878), Reimarus (1862), and Voltaire (1870, 5th ed. 1877), the last a work of remarkable merit. Not until 1864 did he again turn to theology, when he published *Das Leben Jesu für das deutsche Volk*, following it in the next year by *Die Halben und die Ganzen* and *Der Christus des Glaubens und der Jesus der Geschichte*. His last work was *Der alte und der neue Glaube, ein Bekenntnis* (1872, 11th ed. 1881). In these last works Strauss gave up entirely the faith he once may have had in Christianity. Strauss's popularity was doubtless due as much to his clear and captivating style as to any logical force in his arguments.

His *Gesammelte Schriften* were edited with an Introduction by his friend Eduard Zeller (Bonn, 1876-78, 12 vols.). For his life, consult: Zeller, *D. F. Strauss in seinem Leben und seinen Schriften* (Bonn, 1874); Hausrath, *D. F. Strauss und die Theologie seiner Zeit* (Heidelberg, 1876-78).

STRAUSS, JOHANN, the Elder (1804-49). An Austrian composer of dance music, born in Vienna. He received an imperfect musical education. In 1819 he was received into Pamer's orchestra, and four years later joined the celebrated Lanner Quartet as viola-player. He subsequently became assistant conductor of Lanner's orchestra, but in 1824 started an independent organization, with which he played at various resorts, and through which he gave to the world the waltzes which made him famous. In 1845 he was appointed conductor of the Court balls at Vienna. Conspicuous among the 152 waltzes which he published were the "Lorelei," "Gabrielen," "Taglioni," "Victoria," "Kettenbrücken," "Bajaderen," and the "Donau-Lieder." Both as conductor and as composer he succeeded in raising the dance form to an artistic plane, before unknown.

STRAUSS, JOHANN, the Younger (1825-99). A distinguished Austrian composer, born in

Vienna, son of the preceding. His father was averse to his adopting the profession of music, but, aided by his mother, he was enabled to secure instruction on the violin and in composition, and at nineteen years of age severed his home connections and secured an engagement as conductor of an orchestra at a popular restaurant in Hietzing. He used the opportunity to play his own waltz compositions and soon became widely popular. After his father's death he united both orchestras and began a concert tour through many European countries. From 1855 to 1865 he was the conductor of the Petropaulovski Park summer concerts in Saint Petersburg, and from 1863 to 1870 was also conductor of the Court balls. He composed nearly 500 dance pieces, which for the most part possess the highest merit. Among the best known may be mentioned: *The Beautiful Blue Danube; Roses from the South; Artist's Life; Vienna Blood; The One Thousand and One Nights; Wine, Women, and Song.* His operettas were entitled as follows: *Indigo* (1871); *Der Carneval in Rom* (1873); *Die Fledermaus* (1874) *Cagliostro* (1875); *Prinz Methusalem* (1877); *Der lustige Krieg* (1881); *Eine Nacht in Venedig* (1883); *Der Zigeunerbaron* (1885); *Simplicius* (1887); *Ritter Pasman* (1892); *Fürstin Ninetta* (1893); *Jabuka, oder das Apfelfest* (1894); *Waldmeister* (1895); *Die Göttin der Vernunft* (1897); and a ballet *Aschenbrödel.* For his biography consult Eisenberg (Leipzig, 1894) and Prochazka (Berlin, 1900).

His brothers, JOSEPH (1827-70), who became leader of the Vienna orchestra in 1863, and EDUARD (1835—), who assumed its direction in 1870, both did creditable work as musical conductors and composers of dance music.

STRAUSS, RICHARD (1864—). A German composer, the most ingenious disciple of the so-called school of Weimar. Born in Munich, he mastered the technics of the violin and piano when quite young, and in 1875-80 studied theory and composition with kapellmeister Wilhelm Mayer. In October, 1885, Strauss became musical director at Meiningen. In 1886-89 he was kapellmeister at Munich and was then called to Weimar. His radical tendencies were soon recognized, and his espousal of extremely modern music caused his conducting of Wagner to become of notable interest. On his return from a trip to Greece, Egypt, and Sicily, his music drama *Guntram*, opus 25, dedicated to his parents, was produced at Weimar, in 1894.

Strauss returned to Munich as Court kapellmeister in 1895, and in the same capacity went to Berlin in 1898. He wrote *Italia,* a symphonic fantasia, in 1886. It is fresh, vigorous, and characteristic in themes and coloring. Then followed a series of daring orchestral compositions. The chronology of the greater symphonic works is as follows: *Don Juan* (1888); *Macbeth* (1887); *Death and Apotheosis* (1889); *Till Eulenspiegel* (1895); *Thus Spake Zarathustra* (1895); *Don Quixote* (1897); *A Hero's Life* (1898). His later works include, besides numerous songs and choruses, an opera, *Feuersnot* (1901); a tone poem entitled *Sinfonia domestica;* and *Taillefer,* a choral work with orchestra, based on a poem by Uhland. Strauss's earlier productions tell no tale of genius; the mark of the file is upon them. But from his twentieth opus his originality shows itself. He invented the tone poem, in which the line of design is as sternly unwavering as the symphony, and the possibilities for expression almost illimitable. The Strauss themes condition their treatment, and if his harmonic scheme sometimes seems ugly, his melodic curve daring, and his orchestration polyodic, it must be remembered that the same criticisms were made of Richard Wagner's music. The developing sections in his tone poems are remarkable. Perhaps, following the trend of the Lied writers since Schumann in his songs, the voice is woven too closely in the dense fabric of harmony, yet many effects of pure, rhythmetic, and sensuous beauty are discovered. Here Strauss has often dared to be simple in sentiment. Such a song as the *Serenade* is heard with delight by audiences that do not realize the complexity of a scheme expressing itself so naïvely. It is the epical Strauss that appeals especially to the imaginative.

Consult: Fuller-Maitland, *Masters of German Music, with Illustrations* (London, 1894); Huneker, *Mezzotints in Modern Music* (New York, 1899); the monographs by Seidl and Klatte (Prague, 1896), and Brecher (Leipzig, 1900); and *The Musical Times,* vol. xliv., No. 719 (London, 1903).

STRAW BAIL. In old English law, the names of two or more fictitious persons entered on the records of a court as sureties for the appearance of a defendant in a civil action. In early times a defendant was first served with a summons, and if he did not appear he was considered to be guilty of contempt of court, for which the sheriff arrested him under a *capias,* and he was obliged to give bail for his appearance. Gradually, through the change of practice in serving only one process and the indulgence of the courts, this became a mere formality, and the fictitious names of 'John Doe' and 'Richard Roe' were entered as sureties. This was known as *common* or *straw bail.* This practice no longer prevails, but the name is retained to denote a financially irresponsible surety on a bail bond. See BAIL.

STRAWBERRY (AS. *strēawberie, strēawberige,* strawberry; perhaps so called either because the long stems resemble straws, or because of an old custom of stringing the berries on straws). Certain perennial herbs of the natural order Rosaceæ, widely distributed mostly in temperate regions throughout the world. The cultivated forms are all derived by the hybridization and crossing of three principal species, *Fragaria vesca, Fragaria Virginiana,* and *Fragaria Chiloënsis,* particularly the last named. The plants are low growing, have trifoliate leaves, white flowers either pistillate or polygamous, and numerous achenes on usually red, sometimes yellowish-white fleshy receptacles which constitute the edible part. The plants are hardy and may be grown in almost any region in America from Florida to Alaska. The varieties grown almost universally in America have a short season of fruitfulness, but several of the European varieties bear more or less continuously throughout the summer and early autumn.

Since young plants are most productive, the strawberry plantations are usually allowed to fruit only once, sometimes twice. The plants obtained from rooted runners are set in the field in spring or in late summer, and are allowed to form matted rows from their runners or are grown in so-called hills, in which case the runners are cut off, and the plants made to form stools. The former method is by far the most popular, but finer and larger individual fruits, though in smaller number, are obtained by the latter method. The land may be any rich soil suitable for corn or potatoes, and should have been in cultivation for at least one year, preferably two or three, previous to the planting of the strawberries, in order to be free from the larvæ of certain insects that feed on the roots especially of grasses. The plants are usually set about 18 inches asunder, in rows three feet apart, and given clean culture throughout the season. When the ground has frozen hard straw, marsh hay, or similar substance free from weeds is spread upon the plants as a winter mulch. This is raked between the rows when growth starts in the spring and allowed to remain to protect the berries from dirt during rains. Usually in the spring of the second year complete fertilizers are applied, but no cultivation is given. After the crop is gathered, the plants are plowed under and the land used for some crop such as cabbage, which will mature before frost. Land cropped with strawberries should be planted to other crops for two or three years before strawberries are again planted.

COMMON WILD STRAWBERRY (*Fragaria Virginiana*).

Since the introduction of refrigerator transportation the strawberry industry has vastly increased. Large areas in the Gulf States are devoted to the crop, shipments are made to the North in early spring, and as they cease areas farther to the north supply the demand until midsummer, when the market is furnished from northern localities. The whole industry has been developed since the introduction, in 1834, of the Hovey strawberry, a variety which originated in Massachusetts. Since that date thousands of varieties have been introduced, tested, and even if they were popular for a short time have been supplanted by superior ones. Strawberries are cultivated to a small extent under glass to supply a demand for forced fruits in some cities.

The principal disease to which the strawberry plant is subject is the blight or rust (*Sphærella fragariæ*), which appears on the leaves as small purple spots which increase in size and become brown with purple margins. Serious losses may follow severe attacks. Since the disease is carried over winter in the old leaves, all such should be collected and burned and the young foliage protected by two or three sprayings of Bordeaux mixture or other fungicide (q.v.). A mildew (*Sphærotheca castagnei*) sometimes appears on the leaves as a delicate cobweb which causes the crumpling of the leaves. It seldom causes much injury and is readily controlled as above indicated. Consult: Fuller, *The Strawberry Culturist* (New York, 1897); Terry and Root, *A B C of Strawberry Culture* (Medina, Ohio, 1902).

STRAWBERRY BUSH. See SPINDLE TREE.

STRAWBERRY INSECTS. The principal insect enemy of the strawberry in the Eastern United States is the strawberry weevil (*Anthonomus signatus*), which appears just before the blossoms expand lays an egg in the bud usually of the staminate varieties or those pistillate varieties rich in pollen, and then punctures the stem so that in a few days the bud drops to the ground. The larva develops within the severed bud and after pupation emerges as a dull red or nearly black beetle, about one-tenth of an inch long. Both larvæ and adults feed upon the pollen. Covering the beds, cultivating pistillate varieties, and clean culture are the remedies recommended.

The larva of the strawberry leaf-roller, a small reddish brown tortricid moth (*Ancylis comptana*), rolls the leaves of the strawberry into cylindrical cases during June, becomes a chrysalis within the folded leaf, and appears as a moth in July. A second generation occurs during August. An arsenical spray is the remedy.

The strawberry sawfly (*Harpiphorus maculatus*), a small, black insect, lays its eggs in the substance of the leaf early in May. The pale green larvæ, which feed upon the leaves, and when full-grown are nearly three-fourths of an inch long, burrow in the ground and form minute cocoons. A second generation appears in the late summer and hibernates under ground. Hellebore is recommended as a remedy. Consult: Saunders, *Insects Injurious to Fruits* (Philadelphia, 1889); Chittenden, *The Strawberry Weevil* (Washington, 1897).

STRAW MANUFACTURES (AS. *strēa*, *strēaw*, *strēw*, OHG, *strō*, Ger. *Stroh*, straw; connected with AS. *strēawian*, *strēowian*, Goth. *straujan*, OHG. *strewen*, Ger. *streuen*, to strew, and with Lat. *sternere*, Gk. στορεννύναι, *storennynai*, στρωννύναι, *strōnnynai*, OChurch Slav. *streti*, Skt. *star*, to scatter). Besides the use of straw for the manufacture of paper (q.v.), straw is woven into a great variety of forms, as hats, baskets, and shoes. The most important branch of the straw-plaiting industry is the making of straw hats or of straw braid to be sewed into hats. Much of the straw braid which is used for hats .in England and America is braided in China and Japan.

The conversion of straw into braid is a simple process, requiring few tools but deft fingers. Wheat straw is the material commonly used. The straw pipes must be sufficiently long between the joints, flexible, and of good color. The straw is prepared for braiding by first pulling, instead of mowing the crop. It is then cut into lengths and permitted to dry and bleach in the sun, after which the outer sheath is removed and the straw is again bleached, this time in sulphur fumes. The straw is then sorted as to diameter, length, and color.

It is estimated that in Saxony and Bohemia alone, from 20,000 to 30,000 persons of both sexes and all ages are engaged in this industry. The finest work is done in Tuscany, where the industry was established in the thirteenth century. Here a particularly fine grade of straw has been produced since 1718, from which the famous Leghorn braids are made. The Tuscan straws are not split. In 1840 looms were adapted to straw-braiding, but they have not superseded hand labor. The plaits are known by the numbers of bents into which they are worked as 7 or 11 bents. The production of the finer grades of Tuscan braids is a most delicate operation, so trying to eye and nerve that the workman cannot engage in it for more than two hours at a time.

STRAW AND STRAW MANUFACTURES IMPORTED INTO THE UNITED STATES
(From the U. S. Statistical Abstract for 1900)

	1896		1897		1898		1899		1900	
	Tons	Dollars	Tons	Dollars	Tons	Dollars	Tons	Dollars	Tons	Dollars
Unmanufactured	7,879	31,140	9,386	31,768	1,448	4,463	2,075	4,564	5,495	15,750
Manufactured		1,199,284		1.006,201		260,437		259,185		336,287

STRAW-WORM. See WHEAT INSECTS.

STRAY. See ESTRAY.

STREATOR, strē′tor. A city in La Salle County, Ill., 94 miles southwest of Chicago; on the Vermilion River, and on the Chicago, Burlington and Quincy, the Chicago and Alton, the Wabash, the Indiana, Illinois and Iowa, and the Atchison, Topeka and Santa Fe railroads (Map: Illinois, D 2). There is an attractive park in the heart of the city. Streator has important railroad interests, and is the centre of an agricultural section noted also for its deposits of coal and clay. Bottle and window glass works, foundries and machine shops, and brick and tile manufactories are some of the leading industrial establishments. The government is vested in a mayor, chosen every two years, a unicameral council, and subordinate officials who are appointed by the mayor with the consent of the council. Streator was settled in 1860, and was laid out in 1867. It was incorporated as a village in 1870, and organized as a city in 1882. Population, in 1890, 11,414; in 1900, 14,079.

STRECK′ER, ADOLF (1812-71). A German chemist, born at Darmstadt. He taught successively at Giessen, Christiania, Tübingen, and Würzburg. His extensive original work led to interesting discoveries in connection with the galls of various animals, to the isolation of the coloring matter of madder, to the preparation of the mercury compounds of many alcoholic radicles, and to several important syntheses in organic chemistry, notably those of lactic acid, alanin, and taurin. His publications include: *Das chemische Laboratorium der Universität Kristiania* (1854); *Theorien und Experimente zur Bestimmung der Atomgewichte* (1859); and a German edition of Regnault's well-known textbook of chemistry (begun 1851).

STRECKER, HERMAN (1836-1901). An American entomologist, born in Philadelphia. He acquired considerable skill as a sculptor and designer, but his chief claim to distinction is due to his study of butterflies. His collection of these insects was the largest in America and one of the largest in the world. He published: *Butterflies and Moths of North America* and *Lepidoptera, Rhopalocera and Heterocera, Indigenous and Exotic.* After his death in 1901 his collection was bought by Dean Hoffman for $20,000 and was presented to the American Museum of Natural History in New York City.

STRECKFUSS, strĕk′fo͞os, KARL (1778-1844). A German poet and translator. He was born at Gera, studied law at Leipzig, and occupied high positions in the Prussian civil service. His original works include: *Gedichte* (1823), *Neuere Dichtungen* (1834), and *Erzählungen* (1830), but he is best known as the translator of *Ariosto* (1818-20), *Tasso* (1822 and often), and *Dante* (1824-26).—His son ADOLF (1823-95), a novelist and historian, was the author of *Friedrich I. und die Quitzows* (1859); *Vom Fischerdorf zur Weltstadt; 500 Jahre Berliner Geschichte* (last ed., 1899); and of *Weltgeschichte, dem deutschen Volkerzählt* (1865).

STREET (AS. *stræt,* from Lat. *strata,* street, highway, fem. sg. of *stratus,* p.p. of *sternere,* Gk. *στορευνύναι, storennynai, στρωννύναι, strōnnynai,* OChurch Slav. *streti,* Skt. *star,* Goth. *straujan,* OHG. *strewen,* Ger. *streuen,* AS. *strēawian, strēowian,* Eng. *strew*). The term as here used denotes a way for foot and vehicular traffic in cities and other more or less closely inhabited areas.

Some of the points to be observed in planning a city's streets are as follows: The streets should radiate from the principal centre, and sometimes there should be sub-radiations from local centres. This will save time and distance and afford an opportunity for better artistic effects in the way of commanding central features, such as public squares, monuments, and buildings, and pleasing vistas. Placing pipes and wires in subways, or underground galleries, is a modern means for relieving overhead congestion. Much relief has been gained in a number of cities by placing the wires in inclosed underground conduits accessible from manholes, or covered chambers placed sufficiently near together to render street excavations unnecessary. See SUBWAYS, etc.

In building sidewalks care must be taken to secure an unyielding, well-drained foundation, in order to prevent uneven settlement, cracks, or breaks. Boards or planks are generally laid crosswise of the walk, on longitudinal stringpieces, or timbers, designed to keep the boards off the ground and postpone the inevitable decay. On account of this decay, wooden sidewalks are, in the long run, decidedly uneconomical. Curbstones are from four to six inches thick and deep enough to form the necessary rise above the gutter and to extend into the earth sufficiently to give a firm foundation. They are often set on broken stone, to insure good drainage, or on concrete, to give a solid foundation. They may be of stone or of concrete. Where concrete is used it sometimes extends so as to form the gutter, as well, and has the upper and outer edge of the curb protected with an iron bar or rod, imbedded in the concrete.

See BOULEVARDS; ELECTRIC LIGHTING; ELECTRIC RAILWAYS; STREET RAILWAYS; GAS; HEATING AND VENTILATION (paragraph *Central Stations*); PAVEMENTS; ROAD AND STREET MACHINERY; ROADS; SEWERAGE AND DRAINAGE; SUBWAYS FOR PIPES AND WIRES; WATER-WORKS, etc.

STREET, ALFRED BILLINGS (1811-81). An American author, born at Poughkeepsie, N. Y. He studied law and began practice at Monticello, N. Y., but in 1839 removed to Albany, where he became editor of *The Northern Light*, and was, for the latter half of his life, State librarian. His poems deal with the sights and sounds of the woodland and the life of the more primitive days of the settlement of America. Among his verses are: *The Burning of Schenectady, and Other Poems* (1842); *Drawings and Tintings* (1844); *Fugitive Poems* (1846); and *Frontenac; or, the Atotarho of the Iroquois* (1849), a poetical romance. His chief prose works are: *Woods and Waters* (1860); *The Indian Pass* (1869); *Lake and Mountain; or, Autumn in the Adirondacks* (1870); *Eagle Pine; or, Sketches of a New York Frontier Village* (1871); and one learned work, *A Digest of Taxation in the United States* (1863).

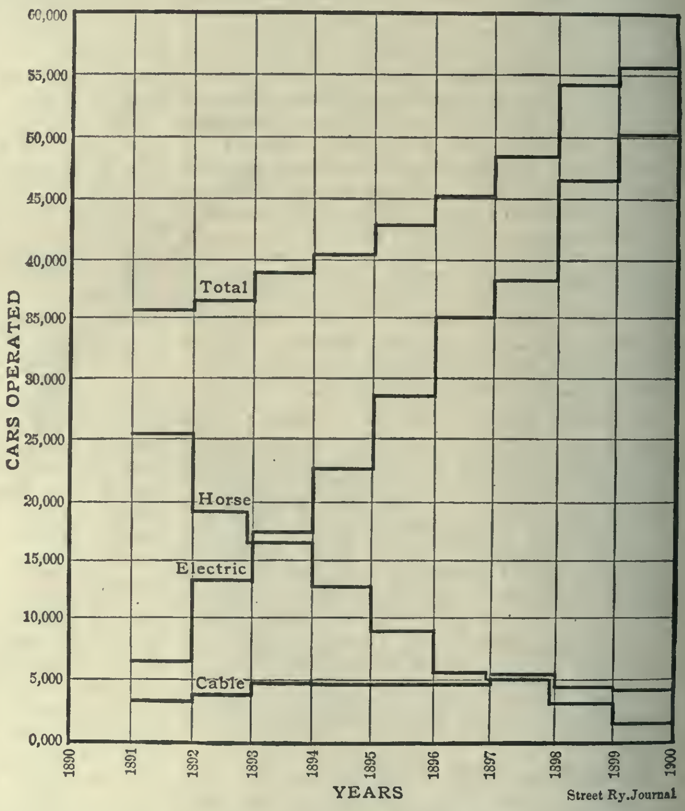
STREET, GEORGE EDMUND (1824-81). An English architect. He studied under Gilbert Scott, from whom he got his partiality for the Gothic style and his talent in restoring mediæval monuments. Among his principal buildings are the theological college at Cuddesden, and the churches of Saint Philip and Saint James, at Oxford, of Saint Margaret, at Liverpool, and many well-designed minor churches. Among his restorations are the cathedrals of York, Bristol, and Carlisle, Jesus College Chapel, Oxford, and Wantage church. Among his writings are *The Brick and Marble Architecture of North Italy in the Middle Ages* (1855), and *Gothic Architecture in Spain* (1865), which are classics in their fields.

STREET RAILWAY. A railway laid upon the public streets of a city or a town, and intended principally for the transportation of passengers. The street railway had its origin in the early tramways of Great Britain (see RAILWAYS), and such roads are still denominated *tramways* in all European countries. The street railway for passenger traffic is, however, distinctly an American development, and the modern passenger tramways of Europe owe their inception to the United States. A street railway was operated in New York City in 1831-32, on which a horse car, much like an old English stage coach in construction, ran from Prince Street on the Bowery to Yorkville and Harlem, following for some distance the route now occupied by the Fourth Avenue Railway, which still operates under the original charter granted in 1831. The road was known as the New York and Harlem Railroad, and it continued in operation as a horse-car line until 1837, when it was temporarily changed to a steam-car line. In 1845 the operation of the horse cars on the railway line was resumed, and it remained the only horse-car line in New York until 1852, when charters were granted for the Second, Third, Sixth, and Eighth Avenue lines. Street railways were first built in Boston, Mass., in 1856. Philadelphia, Pa., had its first line in 1857. The street railway was introduced into England in 1860 through the efforts of George Francis Train, the first line being started in Birkenhead opposite Liverpool. Roads were laid in Liverpool in 1868, in London in 1869-71, and afterwards in Glasgow, Edinburgh, and Dublin. A recent authority (Dumont, *Automobiles Sur Rails*, 1898) says that the first horse tramway in France was built in 1856 on a line extending from Paris to Saint-Cloud, and was called the 'American' railway; but that the first horse-car line in Paris itself was not built until 1875. Street railway enterprises began to be taken up by the South American countries in 1866.

The street railway rail of 1832 was a wrought-iron bar about 5 inches wide, with a groove from 1¾ inches to 2¼ inches wide and from 1 inch to 1½ inches deep, for the wheel flange. The wide and deep groove in this rail gave trouble by catching the wheel tires of ordinary vehicles and wrenching them. To remedy this fault the step rail was adopted. This consisted of a flat bar having a flat surface from 3 inches to 5 inches wide flanked by a ridge or tread about 1 inch high and 1¾ inches wide. This form of rail came into extensive use, especially in America. Another form of step rail had the tread in the centre flanked by a flat surface on each side. The next development was a return to the grooved rail, but with the groove wedge-shaped and narrow. These early forms of rails were simply iron bars spiked to the tops of longitudinal timbers. This timber was replaced by metal longitudinals, chairs, and supports of various sorts as experience suggested improvements, until finally the attempt of trying to maintain the tread or wearing surface of the rail separate from the supporting body was abandoned and the modern girder rail was originated. The girder rail consists of a base and web like the ordinary T-rail for railways, but has a wide grooved head. With the advent of the girder rail the former difficulty of insecure and uneven joints was largely decreased and at the same time a rail was developed which gave the necessary stiffness for carrying the rapidly increasing weights of cars which were made possible by the development of mechanical propulsion. The construction of modern street railway tracks is more fully described in the article on ELECTRIC RAILWAYS.

The success of the first street railways established, inventors and engineers turned their attention to devising means of mechanical propulsion. These various methods fall into seven classes as follows: Traction by steam motors, by compressed air, by gas motors, by carbonic acid engines, by ammonia engines, by cables, and by electricity. Steam, gas, compressed air, and vapor motors have been employed in comparatively isolated instances and under special conditions, although they have been the subject of considerable experimentation and are to be met with occasionally in Europe and to a less extent in the United States. The only systems of mechanical propulsion which have attained extended use in America (leaving elevated railways out of account) are cable power and electric motors. The development of electric propulsion for street cars is described in the article on Electric Railways.

Cable Railways for city passenger service had their origin in San Francisco, and it was at first thought that the system was only applicable to straight lines with heavy grades in favorable climates, but this view was changed when cable traction was established in Chicago on level lines with sharp and difficult curves and was operated despite snow and other climatic disadvantages. As a result an enormous impetus was given to the construction of cable railways in America and such lines were built in a score or more of American cities. In 1886 the Tenth Avenue and 125th Street cable road was put in operation in New York City, and several years later this was followed by the Third Avenue line, 12 miles long, and the Broadway and Lexington Avenue lines. In 1891 there were 70 cable street railway lines in operation in the United States, with an aggregate mileage of 577½ miles. The new construction and extension of the next two or three years increased this total to about 700 miles, which marked the height of the cable railway in America. Since that time the mileage has steadily decreased under the competition of electric traction, until in 1900 there were but 300 miles of cable railway in operation in the United States.



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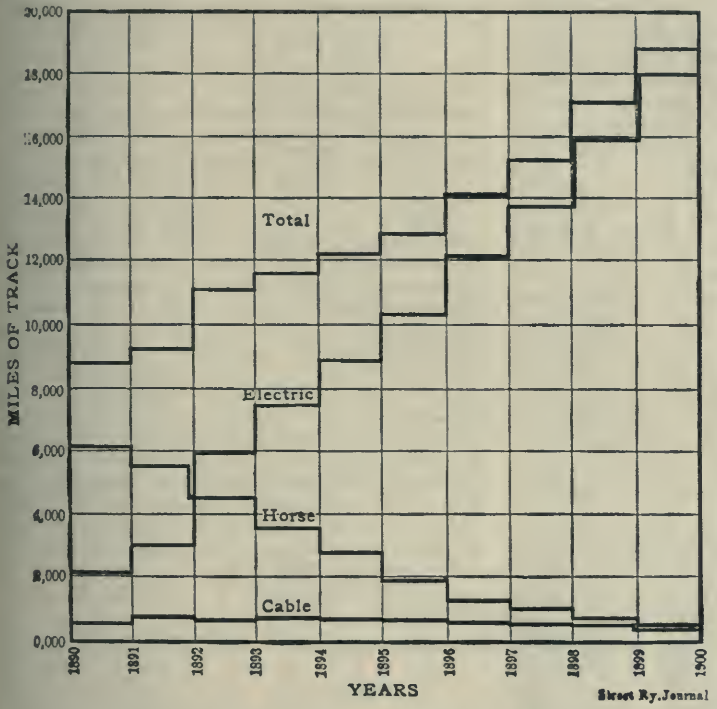
In construction the cable railway consists of a standard street railway track having an underground conduit between the rails. In this conduit there runs an endless wire rope cable guided by suitable pulleys. A slot at the top of the conduit permits a grip projecting downward from the bottom of the car to enter the conduit. This grip is provided at its lower end with jaws which can be so operated from the platforms of the car as to grasp and unloose the cable at will. Generally in modern practice duplicate cables are installed in the conduit, the purpose of which is to have a second cable ready for operation in case of breakage or other accident. Movement is given to the cable by means of a revolving drum around which the cable is wrapped, these drums being operated by powerful steam engines installed in power houses located at intervals along the line. Generally speaking, it is not desirable to operate a greater length of cable than 25,000 feet, but cables as long as 39,000 feet have been successfully operated. The prevalence of curves is perhaps the most important factor determining the length of cable which can be operated. As a general rule it is found that a right angle curve puts a strain upon the cable plant equal to that entailed upon it by 1000 feet of straight road. It may be assumed that from 40 per cent. to 60 per cent. of the power used in operating a cable railway is consumed in operating the cable itself. The size of cable most generally used is 1¼ inches, and the material favored is crucible steel. The life of street railway cables averages about fourteen months, giving from 70,000 to 80,000 miles of service, but there are records of cables having given 144,000 miles of service. In a few cases, of which the New York and Brooklyn Bridge is notable, the cable is not inclosed in a conduit, but is carried on pulleys above ground or on an elevated structure.

In respect to street railway transportation generally the most notable facts are the enormous growth of street railways in mileage and capital invested, and the predominant position held by electric traction for street railway operation. Both of these facts are graphically illustrated in the accompanying diagrams compiled by the *Street Railway Journal.* In the ten years between 1890 and 1900 the street railway mileage of the United States more than doubled; the mileage of cable railways decreased about one-half; the mileage of horse railways decreased from over 6000 miles to 370 miles; and the mileage of electric railways increased from about 2000 miles to over 19,000 miles. A similar course of development has been recorded in the tramway systems of England and Continental Europe, although the totals do not reach the aggregates recorded for the United States. For a condensed statement of the development of electric railways in the countries outside of the United States and Canada, see ELECTRIC RAILWAYS.



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STREET RAILWAY EMPLOYEES, AMALGAMATED ASSOCIATION OF. See RAILWAY BROTHERHOODS.

STREITBERG, strīt′bĕrk, WILHELM (1864—). A German philologist, born in Rüdesheim, and educated in Leipzig, where he became docent in 1889. In the same year he was appointed professor of Indo-Germanic philology at Freiburg, a chair which he left in 1899 for a professorship in Sanskrit and comparative philology at Münster. In comparative grammar he ranks close to Osthoff and to Brugmann. In 1892 he became editor of the *Anzeiger für indogermanische Sprach- und Altertumskunde*, the annual bibliography of the *Indogermanische Forschungen*, and of a series, entitled *Germanische Elementarbücher*, in 1896, in which he wrote "Urgermanische Grammatik" (1896, revised 1903), and "Gotisches Elementarbuch" (1897). His earlier works on Germanics are *Die germanischen Komparative auf -oz-* (1890); *Zur germanischen Sprachgeschichte* (1892); and *Entstehung der Dehnstufe* (1894).

STRELITZ, strā′lĭts. A town in the Grand Duchy of Mecklenburg-Strelitz, about two miles south of Neustrelitz. It was formerly the capital of the country. It has some manufactures. Population, in 1900, 4165.

STREL′TSI, STRELTZI, or **STREL′ITZ.** The Russian Imperial guard, organized by Ivan IV. in the second half of the sixteenth century. At that time, and for long afterwards, they were the only standing force in Russia, and at times amounted to between 40,000 and 50,000 men. They were stationed at Moscow in time of peace, in a quarter of the capital which was set apart for them, and enjoyed special privileges. Incessant conspiracies rendered them in time dangerous. In 1698 a revolt of the Streltsi led to a bloody contest in which they were defeated with great loss. Peter the Great finally suppressed them (1705).

STREMAYR, strā′mīr, KARL VON (1823—). An Austrian statesman, born at Gratz, where he also studied law, entered the Government service, and subsequently was Attorney-General and docent at the university. In 1868 he was appointed councilor in the Ministry of the Interior and in 1870-79 was Minister of Public Instruction, when he brought about the repeal of the concordat of 1855. President of the Council after the going out of Auersperg Ministry in 1879, he entered the Cabinet of Count Taaffe as Minister of Justice, but resigned in 1880, was appointed vice-president and, after Schmerling's resignation in 1891, president of the Supreme Court, from which post he retired in 1899. He was called to a seat in the House of Lords in 1889.

STRENGTH OF MATERIALS. A term which may be defined as the resistance which materials offer against deformation. Every load produces in the structure an internal resistance which balances it, and this internal resistance is called a *stress.* Three kinds of direct stress may be produced by load, viz. a stress tending to pull apart, or *tensile stress;* a stress tending to push together, or *compressive stress;* and a stress tending to slide on parallel planes, or *shearing stress.* Complex stresses such as flexure and torsion are capable of being resolved into tension, compression, and shearing stresses. A *unit stress* is the stress per unit of area; the unit of area is the square inch in English-speaking countries and the square centimeter in countries where the metric system of measures prevails. In all cases of direct stress the total stress is supposed to be uniformly distributed over the area of the cross-section. When a tensile or compressive force is applied to a bar of metal it elongates or is shortened, and up to a certain limit the elongation or shortening is proportional to the load. Beyond this limit the elongation or shortening increases more rapidly than the load. The unit stress at which the deformations begin to increase in a faster ratio than the stress is called the *elastic limit,* or less commonly the elastic strength. When the unit stress in a bar is less than the elastic limit, the bar returns, when the stress is removed, to its original dimensions. When, however, the unit stress is greater than the elastic limit, the bar does not fully return to its original dimensions, but a permanent distortion remains. Therefore, if a material is strained beyond its elastic limit, a permanent injury results to its elastic properties; and for this reason it is the universal practice in designing engineering structures to make certain that the unit stresses never exceed the elastic limit of the material. When a material is under a stress exceeding its elastic limit it is usually in an unsafe condition. If the stress be increased the deformation rapidly increases until finally the material ruptures.

The unit stress which occurs just before rupture takes place is called the *ultimate strength* of the material. The ultimate strengths of materials are from two to four times as great as their elastic limits. The strength of materials is determined by straining a piece of the material to rupture and observing the elastic limit, ultimate strength, and other coördinate phenomena.

Tension. In testing a material under tension a 'test piece' or 'test specimen,' usually eight inches long and one square inch in section, is broken by direct pull. The loads are gradually applied. At first each increment of load produces a proportionate increment of elongation, but after the load has reached a certain amount the elongation begins to increase more rapidly than the load. The unit load recorded just as this change in the rate of deformation takes place is the elastic strength or the elastic limit of the material. As the load continues to increase the elongation increases more rapidly than the load and is commonly accompanied by a reduction in area of the cross-section of the test piece. Finally the test piece breaks and its ultimate strength is recorded. Record is also taken of the total elongation of the piece and of the total reduction of area. These last two records are indices of the ductility of the material. The usual records of a tensile test of materials consist, therefore, of figures showing the elastic limit, the ultimate strength, the percentage of elongation, and, often, the percentage of reduction of area. These values vary greatly for different kinds of materials and considerably for different qualities of the same material. In printing figures for illustration, therefore, the best that can be done is to select rough average values. The following figures are taken from Prof. Mansfield Merriman's *The Strength of Materials* (New York, 1897), which will be found an excellent discussion of the subject for the non-technical reader:

MATERIAL	Elastic limit, lbs. per sq. inch.	Ultimate strength, lbs. per sq. inch.	Ultimate elongation, per cent.
Timber	3,000	10,000	1.5
Cast iron	6,000	20,000	0.5
Wrought iron	25,000	55,000	20.
Steel	50,000	100,000	10.

Compression. In testing for compressive strength the test piece used is short and thick, a cube and a short cylinder being the common forms of test pieces. The phenomena which occur are substantially as in tension, first a distortion proportional to the load until the elastic limit is reached, and then a distortion increasing more rapidly than the load increases until rupture occurs. The manner in which rupture occurs is quite different from the manner in which it occurs in tension. In tension the material draws down to a smaller diameter and finally parts by a more or less ragged fracture at approximately right angles to the direction of the pull; in compression the test piece first bulges to an increased diameter and then ruptures with a fracture oblique to the direction of the pressure. This method of fracture occurs only when the test piece is thick compared with its height; when the height is great compared with the thickness lateral flexure or bending occurs and the conditions of rupture are no longer those of simple compression, as it is explained in the succeeding paragraph on the strength of columns. As was the case with tension, only rough average figures of comparative strength can be given, owing to the fact that this strength varies for different materials and with different qualities of the same material. The following figures are quoted from the work of Professor Merriman which is named above:

MATERIAL	Elastic limit, lbs. per sq. inch	Ultimate strength, lbs. per sq. inch
Timber	3,000	8,000
Stone	——	6,000
Cast iron	20,000	90,000
Wrought iron	25,000	55,000
Steel	50,000	150,000

Shear. Shear is the stress produced by two parallel forces acting on the material in opposite directions, as, for example, do the blades of a pair of shears. If a weight be suspended by a bar which is composed of two shorter bars connected at one end by a rivet or bolt passing through them, the stress brought upon the rivet is a shearing stress. The same stress is exerted by a punching machine in punching holes in metal plates. The shearing strength of materials often differs according to the direction in which the shearing forces are exerted. Thus the shearing strength of timber is much less along the grain than at right angles to the grain. The following figures taken from Professor Merriman's book named above give the average ultimate shearing strengths of the more common structural materials:

MATERIAL	Pounds per sq. inch
Timber, longitudinal	600
Timber, transverse	3,000
Cast iron	20,000
Wrought iron	50,000
Steel	70,000

ACTUAL VALUES. The figures given in the preceding tabular statements show rough average values, useful chiefly to be memorized as a basis for approximation. In careful designing the engineer requires actual values as determined by authoritative tests upon the particular material he is using or proposes to use. These values vary within quite narrow limits for each kind or quality of any material and within broader limits for all kinds and qualities of the same material. The ultimate average strengths of six of the most common structural timbers are as follows:

TIMBER	Pounds per square inch	
	Tensile strength	Compressive strength
Hemlock	8,000	5,000
White pine	8,000	5,500
Chestnut	12,000	5,000
Red oak	9,000	6,000
Yellow pine	15,000	9,000
White oak	12,000	8,000

These values have been obtained by testing small pieces. Timbers of large size such as are actually used in engineering structures will fall from 20 per cent. to 50 per cent. below these values in strength. These values are also subject to a variation of about 25 per cent. according to time of cutting, place of growth, and methods of seasoning. The shearing strength of timber is more variable than either the tensile or the compressive strength. The values average about as follows:

TIMBER	Pounds per square inch	
	Along the grain	Across the grain
White pine	500	2,500
Chestnut	600	1,500
Yellow pine and oak	600	4,000

The elastic limit of timber is not well defined; it varies from one-third to one-half the ultimate strength in tension. The elongation at the point of rupture in tension is from 1 per cent. to 2 per cent. Tensile and shearing tests of brick are seldom made, but the compressive strength varies from 500 pounds per square inch for soft brick to 10.000 pounds for pressed brick, and to 15,000 pounds for the best qualities of hard burned paving brick. The crushing strengths of the principal building stones of the United States are about as follows:

STONE	Pounds per square inch	
	Minimum	Maximum
Trap rock	20,000	24,000
Granite	12,000	21,000
Marble	8,000	20,000
Limestone	7,000	20,000
Sandstone	5,000	15,000

Cast iron is so variable in quality that similar specimens will vary from 10 per cent. to 20 per cent. in strength. Fair average values are 20,000 pounds per square inch in tension and 90,000 pounds per square inch in compression. The elastic limit is poorly defined and the elongation is practically nil, indicating clearly the fact, known to every one familiar with this material, that it is a hard and brittle substance. A direct contrast to cast iron is afforded by wrought iron with a tensile and a compressive strength nearly equal and ranging between 50,000 and 60,000 pounds per square inch, and with an elongation of 20 per cent. to 30 per cent. and an elastic limit well defined at about 25,000 pounds.

Steel is manufactured in a variety of grades distinguished by the relative amounts of contained carbon, as mild steel, medium steel, hard steel, and extra hard steel. Ordinary structural steel for bridge and building construction has an ultimate tensile strength of from 60,000 pounds to 70,000 pounds per square inch and an elastic limit of from 30,000 pounds to 40,000 pounds per square inch. Nickel-steel, or steel containing a small percentage of nickel, has been made with a tensile strength of 277,000 pounds per square inch and an elastic limit of 100,000 pounds per square inch. The compressive strength of steel is always greater than its tensile strength. The maximum compressive strength recorded for hardened steel is 392,000 pounds or 196 tons per square inch.

The tensile strengths of some of the other more common metals are about as follows:

MATERIAL	Pounds per sq. inch
Brass, cast	23,500
Brass wire	49,000
Copper, cast	24,000
Copper wire	60,000
Gold, cast	20,000
Gold, wire	27,500
Lead, cast	2,050
Lead wire	1,650
Platinum wire	56,000
Aluminum	25,000

Common mortar composed of one part lime and five parts sand has a tensile strength of from 15 to 30 pounds and a compressive strength of from 150 to 300 pounds per square inch at the age of six months. Natural hydraulic cement will test from 100 to 200 pounds per square inch in tension when one month old, and Portland cement will test from 600 to 800 pounds per square inch at the same age. Mortars and pastes of cement and lime increase in strength with age. For a concise statement of strengths of a great variety of other materials, see Trautwine, *Engineers' Pocket Book* (New York, 1900).

WORKING STRESSES. The loads carried by a structure should never strain the material to an amount at all close to its ultimate strength. Were they to do so the elastic limit of the material would be exceeded and distortion would ensue even though ultimate rupture did not occur. Therefore, in designing a structure a unit stress is adopted which is certain not to cause distortion or rupture, and the size of each member is determined by dividing this unit stress into the total load on the member. This assumed unit stress is called the working stress, and it varies for any material according to the character of the load it is to support. Thus the safe working stress for a varying load is less than for a steady load, and that for a sudden load or shock is less than for a varying load; a load producing tension and compression alternately requires the use of a smaller working stress than does a steady load or a varying load in tension only. In all cases the working stress must be less than the elastic limit of the material. It has long been the practice to call the ratio of the ultimate strength to the working stress *the factor of safety.* The factors of safety commonly employed for different materials and for different forms of load are given by Professor Merriman as follows:

MATERIAL	For steady stress (buildings)	For varying stress (bridges)	For shocks (machinery)
Timber...............	8	10	15
Brick and stone..........	15	25	35
Cast iron.....................	6	15	20
Wrought iron.............	4	6	10
Steel............................	5	7	15

Resilience. One of the most important properties of a material is its capacity to resist the work of external forces, or its resilience. If a bar is placed in a testing machine and pulled by a force gradually increasing from 0 to F, and this pull produces an elongation equal to *e*, the work done on the bar is the product of the average pull into the elongation, or one-half F*e*. Since the internal stresses in the bar resist the work done by the external force, they must also perform an amount of work represented by one-half F*e*, and the measure of resilience of a material is the product of the average force exerted upon it multiplied by the elongation which this force produces. Elastic resilience is that internal work which has been performed when the internal stress reaches the elastic limit; ultimate resilience is that internal work which has been performed when the material is replaced. Resilience, like work (see Work), is measured in foot pounds, or, more commonly, in inch pounds. The higher the resilience of a material is the greater is its capacity to resist the work of external forces. Cast iron has very low resilience and wrought iron and steel have high resilience.

Bending Stress. When a beam is loaded it is bent from its original form and takes a curved shape. The fibres on one side of a loaded beam are, therefore, shortened or compressed and the fibres on the opposite side are lengthened or subjected to tension. Midway between the two sides where compression ends and tension begins there are fibres which are neither shortened nor lengthened, and this layer or surface of fibres is called the neutral surface. A simple beam is a bar resting upon supports at its ends and is the kind most commonly in use. A cantilever beam is a bar resting on one support at the middle, or if a part of a beam projects out from a wall or beyond a support it is called a cantilever beam. In a simple beam the lower part is under tension and the upper part is under compression; in a cantilever beam the reverse is the case. Beams almost universally fail by tearing apart under the horizontal tensile stress developed by bending. Mathematicians have calculated formulas for determining the resilience of beams to bending, the safe loads to be put on beams, etc., but a consideration of these is a matter of some intricacy and the reader is referred to the books mentioned at the close of this article for such information. From these studies, however, the following important laws regarding rectangular beams have been formulated: The strength varies directly as the breadth and directly as the square of the depth; the strength varies inversely as the length; a beam is twice as strong under a distributed load as under an equal concentrated load.

Strength of Columns. A bar under compression whose length is greater than about ten times its thickness is called a column. Columns generally fail under stresses produced by combined compression and bending. The phenomena are very complex and their investigation is a problem of great intricacy, for whose solution the reader must consult special treatises on the subjects. Columns are of three kinds: Class *a* includes those with hinged ends; class *b* includes those with one end hinged and one end fixed (the piston rod of a steam engine is a column of this type); class *c* includes those having both ends fixed, these being used in bridge and building construction. It has been found by experiment that class *c* is stronger than class *b* and that class *b* is stronger than class *a*.

Torsion. Torsion is that kind of stress which occurs when external forces tend to twist a body round an axis. A shaft which transmits power is twisted by the forces applied to the pulleys and thus all its cross-sections are brought into stress. This stress is a kind of shearing, but the forces acting in different parts of a section are not parallel. Special formulas have been developed by engineers for calculating strength against torsional stress.

Bibliography. Besides the work of Professor Merriman which has been mentioned, the reader may consult to advantage the following works: Johnson, *The Materials of Construction* (New York, 1897); Thurston, *Materials of Engineering* (ib., 1883); Unwin, *The Testing of Materials of Construction* (ib., 1899); Mehrtens, *Testing of Materials* (ib., 1901).

STRE'PHON. In Sidney's *Arcadia*, a shepherd in love with Mania. In literature, a stock name for a lover.

STREPSIP'TERA (Neo-Lat., from Gk. *στρέψαι*, *strepsai*, aor. of *στρέφέιν*, *strephein*, to twist + *πτερόν*, *pteron*, wing). A group of insects of rather uncertain rank and position, comprising the curious family Stylopidæ, and now thought to fall in the Coleoptera. The group consists of a small number of species, very singular in structure and habits, apparently forming a connecting link between Coleoptera and Hymenoptera. The species are all small, and in their larval state live parasitically in the bodies of bees, wasps, and certain Hemiptera, forming the genera Stylops, Colacina, and Xenos. The first infests bees of the genus Andrena, and Xenos occurs in a genus of wasps (Polistes). Bees that are carrying or have carried Strepsiptera are said to be 'stylopized,' because the abdomen of the bee is deformed. These parasites do not cause the death of the host. When about ready to transform the larva pushes one end of the body out between two of the abdominal segments of its host. The metamorphosis of the female is very slight, while that of the male is complete. The male leads a short and extremely active life of a few hours only, or in some species of a day. The female never changes position and becomes little more than a sac filled with an enormous number of developing young. When the young emerge they are known as 'triungulins.' How the triungulins find their way to the bee-larvæ is not known. It is supposed by some writers that parthenogenesis occurs with the Strepsiptera, but there appears to be no definite proof. The Strepsiptera are also sometimes called Riphiptera.

STREPTOCOCCUS. See BACTERIA; SEPTICÆMIA; PYÆMIA.

STRET'FORD. A manufacturing town in Lancashire, England, 3½ miles southwest of Manchester. Population, in 1891, 21,756; in 1901, 30,346.

STRET'TO (It., bound). In music, a term which signifies that the movement to which it is prefixed is to be performed rapidly, with a gradual acceleration toward the close. The term *stretto* is also applied to the finale of a fugue, where the subject and answer enter so closely together that they overlap. See FUGUE.

STRICK'LAND, AGNES (1796-1874). An English historian, daughter of Thomas Strickland, of Reydon Hall, near Southwold, in Suffolk, born in London. She was educated mostly at home under the direction of her father. After writing considerable verse and several historical tales for children, Miss Strickland planned a series of biographies of the Queens of England. In this undertaking she was much helped by her sister Elizabeth (1794-1875). *The Lives of the Queens of England* appeared in sections between 1840 and 1848, and filled twelve volumes (revised edition, 6 vols., 1864-65). Meanwhile, besides much miscellaneous work, Miss Strickland published *Letters of Mary Queen of Scots* (1842-43; complete ed., 5 vols., 1864); *Lives of the Queens of Scotland* (1850-59); *Bachelor Kings of England* (1861); and *Lives of the Last Four Stuart Princesses* (1872). Consult the *Life* by her sister Jane M. Strickland (Edinburgh, 1887), and *Pearls and Pebbles*, by another sister, Mrs. Catherine P. Traill (London, 1894).

STRICKLAND, HUGH EDWIN (1811-53). An English geologist. He studied at Oxford, and in 1850 became reader in geology at that university, succeeding Dr. Buckland, and retaining the post till his death. He was one of the founders of the Geological Society, and of the Ray Society, which on account of his representations undertook the publication of Agassiz's *Bibliographia Zoologiæ et Geologiæ*, three volumes of which he edited. He was associated with Sir Roderick O. Murchison in the recognition and study of the Silurian system.

STRICT CONSTRUCTIONISTS. A term in American politics applied to those who, for various reasons, have maintained that the Federal Constitution should be construed strictly in accordance with its letter, as opposed to those, known as 'broad constructionists,' who have believed that the Constitution should be construed liberally, and have claimed for the General Government more or less extensive powers, called 'indirect powers' or 'implied powers,' not granted specifically by the Fundamental Law. Conflicts between the adherents of the two views have recurred frequently in the history of the United States, e.g. in the controversies over the chartering of a United States Bank, over the question of 'internal improvements,' and over the power of the General Government with regard to the restriction or prohibition of slavery in the Territories; and it is upon this question that, directly or indirectly, party differences in the United States have been largely based. In general, it may be said that the strict constructionist view has been held, more or less consistently, by the Anti-Federalist and Democratic parties (qq.v.); and the broad constructionist view, more or less consistently, by the Federalist, National Republican, Whig, Free-Soil, and Republican parties (qq.v.); though there has been a tendency for the party in power, irrespective of its platform, to lean to the side of broad or liberal construction, and for the party in opposition, also irrespective of its platform, to lean to the side of strict construction. A broad constructionist policy has always had for its effect the strengthening of the Central Government as compared with the States; and a strict constructionist policy the strengthening of the States as compared with the Central Government. See CONSTITUTION; UNITED STATES, section on *History*.

STRICTURE (Lat. *strictura*, from *stringere*, to draw tight). A contraction in the calibre of one of the mucous-membrane-lined tubular structures of the body, such as the urethra, the rectum, the œsophagus, or the larynx. The most common form of stricture and the variety generally referred to when the term stricture is used alone is stricture of the urethra. Three varieties of stricture of the urethral canal are recognized: (1) spasmodic; (2) inflammatory; and (3) organic. The first form is due simply to reflex muscular contraction caused by irritation of some portion of the urethra, as from an ulcerating spot or a sensitive organic stricture. The second form is due to simple inflammatory swelling of some portion of the urethral tract, such as occurs in acute gonorrhœa or after the internal administration of such drugs as cantharides and turpentine. The third, and by far the most frequent and important variety of stricture, is caused by permanent changes in the tissues of the urethra and those surrounding it. These changes usually consist either in inflammatory thickening of the urethral wall and periurethral tissues or else in actual cicatrization and narrowing of the channel from the accompanying contraction; or both of these conditions may be present at the same time. The initial causes in bringing these changes about are chronic inflammation (*gonorrhœa*) or injuries by caustic or irritant substances.

The results of stricture of the urethra if allowed to persist are often far-reaching and disastrous. The bladder, ureters, and kidneys may finally in turn become the seat of disease from the continued retention of urine unable to find free and regular exit through the natural outlet, or rupture of the urethra from prolonged retention, allowing extravasation of urine into the surrounding tissues, with death resulting from uræmic poisoning.

The treatment of organic stricture of the urethra is mainly mechanical. It consists in dilatation of the contracted area by means of sounds or bougies, and where this method is inapplicable divulsion of the stricture by means of suitable cutting instruments is indicated. After division of the stricture the lumen of the urethra is kept open to the proper degree by the subsequent periodic passage of a sound. Consult Dennis, *American Text-Book of Surgery* (Philadelphia, 1892).

STRIEGAU, strē'gou. A town in the Province of Silesia, Prussia, 25 miles by rail southeast of Liegnitz (Map: Germany, G 3). Leather products, cigars, sugar, brushes, and whips are the principal manufactures. Basalt and granite are mined in the vicinity. Population, in 1900, 12,858.

STRIGEL, strē′gel, BERNHARD (c.1460-1528). A German painter of the Swabian school, born at Memmingen and probably a pupil of Zeitblom at Ulm. He stood in high favor with the Emperor Maximilian I., in whose service he repeatedly journeyed to Augsburg, Innsbruck, and Vienna. His religious paintings, of which there are four interesting altar wings (1515) in the Berlin Museum and a Pietà, besides three others, in the Karlsruhe Gallery, do not quite equal his portraits, notable specimens of which are that of the Augsburg patrician Konrad Rehlinger (1517), in the Pinakothek, Munich; "Councilor Cuspinian and Family" (1520), in the Berlin Museum; and "Emperor Maximilian with Family" and "King Louis II. of Hungary" (1524), both in the Vienna Museum.

STRIGEL, VIKTORIN (1524-69). A theologian of the Reformation period. He was born at Kaufbeuren, Swabia, studied under Melanchthon in Wittenberg, and became professor at Jena in 1548. He became involved in the synergistic controversy (see SYNERGISM) and was imprisoned for several months in 1559. Ultimately he was forced to leave Jena, and went to Leipzig (1562), and later to Heidelberg (1567). Here he was charged with holding Calvinistic views. His chief work was the *Loci Theologici*, published posthumously (1581-84). Consult: Otto, *De Victorino Strigelio* (Jena, 1843); Döllinger, *Die Reformation*, vol. iii. (Regensburg, 1848).

STRIKE (AS. *strīcan*, to advance quickly, OHG, *strīhhan*, Ger. *streichen*, to stroke, Goth. *striks*, stroke; connected with Lat. *stringere*, to draw tight, Gk. *στραγγάλη*, *strangalē*, halter, *στραγγός*, *strangos*, twisted). A term used in geology to indicate the line of intersection of a stratum with the plane of the horizon, the strike thus being at right angles to the dip. The line of strike coincides with the outcrop when the surface of the ground is level, or when the dip is vertical. If the dip is constant in one direction, the strike will be a straight line; but with a gradually changing dip, as from south through southeast to east, the strike will be a curve. In the case of a quaquaversal fold it is a complete circle. The strike is usually measured by placing the compass so that the north and south line is at right angles to the dip and then reading the number of degrees from the north pole of the needle to the north and south line; a strike of N. 45° E. thus means 45° east of north or northeast. See DIP.

STRIKES and **LOCKOUTS**. A strike, in industry, occurs when there is a cessation of work on the part of a body of employees acting in concert to enforce some demand upon the employer, or to resist some demand which the employer has made. The employees are here assumed to take the initiative in ceasing work. When, on the other hand, the employer shuts down his establishment in order to compel workmen to comply with some demand, the suspension is called a lockout. It is not always easy to distinguish the two in practice, especially as an employer may not infrequently lock out his men in anticipation of, or on threat of, a strike.

Certain popular movements in the Middle Ages bear resemblance to strikes, such as the disturbances in England in the second half of the fourteenth century. More like the modern strikes were the contests between different guild organizations, or between journeymen and guildsmen, in both English and Continental towns. But as a social problem, as a frequent and apparently enduring feature of the industrial system, strikes belong to the nineteenth century. The strike has usually been an essential part of the policy of trade unions (q.v.). Misused though the strike has sometimes been, the existence of the union as its directing and controlling agency has been the chief means in transforming local, half-insurrectionary outbreaks into carefully planned attempts to attain well-recognized ends.

The detailed causes of strikes are manifold, but the chief causes concern the wages question. In prosperous times strikes are likely to be made for increase of wages; in times of depression, against a decrease. Demand for a reduction of hours is a relatively frequent cause. Also of importance are strikes for the enforcement of union rules of work, for recognition of the union against the employment of non-union men, and in sympathy with strikes in other trades. The strike is often the first weapon employed by a newly organized body of laborers to strengthen their position. Laborers have sometimes complained that they were forced into a strike by their union, and an unsuccessful strike often results in the dissolution of a local union or in the decay of a larger body. The sympathetic strike has not generally proved advisable, and is regarded with disfavor by the best unions. To avoid or put down strikes employers may form organizations or use the lockout. They have at times been accused of instigating violence in order to bring the strike into public disfavor and obtain the aid of troops. On the employees' side boycotting and 'picketing' of all sorts are likely to occur in a serious strike. The bitter feeling against men who refuse to strike or who come to take strikers' places often makes the more peaceable forms of persuasion end in intimidation or violence. Public sympathy is an almost essential element in the success of any large strike, and is likely to be alienated by violence or the destruction of property. This is well realized by the better trade unions, but when disorder or riots occur—often due to a semi-criminal floating population—the public may probably fail to lay the blame elsewhere than on the strikers. The magnitude of some recent strikes in important industries has emphasized the harm done to general business, and the interest which the public has in labor disputes as a third and impartial party. Conciliation and arbitration have come prominently forward as remedies for strikes. In 1888 a Federal law provided for the appointment by the President of strike commissioners in disputes involving inter-State commerce, and the Chicago Strike Commission recommended a permanent commission on the subject. The improved organization of trade unions, their increased responsibility, and the use of the trade agreement may lessen the waste of strikes in the future.

LEGAL ASPECT. Any combination of laborers to raise wages was illegal in England until 1824, and in France until 1864. In the United States strikes as such have never been illegal, but until after 1830 it was not definitely settled that strikers could not be arraigned for civil and criminal damages under the conspiracy laws. When a strike represents a combination to injure property or a definite person it is illegal, and the same is true of acts of intimidation, the destruction of property, or the forcible prevention of work. Some forms of sympathetic strikes and of the boycott have been held illegal. Riots are covered by the criminal law. In many States there are special statutes regarding strikes. Thus the common law of conspiracy has been expressly repealed in New York, Pennsylvania, New Jersey, and several Western States, but the statutes usually provide for punishment of the use of force or intimidation. Certain States have special laws regulating strikes on railways or in mines, a few make the municipality or county responsible for damages due to strikes, while Missouri and Wyoming forbid the employment of private officers from without the State for the protection of the employer's property against violence on the part of the strikers. The use of injunctions has been regulated by statute only in Kansas. A difficult question is often involved in determining how far workmen may go in persuading others to join a strike. A leading case is that of the Northern Pacific Railroad (Arthur *vs.* Oakes, 63 F. R., 310), in which the employees were enjoined from (1) intimidating, (2) persuading others to strike, or (3) combining to strike themselves in such manner as to cripple the railroad. On appeal, however, the second and third clauses were abolished. Since the passage of the Inter-State Commerce Act (1887) and the Anti-Trust Law (1890), the courts of equity have acquired enlarged powers. Interference with the United States mails or with inter-State commerce (in railroad strikes) may be a serious offense. The United States can obtain an injunction against strikers, who, if they violate its provisions, may be summarily punished for contempt of court. In cases where railroads are under receivers the receiver is regarded as an official of the court, and a strike against the road may be as such unlawful. The use of injunctions in labor disputes is by no means new, but was brought into special prominence by the Chicago strike of 1894. As a method of dealing with strikes the injunction is prompt and effective, but its execution practically involves arrest without indictment and trial without jury; it implies very great power in the hands of courts; and its frequent employment, not always in the wisest way, has created much bitter feeling and distrust of courts among workingmen.

HISTORY. In the United States there are a few records of strikes previous to 1800, such as those of the journeymen bakers in New York in 1741, and of the journeymen shoemakers in Philadelphia in 1796, 1798, 1799, and 1805. Something like a modern strike occurred in New York in 1802 among the sailors. They paraded the streets and compelled others to join them, but were dispersed by constables, and their leader was punished. From 1821 to 1834 there are accounts of only a few strikes each year, the records being doubtless very incomplete. These were generally among the building trades, hatters, tailors, shoemakers, and laborers on the Chesapeake and Ohio Canal. "In 1835," says the report of the Commissioner of Labor (1901, p. 721), "strikes had become so numerous as to call forth remonstrant comments from the public press." A number of strikes for a ten-hour day occurred in the thirties, while strikes for eight hours were general in 1872-73. From 1881 to 1900, according to the Reports of the United States Department of Labor, there have been 22,793 strikes, involving 117,509 establishments and 6,105,694 employees thrown out of employment. Of the latter 90 per cent. were males. The duration of strikes varies of course within wide limits, the average for twenty years being 23.8 days. The statistics of wage loss to employees ($257,000,000) and to employers ($122,000,000) have very little significance. More than $16,000,000 was contributed by labor organizations (the figure is probably too low). Considered by States, 28 per cent. of all strikes occurred in New York, 12½ per cent. in Pennsylvania, 11.6 per cent. in Illinois, 7½ per cent. in Massachusetts, and 6 per cent. in Ohio. In New York City 5090 strikes are recorded, in Chicago 1737. Considered by industries 19½ per cent. of all strikes occurred in the building trades, 11 per cent. in coal and coke, 9 per cent. in the metal trades, 6.6 per cent. in tobacco, 5.6 per cent. in transportation. The largest strikes usually occur in mining and railroading, as is shown by the fact that of the total number of striking employees 31 per cent. were in coal and coke, 7.9 per cent. in transportation, and only 10.9 per cent. in the building trades.

Labor organizations ordered 63.46 per cent. of the total strikes, and of these 52.86 per cent. (of establishments involved) were successful, 13.6 per cent. succeeded partly, and 33.54 per cent. failed. The corresponding figures for strikes not ordered by organizations are 35.56 per cent., 9.05 per cent., and 55.39 per cent., this advantage of organization appearing for each of the twenty years. As to cause, 28.7 per cent. of the strikes were for increase of wages, 11.23 per cent. for the same with reduction of hours, 11.16 per cent. for reduction of hours, 7.17 per cent. against reduction of wages, 3.47 per cent. in sympathy with a strike elsewhere, 2.34 per cent. against employment of non-union men, and 2.35 per cent. involving recognition of the union.

Among historic American strikes have been the great strikes of 1877 on the Baltimore and Ohio, Pennsylvania, and other railroads, in which much damage to property was done and troops were called out; the telegraph operators' strike in 1883; the strike on the Gould system in 1885; the Homestead strike at the Carnegie works in 1892, the bitterest in American history and involving a sanguinary battle between Pinkerton detectives and unionists; the Chicago strike of 1894, which grew out of an effort of the newly organized American Railway Union to boycott Pullman cars in order to aid strikers at the Pullman works; the bituminous coal strike in the summer of 1894; street railway strikes in several large cities (1900-01); the steel strike (1901); and the great anthracite coal strikes of 1900 and 1902.

In England, strikes being illegal, until 1824 participants could be and were punished for conspiracy. At that date the combination laws were repealed, and since then a number of statutes have defined the legal position and rights of workmen in labor disputes. The better-developed English unions have adopted a conservative policy in regard to strikes. Employers are more accustomed to dealing on equal terms with their men than is true in the United States. The formation of unions of unskilled laborers has been accompanied by many strikes, among which the great Dock strike of 1889 attracted a remarkable amount of public sympathy and assistance. The engineering strike of 1896 roused much discussion as to the effect of unionism on English trade supremacy. In 1900 there occurred in Great Britain 648 strikes and lockouts, involving directly 135,145 employees; 202 of the disputes resulted in favor of the employees, 211 in favor of employers, and 221 were compromised. In Germany (1900) there were reported 1433 strikes, involving 122,803 workmen; 275 strikes succeeded and 505 succeeded partly. In France for the same year are recorded 1229 strikes and 432,324 strikers; 371 were wholly and 368 partly successful. In 1890 a famous strike occurred in New South Wales, beginning as a strike of the Shearers' Union against non-union men, but spreading to the railroads, and finally to nearly all industries. The report (Sydney, 1891) of the commission appointed to investigate it is one of the most valuable books upon the subject.

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STRINDBERG, strĭnd′bĕry′, AUGUST (1849—). A Swedish novelist, dramatist, and miscellaneous writer, the most prominent exponent in Swedish literature of the modern realistic tendency. He was born in Stockholm, and after some success as a dramatic author became at once more widely known through his novel *Röda rummet* (The Red Room, 1879), satirical sketches of the literary and artistic world. In the same vein was *Det nya riket* (The New Kingdom, 1882), which caused such violent discussion on the part of the reactionary journalistic faction as to induce its author to repair to foreign parts, principally Paris, Germany, and Switzerland. Since 1897 he settled again in Sweden. His other novels include Hemsöborna (The Natives of Hemsö, 1887), *Skärkarlslif* (Life on the Skerries, 1888), and *I Hafsbandet* (Sea-girt, 1890). Worthy of notice are also several collections of short stories, to wit: *Från Fjerdingen och Svartbäcken* (From Fjerdingen and Svartbäcken, 1877); *Giftas* (Marriages, 1884), treating satirically of the relation between the sexes in the present age, and which involved him in a lawsuit for alleged irreverent attacks on religious institutions; and *Utopier i verkligheten* (Utopias Realized, 1885), advocating the solution of the labor question from the socialist point of view. Of his dramas *Mäster Olof* (1872) constituted his first stage success and was followed by *Gillets hemlighet* (The Secret of the Guild, 1880), *Herr Bengt's hustru* (Mr. Bengt's Wife, 1882), *Fadren* (The Father, 1887), and *Fröken Julie* (Miss Julia, 1888). Among his other works are *Svenska folket i helg och söken* (The Swedish People in Every Walk of Life, 1882), on which was based the series of seventeen stories *Svenska öden och äfventyr* (Swedish Destinies and Adventures, 1882-90), and *Gamla Stockholm* (Old Stockholm, 1882), in collaboration with Claes Lundin. He published an autobiography entitled *Tjenstegvinnans son* (The Servantmaid's Son, 1886). Consult Hansson, *Das junge Skandinavien* (Dresden, 1891), and Brandes, *Menschen und Werke* (Frankfort, 1894).

STRING (AS. *strenge,* OHG. *strang,* Ger. *Strang,* string, either from AS. *strang,* OHG. *strengi,* Ger. *streng,* strong, or connected with Lat. *stringere,* to draw tight, Gk. *στραγγός*, *strangos,* twisted). The strings of musical instruments are made either from silk, from the entrails of sheep, or from metal. Formerly the metal strings were made of brass or copper, but now they are generally made of steel (for the pianoforte). For the string-instruments (violin, guitar) gut strings are generally used. The thinner the string the higher is the pitch. Excessive thickness for the lower strings is avoided by winding them with thin copper or silver wire. Recently strings, especially those which are overspun, have been manufactured from silk. For the violin the highest or E string is also sometimes made of silk, but its tone quality is inferior to that of a gut string. The silk strings are chiefly used by violinists for the purpose of practicing in warm weather, when the moisture of the fingers causes the gut strings to snap in a short time. See VIOLIN.

STRINGED INSTRUMENTS. See MUSICAL INSTRUMENTS.

STRINGEN′DO (It., drawing tight, compressing). A term used in music to denote a rather sudden acceleration in the time.

STRINGHALT (corruption of *spring* + *halt,* lame). A peculiar catching up of the horse's legs, usually the hind ones. It is most noticeable when the animal is first brought out of the stable, when he is excited, or made to turn suddenly round; it is a form of chorea or Saint Vitus's dance. It does not interfere with usefulness, and is difficult to treat. When due to local injury the habit may be corrected by local treatment.

STRINGHAM, strĭng′am, SILAS HORTON (1798-1876). An American naval officer, born at Middletown, N. Y. He was appointed midshipman in the navy in 1809, served on the frigate *President* in her conflict with the *Little Belt*, and in the engagement in which she was captured by a British squadron; fought in the war with Algiers, and served on the *Hornet* against the West India pirates. In 1847, as commander of the *Ohio*, he assisted in the bombardment of Vera Cruz. When the Civil War began he was made flag-officer of the North Atlantic blockading squadron, and in August, 1861, coöperated with Gen. B. F. Butler in the capture of the forts on Hatteras Inlet. In the following month he asked to be relieved of command, probably because of the criticisms that had been made against him for not following up his success. In 1862 he became a rear-admiral on the retired list.

STRIPPING (from *strip*, AS. *strypan*, Ger. *streifen*, to strip, plunder). A term used to designate the useless rock which overlies a bed of ore, coal, or building stone, and which has to be removed before the mineral or rock desired can be quarried.

STROBOSCOPE. An instrument used for studying the motion of a body where by means of a rapid succession of slits or other openings, or its illumination at regular interval the eye receives a series of images on the retina. Where these impressions occur with sufficient rapidity the illusion of motion is produced, and advantage of this is taken in certain toys and scientific instruments. In its simplest form the stroboscope, which was first devised by Stampfer and Plateau, consists of a disk or cylinder with a series of slits through which the observer looks at the pictures or moving object. As the disk or cylinder revolves the slits come successively before the eye and through them the observer gets a series of glimpses of the moving object. If each of the pictures represents a successive stage in an action such as the motion of a pendulum, a man or animal running, etc., the illusion of motion is produced, provided that the interval between the glimpses of the pictures is less than the duration of the image on the retina a time, which varies from 1-10 to 1-50 of a second. A simple stroboscope or zoëtrope is illustrated in the article Illusion, while under Kinetoscope will be found descriptions of some of the more complex apparatus based on this principle. Anschütz (q.v.), a German photographer, who had achieved considerable success at instantaneous photography, made an important application of the stroboscope principle in his "tachyscope," by rotating transparent pictures on a drum or disk, and having them illuminated by the momentary glow produced by the passage of a spark from an induction coil through a Geissler tube. Although the period of discharge is very brief, yet the sparks follow with regularity, and as the successive pictures always occupy the same position relative to the eye of the observer, the illumination appears continuous, and the effect of motion is produced. See Illusion, Kinetoscope.

STRODTMANN, strôt′män, Adolf (1829-79). A German author, born at Flensburg. He studied at Kiel, and, while taking part in the insurrection of 1848, was wounded and captured by the Danes. On being set at liberty he published *Lieder eines Gefangenen auf der Dronning Maria* (1848). He resumed study at Bonn under Kinkel, but was suspended on account of his political activity. He then published *Lieder der Nacht* (1850) and a biography of Gottfried Kinkel (1850). He went to Paris, to London, and in 1852 to America, where for four years he was by turns bookseller and journalist in New York City and Philadelphia. Returning to Germany in 1856, he became known as a biographer of Heine and as war correspondent for several newspapers during the Franco-German campaign. He translated much from English writers. His most noteworthy volume in this field is *Amerikanische Anthologie* (1870), a group of successful renderings from American lyric poets.

STROBEL, strō′b'l, Edward Henry (1855 —). An American diplomat, born at Charleston, S. C. He was educated at Harvard. From 1885 to 1890 he was secretary of the United States legation at Madrid, and for a considerable period served also as chargé d'affaires. In 1888-89 he acted as a special diplomatic agent of the United States to Morocco. Returning to the United States, he became in April, 1893, Third Assistant Secretary of State. In April, 1894, he was appointed United States Minister to Ecuador, but later in the year was transferred to Chile, where he remained until 1897. In the latter year he acted as an arbitrator in a dispute between France and Chile, and in 1899 was counsel for Chile before the United States and Chilean Claims Commission. In 1898 he became Bemis professor of international law in the Harvard Law School. In 1903 he was granted leave of absence to accept the post of general adviser to the Government of Siam under a two years' agreement. He published *The Spanish Revolution* (1898).

STROGANOFF, strō′gȧ-nôf. A family of Russian nobles, descended from Anika, a wealthy merchant of Novgorod, who, in the beginning of the sixteenth century, owned extensive salt pits and iron works in the Ural Mountains. His sons Yakoff and Grigori obtained from Czar Ivan IV. important territorial grants and trade monopolies, founded several cities and fortified towns, and in 1574 received a deed of gift for the Siberian territory bordering on their possessions. The conquest was, however, not accomplished until after their death in 1581, by their youngest brother, Semen Anikitch, with the coöperation of Yermak, ataman of the Don Cossacks, when Western Siberia was subdued within two years and annexed to the Russian crown. The extraordinary privileges granted to the family were taken, in 1722, from the then living representatives, the brothers Alexander, Nikolai, and Sergei, by Peter the Great, who in exchange conferred upon them only the baronial title. A great-grandson of Nikolai was Sergei Grigoryevitch (1794-1882), the chief promoter of the archæological excavations on the shores of the Black Sea. He founded and endowed a school of design at Moscow, and acted as curator of the Moscow educational district in 1835-47. His sound judgment in the selection of professors, his munificence and liberal spirit, made this the most brilliant period in the history of the University of Moscow.

STRO′MATOP′ORA (Neo-Lat., from Gk. *στρῶμα*, *strōma*, covering + *πόρος*, *poros*, pore). An extinct genus of hydroid corals, which formed extensive coral reefs during some periods of Paleozoic time. The colonies formed rounded or incrusting and sometimes branching masses that show a concentric lamination and an irregular, cellular, microscopic structure. These hydroid corals are found in fossil coral reefs in the Chazy, Niagara, Lower Helderberg, and Onondaga limestones of New York State, and large specimens, which when polished are of great beauty, have been obtained in the Upper Devonian of the Central States.

STROMB (Lat. *strombus*, sort of spiral snail, from Gk. *στρόμβος*, pine-cone, snail, from *στρέφειν*, *strephein*, to turn, twist). A large gastropod mollusk of the family Strombidæ, or more particularly its shell. The species are numerous, and are mostly inhabitants of tropical seas. *Strombus gigas*, the 'queen conch,' is the largest known univalve. It is found in the West Indies, on reefs in shallow water, and is fished both for the table and on account of the shell. Great numbers of the shells are imported into Europe and America and are sometimes called 'fountain-shell,' from their aptness as garden ornaments. Their chief use, however, is by cameo-makers. Pearls of a delicate pink color are sometimes found in this shell.

STROMBOLI, strôm′bô-lē. A volcanic island belonging to the Lipari Islands (q.v.).

STRONG, Augustus Hopkins (1836—). An American clergyman, educator, and author. He was born at Rochester, N. Y., and graduated at Yale in 1857 and at the Rochester Theological Seminary three years afterwards. He became a Baptist minister, and in 1872 was made president of the Rochester Theological Seminary and professor of biblical theology in that institution. Among his published works are: *Systematic Theology* (1886; 3d ed. 1890); *Philosophy and Religion* (1888); *Great Poets and Their Theology;* and *Christ in Creation and Ethical Monism* (1899).

STRONG, Caleb (1745-1819). A Governor of Massachusetts, born at Northampton in that State. He graduated at Harvard College in 1764, and was admitted to the bar in 1772. During the Revolution he served in the Massachusetts General Court and in the Committee of Safety of his town, and from 1779 till 1780 sat in the Massachusetts Senate. He was a member of the Philadelphia Constitutional Convention of 1787. From 1789 till 1796 he was a United States Senator, and he was Governor of Massachusetts from 1800 till 1807, and again from 1812 till 1816. In politics he was an ardent Federalist, and as such was bitterly opposed to the War of 1812. On June 26, 1812, he issued a proclamation for a public fast on account of the war just declared "against the nation from which we are descended, and which for many generations has been the bulwark of the religion we profess." By the advice of the State Supreme Court he refused to comply with the President's request to call out the State militia to help in the prosecution of the war. In explanation of this refusal he said that to the Governor, not to the President, belonged the power to decide when to call out the militia. Afterwards he placed the militia of the State under a State major-general; was active in other measures looking toward the practical nullification of the national authority; and approved the report of the Hartford Convention (q.v.). He published *Patriotism and Piety; or Speeches and Proclamations of Governor Strong* (1808). His *Life* was written by Alden Bradford (Boston, 1820). Consult also Dwight, *The Strong Family* (Albany, 1871).

STRONG, George Crockett (1832-63). An American soldier, born in Stockbridge, Vt. He graduated at West Point in 1857; was an ordnance officer with the rank of lieutenant on the staff of General McDowell in the first battle of Bull Run, and later served successively on the staffs of Generals McClellan and Butler. He commanded an expedition sent from Ship Island against Biloxi, Miss., in April, 1862, and another sent against Pontchatoula, and was commissioned brigadier-general of volunteers in November, 1862. He commanded a brigade in the operations against Charleston, S. C., in June and July, 1863; made a successful descent on Morris Island on July 10th; and on the 18th of the same month was mortally wounded while gallantly leading the assault on Fort Wagner. A commission as major-general of volunteers was made out to date from the day of the battle. He published *Cadet Life at West Point* (1862).

STRONG, James (1822-94). An American Methodist lay biblical scholar and educator. He was born in New York City and studied medicine for a time, then entered Wesleyan University, Middletown, Conn., graduating 1844. He taught languages at Poultney, Vt., in 1844-46; lived in Flushing, L. I., in 1848-57, teaching privately and acting as president of the Flushing Railroad and president of the village. He was professor of biblical literature and acting president of Troy University in 1858-63; professor of exegetical theology in Drew Theological Seminary, Madison, N. J., 1868-93. He traveled in the East in 1874, and was a member of the Anglo-American Bible Revision Committee, 1871-81. In 1853 he became associated with Dr. John McClintock in the preparation of the *Cyclopædia of Biblical, Theological, and Ecclesiastical Literature* (revised edition 1890), and in 1870 became editor-in-chief. The best-known of his works besides the *Cyclopædia* are *English Harmony and Exposition of the Gospels* (1852), *The Tabernacle of Israel in the Desert* (1888), *Doctrine of a Future Life* (1892), *Exhaustive Concordance of the Bible* (1895), a work upon which he was engaged for thirty-five years. The *Student's Commentary on the Book of Psalms* (1896) was issued posthumously with prefatory memoir by Rev. Henry A. Buttz.

STRONG, Sir Samuel Henry (1825—). A Canadian jurist, born at Poole, England. He went to Canada in 1836 and in 1849 was admitted to the bar. In 1856 he was appointed a member of the commission for consolidating the statutes of Upper Canada and Canada; in 1863 was created Queen's counsel, and in 1869 was made a vice-chancellor of the Court of Chancery. He was called to the Ontario Court of Error and Appeal in 1874, and in 1875 was made puisne judge in the newly constituted Canadian Supreme Court, of which he became Chief Justice in 1892. In 1897 he was sworn of her Majesty's Privy Council.

STRONG, Theodore (1790-1869). An American mathematician, born in Massachusetts. He was educated at Yale and after graduation (1812) became tutor in mathematics at Hamilton College, and in 1816 professor of mathematics. In 1827 he accepted the chair of mathematics and natural philosophy in Rutgers College, a position which he retained till 1862, when he retired from active life. Strong made many important contributions to mathematical science. A new geometrical demonstration of the values of the sines and cosines of the sum and difference of two arcs was given by him in 1818. He also gave a solution of the irreducible case of the cubic equation, and devised a method for the application of the binomial theorem to the extraction of the roots of whole numbers. His two principal systematic works are *A Treatise on Elementary and Higher Algebra* (1859) and *A Treatise on the Differential and Integral Calculus* (1869).

STRONG, William (1808-95). An American jurist, born in Somers, Conn. He graduated at Yale in 1828, and was admitted to the bar in Reading, Pa., in 1832. In 1846 and again in 1848 he was elected to the national House of Representatives as a Democrat; and from 1857 until 1868 he was a justice of the Pennsylvania Supreme Court. From 1870 until 1880 he was associate justice of the United States Supreme Court. He was a member of the Electoral Commission that decided the disputed Presidential election of 1876 and in that capacity contended that Congress had no power to canvass State returns for Presidential electors. He was for many years connected with societies for the advancement of Sunday schools and missionary work.

STRONG, William L. (1827-1900). The last Mayor of New York previous to the formation of Greater New York. He was born in Richland County, Ohio; was a drygoods salesman in Wooster and then in Manchester, Ohio; in 1853 went to New York City, where he engaged in similar business, and in 1869 became the head of the firm of William L. Strong & Co. In politics he was a Republican. From 1895 to 1898 he was Mayor of New York, having been elected on a fusion ticket supported by Republicans and anti-Tammany Democrats.

STRONGBOW. A surname of Richard Fitz Gislebert, Earl of Pembroke, one of the leaders in the Anglo-Norman conquest of Ireland (q.v.).

STRONGYLUS (Neo-Lat., from Gk. *στρογγύλος*, round). A genus of nematode worms, parasitic in man and other animals. The only true strongylus infesting man is *Strongylus bronchialis*. The male usually measures rather more than half an inch, while the female is upward of an inch in length. It is apparently a rather uncommon parasite, as few cases have been reported, though allied species occur in the lungs and air passages of pigs, calves, and sheep. Closely allied to Strongylus is the genus *Eustrongylus*, which contains the species *Eustrongylus gigas*, which is the largest nematode worm at present known to infest man or any other animal, the male measuring a foot in length, and one-fourth of an inch in diameter, while the female is more than three feet, its transverse diameter being fully half an inch. The body is cylindrical, and more or less tinged with redness; the head obtuse, and furnished with a simple oval aperture surrounded by six chitinous nodules. This worm occurs in the kidneys and bladder, sometimes in the abdominal cavity and the omentum, more rarely in the lungs and liver of man and other animals. Fortunately, it is very rare in man; it is said that weasels are the animals in which it is most commonly found.

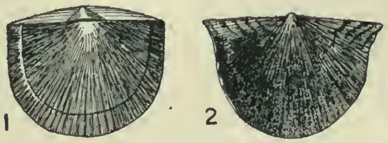
STRONTIUM (Neo-Lat., from *Strontian*, Argyllshire, Scotland). A metallic element first isolated by Davy in 1808, its earth having been recognized as a distinct chemical substance after Cruikshank (1790), Hope (1792), and Klaproth (1793) had discovered that it gives a peculiar coloration if introduced into a flame. Strontium occurs as the carbonate (strontianite), as the sulphate (celestite), as the silicate in combination with barium and calcium (brewsterite), also in small quantities in other minerals, such as arragonite, calcite, and dolomite. It further occurs in mineral and sea waters, and also in the ashes of certain plants. The metal may be obtained by the electrolysis of the moistened hydroxide or the chloride. Strontium (symbol, Sr; atomic weight, 87.61) is a yellow metal with a specific gravity of 2.5; it melts at a moderate red heat. It is both malleable and ductile, is less electro-positive than calcium and the alkali metals, oxidizes quickly on exposure to the air, and burns brilliantly when heated, forming the oxide. It combines with oxygen to form a monoxide (SrO) and a dioxide (SrO_2). The former is a gray-white, porous, infusible solid that is usually prepared by igniting the nitrate. The hydrate formed by the action of water on the oxide has the property of combining with crystallizable sugar to form a saccharate easily decomposed by carbon dioxide, and hence is extensively used for the separation of sugar from beet-root molasses. The nitrate, which may be prepared by dissolving the carbonate in warm dilute nitric acid and evaporating to crystallization, finds use for pyrotechnic purposes, owing to the red flame with which it burns.

STROPHADES, strŏf'ȧ-dēz (Lat., from Gk. *Στροφάδες*). Two small islands in the Ionian Sea, now Strofadia and Strivali. The name was given from the legend that the sons of Boreas pursued the Harpies to the islands, thence returning (*στρέφειν*, to turn) from their expedition.

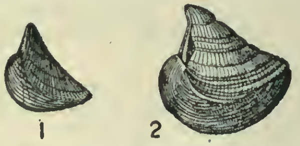
STROPHANTHUS (Neo-Lat., from Gk. *στρόφος*, *strophos*, twisted, bent, from *στρέφειν*, *strephein*, to turn, twist + *ἄνθος*, *anthos*, flower). A drug consisting of the seed of Strophanthus hispidus, a climbing African plant of the order Apocynaceæ. From the seed can be obtained its active principle strophanthin, a bitter glucoside. This is a white, amorphous, or crystalline powder, soluble in water or alcohol. The physiological action of the drug is much like that of digitalis (q.v.). It slows the action of the heart, increases its contractility, and increases the arterial tension, though less than digitalis. Its action is more rapid, less protracted, and less certain than that of digitalis. It is also less diuretic, less apt to disturb the stomach, and is not cumulative. In large doses it is a direct poison to the voluntary muscles, which become tonically contracted and pass into a condition resembling *rigor mortis*. Strophanthus is a valuable cardiac stimulant and is used in cases in which digitalis is indicated, but in which, for any reason, it is necessary to substitute another drug. It is also of use when digitalis fails to act. The official tincture is the form generally employed.

STROPHE, strō′fė (Lat., from Gk. *στροφή*, a turning, from *στρέφειν*, *strephein*, to turn, twist). A term which originally designated the evolutions of the Greek chorus from one position to another in the orchestra; then the portion of the song which accompanied this movement. In its ordinary sense, as applied to Greek and Latin lyric poetry, it designates a combination of rhythmical periods to which a following combination corresponds exactly or very closely; these are known respectively as strophe and antistrophe (q.v.). The name is also often applied to the stanza of modern poetry. See VERSIFICATION.

STRO′PHOME′NA (Neo-Lat. nom. pl., from *στρόφος*, *strophos*, twisted, bent + *νήνη*, *mēnē*, crescent). An important genus of fossil long-hinged brachiopods of Paleozoic age, typical of the family Strophomenidæ. The primitive members of this family are characterized by their general semicircular outline, long hinge lines, and well-developed cardinal teeth, distinct hinge areas, and low beaks. In the secondary derived members of the group the hinge line shortens, the beak lengthens, the hinge area increases in height, and the articulating processes undergo interesting modifications, while correlated modifications take place in the interior of the shell. The simplest and earliest member is Rafinesquina (Ordovician), with valves normally concavo-convex dorsoventrally, and hinge line simple. Strophomena (Ordovician and Silurian) in its embryonic stages has the general form of shell seen in Rafinesquina, but the adults have the valves resupinate or recurved so that the dorsal valve is convex and the ventral valve flat or concave. From Rafinesquina arises a long line of descendants reaching into Carboniferous times. These genetically related types are Strophomena (Ordovician to Silurian), Orthothetes (Silurian to Carboniferous), Derbya (Carboniferous), Streptorhynchus (Upper Carboniferous to Permian). Consult Hall and Clarke, "An Introduction to the Study of the Genera of Palæozoic Brachiopoda," *Palæontology of New York*, vol. viii., part i. (Albany, 1892).



1, *Orthothetes Chemungensis* (view from the brachia valve); 2, *Strophomena filitexta* (pedicle valve).



1, *Stroptorhynchus pelargonatus* (profile); 2, *Derbya Bennetti* (profile).

STROSSMAYER, strŏs′mī-ẽr, JOSEPH GEORG (1815—). An Austrian Roman Catholic bishop, born at Eszék, Slavonia. After being educated at Diakovár, Budapest, and Vienna he became professor in the seminary at Diakovár, afterwards Court chaplain in Vienna, and in 1849 Bishop of Diakovár. A leader of the Croatian national party, he promoted the cause of education in various ways, contributed largely to the establishment of the academy and university at Agram, and built the beautiful Romanesque cathedral at Diakovár. He came most prominently into notice at the time of the Vatican Council, in which he was considered the leader of the Inopportunists, or those who considered it inadvisable to define Papal infallibility.

STROTHER, strŏᴛʜ′ẽr, DAVID HUNTER (1816-88). An American author and illustrator, born at Martinsburg, W. Va. Educated as an artist, he first became known to the public in 1852 as 'Porte Crayon,' the author of a series of amusing papers published in *Harper's Magazine*, descriptive of travel, scenery, and manners in the South. Many of these were afterwards collected in *The Blackwater Chronicle* (1853) and *Virginia Illustrated* (1857). He entered the Union army as captain in 1861, became colonel, resigned in 1864, and in 1865 was brevetted brigadier-general. After the war he continued to write and sketch for periodicals, and from 1879 to 1885 was Consul-General to Mexico.

STROUD, stroud. A town in Gloucestershire, England, nine miles miles south-southeast of Gloucester, at the confluence of the Frome and Slade (Map: England, D 5). It is the centre of the woolen manufactures of Gloucestershire. The water of the Frome is peculiarly adapted for use in dyeing scarlet and other grain colors; and on this account cloth factories and dye works have been built along its banks for a distance of twenty miles. At the Domesday survey Stroud was part of Bisley Parish, from which it separated in 1304.

STROUDS′BURG. The county-seat of Monroe County, Pa., 53 miles southeast of Scranton, on the Analomink River, and on the New York, Susquehanna and Western and the Delaware, Lackawanna and Western railroads (Map: Pennsylvania, F 3). It is in a beautiful region. But four miles distant is the famous Delaware Water Gap. In East Stroudsburg is a State Normal School. There are flour and woolen mills. Population, in 1890, 2419; in 1900, 3450.

STROZZI, strŏt′sė. A noble Florentine family which first attained prominence toward the end of the thirteenth century. From that time until 1530 they appear as the rivals of the Medici, with whom they shared the great offices of State. At their most flourishing period toward the end of the fifteenth century they numbered eighty heads of families. Then was built from the plans of Benedetto da Majano and Cronaca that famous palace which has been ranked with the Farnese at Rome and the Vendramin at Venice as one of the three finest in Italy. Cosmo I. de' Medici upon his accession in 1537 brought about the fall of the rival house. Various branches of the family took foreign service or settled in Naples, Mantua, and Ferrara.

STROZZI, BERNARDO (1581-1644). An Italian painter (called Il Prete Genovese and Il Capuccino). He was born in Genoa and began to paint at sixteen, but gave up his art to become a Capuchin monk. The necessities of his family required his aid, however, and he was temporarily permitted to leave the monastery in order to give himself again to painting. When he refused to return to the cloister after the death of his mother and the marriage of his sister he was arrested and imprisoned in the dungeon of his Order for three years, when he escaped to Venice and there worked privately and for the State, decorating the library of Saint Mark's and the churches of San Benedetto and of the Incurabili. His best efforts were portraits.

STRUENSEE, stro͞o′en-zā, JOHANN FRIEDRICH VON, Count (1737-72). A Danish statesman, born August 5, 1837, at Halle, Saxony. He studied medicine, became the physician of King Christian VII. (q.v.) of Denmark (1768), and rose to the highest favor. In 1771 he was made Minister of State with unusual powers. Since the Revolution of 1660 Denmark had been under the domination of the nobility, who as a council of State governed the country. Struensee dissolved the council, and proclaimed the establishment of the ancient royal power. These measures amounted in reality to a revolution, and to a declaration of war against the aristocracy. The Queen and Struensee, in whose hands the whole power now was, chose new ministers, and excluded the feeble Christian entirely from the management of affairs. In opposition to the policy of his predecessors, Struensee endeavored to free Denmark from Russian influence, and to find a natural ally in Sweden. He put the finances in order, reduced the expenditure, freed industry and trade, encouraged education, mitigated the penal laws, and brought order into the administration. Serfdom was partially abolished. The haste with which this revolutionary course was pursued produced a reaction, while the clergy were aroused by Struensee's outspoken skepticism. The Queen and Struensee were accused of criminal relations and the King was prevailed upon, apparently against his will, to sign warrants for the arrest of Struensee. The Minister was accused of having conspired against the person and throne of the King, and of being the lover of the Queen. He was sentenced to death and executed April 28, 1772. Queen Carolina Matilda left Denmark in May, 1772, and died in 1775 in the castle of Celle in Hanover. Consult *Struensee et la cour de Copenhague—mémoires de Reverdil* (Paris, 1858).

STRÜMPELL, strụm′pel, LUDWIG (1812-99). A German philosopher, born at Schöppenstedt. He studied philosophy at Königsberg, where he was influenced by Herbart, and continued his studies at Leipzig. In 1845 he became professor of philosophy at Dorpat, and after 1872 he held a similar position at the University of Leipzig. He became known as a prominent representative of Herbart's philosophy and published *Erläuterungen zu Herbarts Philosophie* (1834), *Die Hauptpunkte der Herbartschen Metaphisik kritisch beleuchted* (1840), *Gedanken über Religion und religiöse Probleme* (1888), *Abhandlungen zur Geschichte der Metaphysik, Psychologie und Religionsphilosophie* (1896), and *Vermischte Abhandlungen aus der theoretischen und praktischen Philosophie* (1897).

STRUTT, JOHN WILLIAM. An English physicist. See RAYLEIGH.

STRUTT, JOSEPH (1749-1802). An English antiquary. He studied engraving and painting, but devoted himself mostly to research in the British Museum. Among his works are *The Regal and Ecclesiastical Antiquities of England* (1773); *The Chronicle of England* (1777-78); *Complete View of the Dress and Habits of the People of England from the Establishment of the Saxons in Britain to the Present Time* (1796-99); *Sports and Pastimes of the People of England* (1801); and a curious historical romance, entitled *Queenhoo Hall*, edited and completed by Sir Walter Scott (1808). Strutt's work as antiquary was so well done that it has not yet been superseded. His engravings in the 'chalk' or dotted style are much sought after.

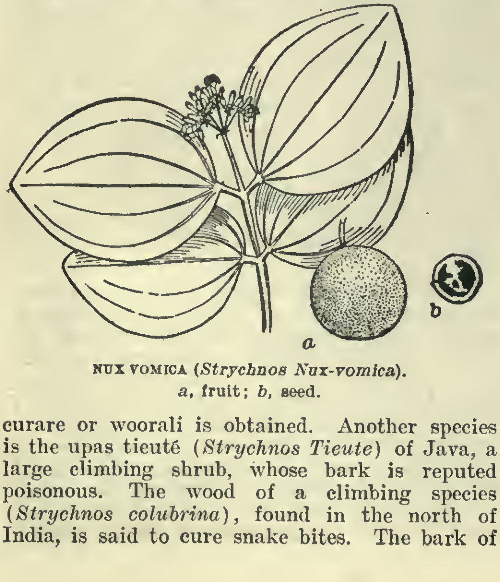
STRUVE, stro͞o′ve, FRIEDRICH GEORG WILHELM VON (1793-1864). A Russian astronomer, born at Altona, Germany. He was educated at the University of Dorpat, and appointed to a post in the observatory in 1813, and continued with the utmost assiduity his observation and researches respecting double and multiple stars, adding immensely to our knowledge of these systems. In 1839 he became director of the newly organized observatory at Pulkova, and here he continued again his classic researches concerning double stars. Struve also executed a number of important geodetic operations, such as the triangulation of Livonia, in 1816-19, and the measurement of an arc of the meridian in 1822-52. He published: *Observationes Dorpatenses* (1817-39); *Catalogus Novus Stellarum Duplicium* (1827); *Stellarum Duplicium Mensuræ Micrometricæ* (1831); *Stellarum Fixarum, Imprimis Compositarum Positiones Mediæ* (1852). All these works are fundamental in the history of double-star astronomy. He published also *Arc du méridien entre le Danube et la Mer Glaciale* (1857-60).

STRUVE, GUSTAV VON (1805-70). A German revolutionist, born in Munich. He was an ardent Liberal, and in 1848 took part with Hecker and others in the first revolt in Baden. After the defeat at Staufen he was captured and sentenced to five years of solitary confinement. Released by the Revolutionists in 1849, he became the leader of the Republican Party in the Constituent Assembly of Baden. Forced to flee again, he went first to Switzerland, then to England, and finally, in 1851, to the United States. Here he composed his *Allgemeine Weltgeschichte* (1853), a history of the world from the standpoint of radical republicanism. When the Civil War broke out he served for a time as an officer in the Eighth New York Regiment, but in 1863 returned to Europe, where he lived for a time in Coburg, then until his death in Vienna. Among his numerous other works are: *Das öffentliche Recht des Deutschen Bundes* (1846); *Geschichte der drei Vollkserhebungen in Baden* (1848); and *Das Revolutionszeitalter* (1860).

STRUVE, OTTO WILHELM (1819—). A Russian astronomer, born at Dorpat. In 1837 he became his father's chief assistant at Pulkova. In 1862 he became the director of Pulkova Observatory, a position which he held till 1889, when he retired to Karlsruhe. In his examination of the northern heavens he discovered 500 binary stars and also determined the parallax of several stars, and observed the variability of the light coming from the nebula of Orion and the several stars hidden in the nebula. He also determined a new value of the precession constant (1841), calculated the dimensions of the ring of Saturn, determined the mass of Neptune, and made observations on solar velocity and the extent of the corona. Struve wrote: *Uebersicht der Thätigkeit der Nicolai-Hauptsternwarte während der ersten 25 Jahre ihres Bestehens* (1865); *Zum 50-jährigen Bestehen der Nikolai-Hauptsternwarte* (1887); *Observations de Pulkova* (1869-93).

STRYCHNINE, or STRYCHNIA (from Lat. *strychnos*, from Gk *στρύχνος*, *strychnos*, plant of the nightshade kind). A poisonous alkaloid resembling brucine (q.v.), obtained from various species of plants, especially from the seeds of the Saint Ignatius bean and from nux vomica. It occurs in right square octahedrons or prisms, colorless and inodorous, scarcely soluble in water, but easily so in alcohol, ether, and chloroform. Pure sulphuric acid forms with it a colorless solution, which, on the addition of bichromate of potash, acquires an intensely violet hue, speedily passing through red to yellow. If, indeed, the solution is diluted with water while it is red and ammonia is added, it becomes a violet purple, changing to yellow. Another test for strychnine is its action upon animals. In nitric acid it ought, if pure, to form a colorless solution; if the solution is reddish it is a sign that brucine is also present. Strychnine combines with numerous acids, and forms well-marked salts, which are amenable to the same tests as the base itself and are soluble in water. Strychnine is intensely bitter, and will impart this quality to 20,000 times its weight of water. See ANTIDOTES.

STRYCHNOS (Lat., from Gk. *στρύχνος*, *strychnos*, *τρύχνος*, *trychnos*, plant of the nightshade kind). A genus of trees and shrubs of the natural order Loganiaceæ. To this genus belongs *Strychnos Nux-vomica*, an East Indian tree of medium size, whose fruit, which is produced in great abundance, is about the size of a small orange. Its disk-shaped seeds, which are the nux vomica of commerce, yield the alkaloids strychnine and brucine. The wood of the tree is very hard and durable. The clearing-nut and Saint Ignatius bean are produced by species of this genus, to which also belongs the South American tree (*Strychnos toxifera*) from which curare or woorali is obtained. Another species is the upas tieuté (*Strychnos Tieute*) of Java, a large climbing shrub, whose bark is reputed poisonous. The wood of a climbing species (*Strychnos colubrina*), found in the north of India, is said to cure snake bites. The bark of *Strychnos Pseudo-quina*, a Brazilian species, is used as a substitute for cinchona. The climbing species are provided with curious hooked tendrils by which they attach themselves to trees. Despite the popular ill-repute attached to many of the species, their fruits, especially those of *Strychnos Nux-vomica*, seem to be harmless, since they are often eaten by birds.



NUX VOMICA (*Strychnos Nux-vomica*).
a, fruit; *b*, seed.

STRYJ, strĭ'y'. A town in Galicia, Austria, 40 miles south of Lemberg (Map: Austria, J 2). It has a castle. Its industries include the manufacturing of leather, matches, and iron products. Population, in 1890, 16,515; in 1900, 23,673.

STRY'KER, MELANCTHON WOOLSEY (1851—). An American educator, born at Vernon, N. Y. He graduated at Hamilton College in 1872 and at the Auburn Theological Seminary four years later. Between 1876 and 1892 he was pastor of churches in Auburn, N. Y.; Ithaca, N. Y.; Holyoke, Mass.; and Chicago. In the latter year he was elected president of Hamilton College. His publications include *The Song of Miriam* (1888), a hymnal *Church Song* (1889), *Dies Iræ* (1893), *Lattermath* (1896), and a number of addresses.

STRYPE, JOHN (1643-1737). A Church of England historian and antiquary. He was born in London, studied at Cambridge, entered the Church, and held for many years, with other smaller livings, the rectory of Leyton, in Essex. His works fill 13 large folio volumes. *Ecclesiastical Memorials*, relating to religion and the Church of England under Henry VIII., Edward VI., and Mary, is his best work, forming, with Burnet's more readable *History of the Reformation*, a consecutive and full account of the reformed Anglican Church. As a writer he is heavy, but honest and plodding, and he was a faithful transcriber of the ancient papers he published, which, he says, were all copied with his own hand. His complete works were reprinted with general index by R. F. Laurence (28 volumes, Oxford, 1820-28).

STU'ART, or **STEWART**. A Scotch and English royal family. Its origin is traced to Fitzflaald, a Norman, who accompanied the Conqueror to England. His second son, Walter (d. 1117), entered the service of David I. of Scotland, who conferred large territorial possessions on him, along with the dignity of Steward of Scotland, which became hereditary in his family, and was assumed by his descendants as a surname, some branches of the house later modifying the orthography to Steuart, or the French form Stuart. For seven generations the stewardship continued unbroken from father to son. Walter, the third steward and grandson of the first steward, held, in addition, the office of justiciary of Scotland. Alexander, fourth steward, was Regent of Scotland in Alexander III.'s minority. James, the fifth steward, was one of the six Regents of Scotland after the death of Alexander III.; and Walter, the sixth steward, by his marriage with Marjory, daughter of Robert Bruce, eventually brought the crown of Scotland to his family. His son, Robert, seventh high steward, was Regent from 1338 to 1341, and afterwards during the captivity of his uncle, David II., from 1346 to 1357. On the death of David II. in 1371 he ascended the throne as Robert II., and died in 1390. (For the subsequent history of the royal family see articles ROBERT II. and

III.; James I., II., III., IV., V.; Mary Stuart; James I. (of England); Charles I. and II.; James II.; Mary II.; and Anne.) In the person of James II. the line of Stuart was driven from the English and Scottish thrones. The claims of the house were upheld by James's son, the Old Pretender (see Stuart, James Edward), and by the latter's son, known as the Young Pretender. (See Stuart, Charles Edward.) A brother of the latter was Henry Benedict Maria Clement, Cardinal York, born 1725. After Culloden (1746) he went to Rome, took orders, and was advanced to the purple by Benedict XIV. in 1747. During his brother's life he was known as Cardinal York; but after his death he assumed the regal style as Henry IX., King of England. The expulsion of Pius VI. from Rome, and other events following upon the French Revolution, drove him to Venice, aged and infirm and reduced to absolute poverty. George III. settled on him an annuity of £4000. He died in 1807 at the age of eighty-two, the last direct descendant in the male line of the royal Stuarts.

The female line of the Stuarts is represented by the descendants of Henrietta Maria, daughter of Charles I., who was married to Philip, Duke of Orleans, brother of Louis XIV. of France. This princess had two daughters, of whom the elder, Mary, was Queen of Charles II. of Spain, and died childless; the younger, Anna Maria, married Victor Amadeus II., Duke of Savoy and King of Sardinia, and was mother of Charles Emmanuel III., King of Sardinia, and grandmother of Victor Amadeus III. of Sardinia. See Savoy, House of.

The branch of the family which the Act of Settlement called to the throne on the death of Queen Anne was descended of the Electress Sophia of Hanover, granddaughter of James I. (VI.) by her mother, the Princess Elizabeth Stuart (q.v.), Electress Palatine and Queen of Bohemia.

The cadets of the House of Stuart, descendants of Robert II., are represented by some of the most noble titles in Scotch and English history. Consult: Stewart, *Historical and Genealogical Account of the Royal Family of Scotland, and of the Surname of Stewart* (Edinburgh, 1739); Noble, *Historical Genealogy of the Royal House of Stewart* (London, 1795); Thornton, *The Stuart Dynasty* (ib., 1890); Gibb and Skelton, *The Royal House of Stuart* (ib., 1890).

STU′ART, Lady Arabella, or Arbella (1575-1615). The daughter of Charles Stuart, Earl of Lennox, a younger brother of Lord Darnley (q.v.). She was the next in the line of succession to her cousin James I. of England, and her relationship to Elizabeth gave rise to a number of plots, including one by Sir Walter Ralegh in 1603, to place her on the throne. Several schemes to marry her were defeated by Elizabeth, but in 1610 it was discovered that she had made a secret marriage with William Seymour (q.v.), grandson of the Earl of Hertford. Seymour was imprisoned in the Tower of London and his wife put in the custody of the Bishop of Durham, but she escaped to a French vessel, in which her husband, who had escaped from the Tower, was also to sail. He did not reach it, but escaped in another vessel, while the vessel in which Arabella sailed was captured and she spent the last five years of her life in the Tower, dying insane. Consult Cooper, *Life and Letters of Lady Arabella Stuart* (1866).

STUART, Charles Edward, often called the Young Pretender (1720-88). A claimant to the throne of Great Britain. He was the eldest son of James Edward, known as the Old Pretender, and was born at Rome. After some military service on the Continent, Charles, encouraged by the French Government, decided to make an armed attempt to obtain the British crown. The French aid, however, did not materialize, and Charles landed almost alone on August 2, 1745, on an islet in the Hebrides. The Highland clans flocked to his standard, and Charles pressed on to Perth, where he was joined by Lord George Murray. The troops of the Government were defeated at Prestonpans on September 21, 1745, and Carlisle was taken in November. Lord George Murray completely outmanœuvred his opponents, and soon had a clear road to London. In the first days of December the Highlanders were in Derby. Panic prevailed in London. But England did not rise in behalf of the Stuarts as had been expected, and Murray was cut off from his base of supplies. In consequence the retreat began on December 6, and the Duke of Cumberland pursued. On April 16 (new style April 27), 1746, the rebels were totally defeated at Culloden Moor. From April to September Charles Edward lay concealed in the Highlands and on the Hebrides with a price on his head, and hunted by the soldiers, but safe in the devoted loyalty of the clansmen. He finally reached France after many hairbreadth escapes. Thereafter his life was chiefly marked by its dissoluteness. It seems that he was in London in 1750, and again in 1752 and 1754, in the vain hope of fomenting another rising. In 1772 Charles married Louisa, Princess of Stolberg (see Albany, Louisa Maria Caroline), but she was unable to tolerate his brutality, and they separated in 1780. Thereafter Charles lived chiefly at Florence in the company of a daughter born to him by Miss Walkenshaw, his mistress. He died at Rome. Consult: Ewald, *Life and Times of Prince Charles Stuart, Count of Albany* (London, 1875); Lang, *The Prince Charles Edward* (ib., 1900).

STUART, Elizabeth (1596-1662). See Elizabeth Stuart.

STUART, Gilbert (1755-1828). An American portrait painter. He was born at Narragansett, R. I., December 3, 1755. He painted his first portraits when thirteen, having had no instruction. In 1770 he was taught by a Scotsman, Cosmo Alexander, who took him to England, but upon Alexander's death Stuart was forced by poverty to return to America after a year's absence. A maturing talent brought him frequent commissions, and thus he was enabled in 1775 to return for further study to England. In London he formed the acquaintance of Benjamin West, who gave him instruction and a home in his own house. After much adversity, during which he supported himself as an organist, he attained a distinguished position. He returned to America in 1792, his impelling motive being to paint the portrait of Washington. He established a studio in New York, but removed to Philadelphia, where the first Washington portrait was painted in 1795; at a still later period he lived in the city of Washington, and finally in 1806 took up his permanent residence at Boston, where he died. The Stuart portraits of Washington, representing the subject in the later years of his life, are the most famous of both artist and sitter. The first of these, representing the right side of the face, the artist destroyed as unsatisfactory, though six replicas exist; after 1796 he painted the portrait known as the 'Athenæum portrait' (Boston Museum), showing the left side. A full length was painted for the Marquis of Lansdowne in 1796. Nearly forty replicas of his various Washington portraits have been traced. The Historical Societies of Boston, New York, and Philadelphia have many examples of his work, as do the Metropolitan Museum and other American collections.

Stuart was an entirely independent master, who followed neither West nor any other model, but nature alone. Though sometimes deficient in drawing, he was a good colorist, and in his best productions deserves to rank beside Gainsborough. He devoted his chief attention to the heads, which are rendered with force and truth, but rather neglected the rest of the portrait. The list of his sitters includes the first five Presidents of the United States, Edward Everett, John Jay, Jacob Astor, Judge Story, W. E. Channing, Josiah and Edmund Quincy, O. H. Perry, Jerome and Mme. Bonaparte. During his residence in England he painted King George III., also George IV. while Prince of Wales, Louis XVI. of France (at Paris), Mrs. Siddons, Sir Joshua Reynolds, Benjamin West, and a notable picture of "W. Grant Skating in Saint James Park," which made his reputation in England. Consult Mason, *Life and Works of Gilbert Stuart* (New York, 1879); Caffin, *American Masters of Painting* (New York, 1896).

STUART, Henry Benedict Maria Clement, Cardinal York (1725-1807). The second son of James Edward Stuart, the Elder Pretender. See Stuart.

STUART, James. Regent of Scotland after the abdication of Queen Mary. See Murray or Moray, James Stuart, Earl of.

STUART, James (1713-88). An English painter, archæologist, and architect, born in London. Until nearly thirty years of age he was a poor fan-painter, but in 1741 he found means to go to Rome, where he studied Latin and Greek and became interested in archæology. From 1751 till 1755 he, together with Nicholas Revett, studied antiquities in Athens. Upon their return to England they published, through the encouragement and aid of the Society of Dilettanti, *The Antiquities of Athens, Measured and Delineated by James Stuart, F.R.S. and F.S.A., and Nicholas Revett, Painters and Architects* (1762). The book attracted widespread attention. Through its influence the classical style in architecture became widely popular. A second volume of the *Antiquities* was published posthumously in 1789; a third in 1795; and a fourth in 1814. A third edition of the first three volumes was published in 1841 for Bohn's *Illustrated Library*.

STUART, James Edward (1688-1766). The son of James II. of England by his second wife, Mary Beatrice, daughter of the Duke of Modena, known as the Chevalier Saint George, or the Old Pretender. Prince James, who was born but a few months before his father's dethronement, was commonly but groundlessly alleged to be a supposititious child, and was involved in his father's exclusion from the crown. In 1715 the party who supported him, known in history as the Jacobites, endeavored to place him on the throne by force of arms. In Scotland the Earl of Mar, with about 5000 men, was checked by the royal forces under the Duke of Argyll at Sheriffmuir (q.v.), and in England the rising, headed by the Earl of Derwentwater, ended by the unconditional surrender of the insurgents at Preston, when Lords Derwentwater and Kenmure were beheaded and other persons of note executed and attainted. James escaped to France, and for the rest of his life resided in obscurity, principally at Rome. In 1719 he married one of the wealthiest heiresses in Europe, Maria Clementina Sobieska, granddaughter of John Sobieski, King of Poland. His son Charles Edward was the Young Pretender.

STUART, James Ewell Brown (1833-64). An American soldier, prominent as a cavalry leader in the Confederate service during the Civil War. He was born in Virginia, attended Emory and Henry College, and graduated at the United States Military Academy in 1854. He then served as lieutenant on the Texas frontier, taking part in several actions with the Apache Indians. In 1857 his regiment was sent to Kansas to maintain peace, and later he saw service against the Cheyenne Indians. In April, 1861, he was promoted to the rank of captain, but resigned from the United States Army upon receiving notice of the secession of Virginia, and was shortly thereafter commissioned lieutenant-colonel of Virginia troops. At the first battle of Bull Run he won distinction as a cavalry commander, and was rewarded in September following by promotion to the rank of brigadier-general. He made several successful raids and took a conspicuous part in the Seven Days' Battle before Richmond. In July, 1862, he was commissioned major-general of cavalry, and shortly afterwards made a dash upon General Pope's headquarters, capturing his official correspondence and making prisoners of several of his staff. This was followed the same night by a successful raid on Manassas Junction. He participated with distinction in the second battle of Bull Run and in the battle of Antietam, made a raid into Pennsylvania, guarded the Confederate right at Fredericksburg, and aided Stonewall Jackson at Chancellorsville. After the death of Jackson and the wounding of A. P. Hill, the command of Jackson's corps devolved temporarily upon him. He took part in Lee's Gettysburg campaign without adding anything to his reputation as a cavalry commander. In the campaign of the Wilderness he won several successes; and when Sheridan advanced upon Richmond General Stuart confronted him at Yellow Tavern, where the Confederates were defeated and General Stuart mortally wounded. He died May 12, 1864. Consult his *Life and Campaigns*, by H. B. McClellan, his chief of staff (Boston, 1885).

STUART, John. See Bute, third Earl of.

STUART, John McDouall (1815-66). A British explorer, born at Dysart, in Fifeshire. In 1838 he emigrated to South Australia. He was with Captain Sturt on an expedition to explore Central Australia, and in 1858 began the work of exploration on his own account. In October, 1861, he started northward, and in July, 1862, arrived at Van Diemen's Gulf. For this exploit he received from South Australia the grant of £2000, which had been offered to the first colonist who should cross the continent.

STUART, Moses (1780-1852). An American scholar and teacher. He was born at Wilton, Conn., and graduated at Yale in 1799. After several years as a teacher, he was admitted to the bar in 1802, but abandoned the law for theology. He was pastor of a church in New Haven (1806-09), but is best known for his service as professor of sacred literature at Andover Theological School (1810-48). He was an inspiring teacher, an indefatigable student, and one of the first to make German scholarship known in America. He prepared several Hebrew grammars, the first of which was used by his classes in manuscript because he was unable to find type or compositors to print it; the last was a translation of Rödiger's *Gesenius* (1846); with Edward Robinson he translated Winer's grammar of New Testament Greek (1825); he also translated writings of Jahn and others on methods of biblical study (1821), and Ernesti's *Elements of Interpretation* (1882).

STUART, Ruth McEnery (1856—). An American writer of stories dealing chiefly with Southern scenes. She was born in Avoyelles Parish, La., and was educated at New Orleans. Her chief publications are: *A Golden Wedding and Other Tales* (1893); *Carlotta's Intended* (1894); *The Story of Babette* (1894); *Solomon Crow's Christmas Pockets and Others* (1896); *Sonny* (1896); *In Simkinsville* (1897); *Moriah's Mourning* (1898); *Holly and Pizen* (1899); *The Woman's Exchange* (1899); *Napoleon Jackson* (1902).

STUBBES, stŭbz, Philip (c.1555-c.1610). A Puritan pamphleteer of the sixteenth century. In 1753 he wrote, in denunciation of the social follies and vices of the age, *The Anatomie of Abuses;* and in the same year he published *The Rosarie of Christian Praiers and Meditations.* He wrote also *A Christall Glasse for Christian Women* (1590) and numerous pamphlets. Both *The Anatomie of Abuses* and *A Christall Glasse* were very popular, and were several times republished. The former was reprinted in 1836 by Trumbull, and afterwards was edited in two parts with 'forewords' by Dr. Furnival, for the Shakespeare Society (1877. 1882). Consult volume ix. of Morley's *English Writers* (London, 1892).

STUBBS, Charles William (1845—). An English divine and author, born in Liverpool. From the Royal Institution School of Liverpool he passed to Sidney Sussex College, Cambridge, where he graduated B.A. in 1868. He became senior curate of Saint Mary's, Sheffield (1868-71). vicar of Granboro in Buckinghamshire (1871-84), of Stokenham in Devonshire (1884-88), rector of Wavertree, Liverpool (1888-94), and Dean of Ely (1894). Among his writings are: *Christ and Democracy* (1883); *God's Englishmen* (1887); *The Land and the Labourers* (1890); *Christ and Economics* (1893); *Christus Imperator* (1894); *A Creed for Christian Socialists* (1896); *Charles Kingsley and the Christian Social Movement* (1898); *The Social Teaching of the Lord's Prayer* (1900); *Pro Patria* (1900). He is also the author of two volumes of poems, *The Conscience* (1884) and *Brightnoth's Prayer* (1899).

STUBBS, George (1724-1806). An English animal painter and anatomist. He was born in Liverpool, where he began the study of his father's profession of surgery. In 1751, however, he went to Rome to study art. Upon his return to England he was soon receiving good prices for paintings of horses, and after 1758 devoted most of his time for six or seven years to the preparation of his famous *Anatomy of the Horse* (1766), a work which, from the standpoint both of anatomy and art, is still authoritative. In 1790 he was engaged to paint all the famous race-horses from the time of the Godolphin Barb, but he only completed 16 in the series. He did some notable work in enameling on large plates. Some of his rustic and heroic pieces were very popular as engravings, but his paintings of horses have never been surpassed for realism and accuracy. Among his best known pictures are "The Grosvenor Hunt," "Horse Affrighted by a Lion," "The Brick Cart," "Warren Hastings," and "Horse and Jockey." In 1800 he exhibited his largest picture, measuring more than 13 feet by 8, which represents "Hambletonian beating Diamond at Newmarket."

STUBBS, or **STUBBE,** John (c.1543-1591). A Puritan zealot, born in Norfolk, England. He was possessed of a fiery zeal against Catholicism, and was so opposed to the Queen's proposed marriage with the Duke of Anjou that, in 1579, he published a pamphlet entitled *The Discoverie of a gaping gulf wherein England is like to be Swallowed by Another French Marriage if the Lord Forbid not the Banes by Letting Her Majestie see the Sin and Punishment Thereof.* Though the pamphlet spoke of the Queen in respectful and loyal terms, Stubbs, his publisher, and the printer were found guilty on a charge of disseminating seditious writings and were sentenced to have their right hands cut off. This cruel punishment was, in fact, inflicted upon Stubbs and the publisher in the market-place at Westminster. When Stubbs's right hand was stricken off, he waved his hat with his left, and cried out, 'God save the Queen!' Nor did the treatment he had received ever lessen his fidelity to his sovereign.

STUBBS, William (1825-1901). An English historian and prelate. He was born at Knaresborough, in Yorkshire, and educated at Ripon Grammar School and at Christ Church, Oxford, being elected to a fellowship at Trinity in the year of his graduation (1848), and ordained in the same year. His *Registrum Sacrum Anglicanum,* a calendar of the English bishops from Saint Augustine (1858), attracted the attention of Archbishop Longley by the learning displayed in it, and won for him the appointment of librarian at Lambeth Palace. In 1866 he was appointed regius professor of modern history at Oxford, and during the eighteen years of his tenure of this chair he had an exceedingly wide influence on historical study in England. His great *Constitutional History of England* (1874-78) at once took rank as the standard authority on the subject, down to the times of the Tudors. He was appointed canon of Saint Paul's in 1879, Bishop of Chester in 1884, and Bishop of Oxford in 1889. He died in London. His historical work was all of the careful modern type, based on faithful study of contemporary documents, many valuable specimens of which he edited. His *Historical Introductions to the Rolls Series* have now been rendered generally accessible by publication in one volume (ed. Hassall, London, 1903). Other notable works are: *Seventeen Lectures on the Study of Mediæval and Modern History* (1886; 3d ed. 1900); and *Councils and Ecclesiastical Documents Relating to Great Britain and Ireland,* edited with A. W. Haddan (1869-73). A volume of *Ordination Addresses* appeared after his death (1901). A complete list of his historical works may be found in Gross, *Sources and Literature of English History* (New York, 1900).

STUCCO (It., from OHG. *stucchi*, Ger. *Stück*, AS. *stycce*, piece, patch; connected with OHG. *stoc*, Ger. *Stock*, AS. *stocc*, Eng. *stock*, stake, club, Skt. *tuj*, to thrust). A composition used for the finer parts of plaster-work, such as cornices and enrichments. Gypsum (q.v.), or plaster of Paris, is used for this purpose. A coarser kind of stucco is also used for making floors, and for plastering the exterior of buildings. The Greeks used stucco to give a finer surface to their coarse stonework, even in their columns, before the finer marbles were used. The Romans also in the temples they built after the Greek manner in the late Republic stuccoed nearly all their exterior surfaces. This stucco was made partly of marble dust, was extremely fine and of a hard and brilliant finish, equal to marble. Stucco was also used for more artistic purposes in late classic art. While wet it was fashioned into ornamental or figured low reliefs. Ceilings and walls in baths (e.g. Pompeii and Roman thermæ), tombs (on the Via Latina), and private houses have preserved these decorations under the Empire, probably from Alexandrian models. Those found near the Farnesina in Rome and now in the Museo delle Terme are among the most charming decorative works of any period. Early Christian art continued the style, as is shown by the well-preserved internal decoration of the baptistery of the cathedral in Ravenna. It was not unknown to the Middle Ages, witness the angels in the church at Hildesheim, and it again became popular during the Renaissance, being profusely used in the ceilings of the later period, often with Rococo designs.

STUCK, stụk, Franz (1863—). A German painter and sculptor, one of the leaders of the so-called Secessionists (q.v.). Born at Tettenweis, Bavaria, he studied at the Munich Academy under Lindenschmit, and became first known through his drawings for the *Fliegende Blätter*, and the two series of art-industrial designs which appeared in Vienna under the titles *Allegorien und Embleme* and *Titel und Vignetten*, rugged rather than refined, but full of vitality and bold in treatment. His first paintings, "The Guardian of Paradise," "Innocentia," and "Fighting Fauns,' exhibited in Munich in 1889, were awarded the gold medal, initiating a series of artistic successes attendant upon his well-known landscapes enlivened with centaurs, fauns, and nymphs, and his impressive delineations of human passions, of which the figure of "Sin" (1893), Eve enfolded by a huge serpent, and, on a larger scale, the allegory of "War" (1894), both in the Pinakothek at Munich, have become particularly famous. In the meanwhile he had painted "Expulsion from Paradise," a "Pietà" (1892), and "Crucifixion" (1892, Stuttgart Museum), a startling deviation from the traditional treatment of this subject. A marked progress in the artist's power of expression was shown in "The Sphinx" (1895, National Museum, Budapest), "Evil Conscience" (1896), and "Procession of Bacchants" (1897). His plastic work, all small figures in bronze, exhibits the same powerful realism in the treatment of form as do his paintings. A characteristic example is the statuette of a "Faun" (National Gallery, Berlin; replicas Kunsthalle, Hamburg, and National Museum, Budapest). Consult the monographs by Bierbaum (Leipzig, 1899); Meissner (Berlin, 1899), and Weese (Vienna, 1903); also Schultze-Naumburg, in *Magazine of Art*, vol. xx. (London, 1896-97).

STÜCKELBERG, stụ′kel-bĕrk, Ernst (1831—). A Swiss genre and landscape painter, born in Basel. He studied under Dietler of that city, and in Antwerp, Paris, Munich, and Italy. In 1869 he won the gold medal at Munich. Among his pictures may be mentioned "A Procession in the Sabine Mountains" (1859, Basel), "The Children's Service" (1867), and "Charcoal Burners in the Swiss Mountains" (Zurich). In 1877 Stückelberg was commissioned to execute a large symbolic fresco, "The Awakening of Art," for the Gallery of Basel. He also won a competition, in the same year, for designs to fresco the Tell Chapel on the Lake of the Four Cantons. The work was completed in 1887.

STUCKENBERG, stụk′*e*n-bẽrg, John Henry Wilburn (1835-1903). An American Lutheran clergyman and author, born at Bramsche, Hanover. He emigrated to America with his parents when a very young man and settled in the West, was graduated from Wittenberg College, Ohio, in 1857, and studied in the universities of Halle, Göttingen, Berlin, and Tübingen. Coming back to America, he was ordained a Lutheran minister and held pastoral charges in Pennsylvania and Iowa. In 1873 he was made professor of theology in Wittenberg College, but in 1880 went to Germany again, where he became pastor of the American Chapel in Berlin. After many years in this service he returned to America and took up his residence in Cambridge, Mass. His later years were largely devoted to the study of theoretical sociology, to which he made valuable contributions. His chief works are: *History of the Augsburg Confession* (1869); *Christian Sociology* (1880); *Life of Immanuel Kant* (1882); and *Sociology* (1903).

STUCLEY, stūk′lĭ, or **STUKELY,** Thomas (c.1525-78). An English adventurer. He was the third son of Sir Hugh Stucley of Devonshire. About 1552 he went to France, and there gained the favor of the King, Henry II., who sent him to England to obtain information to be used in a projected attack on Calais. Stucley, however, revealed the nature of his mission to the English Government, but, instead of being rewarded, was imprisoned in the Tower.. In 1663, with the patronage of Queen Elizabeth, he pretended to join Ribault's colonization expedition to Florida, but instead turned privateer, and seized many French, Spanish, and Portuguese vessels. After two years of this life he was seized at Cork, but apparently was not brought to trial. For several years afterwards he was employed in Ireland, but, having intrigued with Spanish agents, he ultimately fled to Spain. In 1571 Stucley commanded three vessels at the battle of Lepanto, and seven years later, while in the service of Sebastian of Portugal, was killed in the battle of Alcazar in Morocco. He became the hero of numerous ballads and plays. One of these, *The Famous History of the Life and Death of Captain Thomas Stukely*, was printed "as it hath been acted," in London in 1605. It was reprinted in Simpson's *School of Shakespeare* (1878), with a biography of Stucley prefixed.

STUD-BOOK. A geneaological record of blooded stock. The British Stud-Book for horses is the oldest in existence and was first commenced in 1791. All the facts that are in existence regarding the evolution through systematic breeding of the modern horse is obtained through the British Stud-Book. There are similar records for cattle and dogs.

STUDER, stōō′der, BERNHARD (1794-1887). A Swiss geologist, born at Büren, Canton of Bern. He studied at Bern, Göttingen, and Paris, and in 1825 was made professor of geology in Bern, where he labored continuously until 1873. Some of the more important of his works are: *Beiträge zu einer Monographie der Molasse* (1825); *Geologie der westlichen Schweizeralpen* (1834); *Lehrbuch der physikalischen Geographie und Geologie* (1844-47); *Geologie der Schweiz* (1851-53); and *Zur Geologie der Berner Alpen* (1866).

STUHLMANN, stōōl′män, FRANZ (1863—). A German zoölogist and African explorer, born in Hamburg. After studying at Tübingen and Freiburg, he went to East Africa in 1888, and during the revolt of the Arabs in 1890 entered the German corps of defense as a lieutenant, and was severely wounded at Mlembule. After his recovery he joined the expedition of Emin Pasha to the lake region, was sent ahead from Undussuma to Lake Victoria, and reached the coast in July, 1892, at Bagamoyo, whence he returned to Germany with valuable cartographic material and rich collections, to which he added copiously on another trip to German East Africa, undertaken in 1893-94 by order of the Government. He published *Zoologische Ergebnisse einer in die Küstengebiete von Ostafrika unternommenen Reise 1888-90* (1893-1901), and *Mit Emin Pascha ins Herz von Afrika* (1894).

STUHLWEISSENBURG, stōōl′vī′sen-bōōrk (Hung. *Székes-Fehérvár*). A royal free city, capital of the county of the same name, Hungary, 35 miles southwest of Budapest (Map: Hungary, F 3). The episcopal palace and the cathedral are noteworthy edifices. The manufactures of woolens, silks, and knives are extensive and the agricultural interests prominent. Stuhlweissenburg is the Alba Regia of the Romans. From the eleventh to the sixteenth century the kings of Hungary were crowned there; afterwards the ceremonial took place at Pressburg. The city was held by the Turks from 1543 to 1688, with the exception of the period 1601-02. Population, in 1890, 28,942; in 1900, 32,167.

STUKELY, stūk′lĭ, WILLIAM (1687-1765). An English antiquary, born at Holbeach, Lincolnshire. He graduated at Bennet (Corpus Christi) College, Cambridge, in 1708. With Roger Gales he made long antiquarian tours in various parts of England. Among his many published works are: *An Account of a Roman Temple and Other Antiquities, near Graham's Dike in Scotland* (1720); *Itinerarium Curiosum* (1724; 2d ed. 1776); *Stonehenge* (1740); *Abury, a Temple of the British Druids* (1743); *Palæographia Britannica* (1743-52); and *The Medallic History of M. A. V. Caurasius* (1757-59).

STÜLER, stụ′lẽr, FRIEDRICH AUGUST (1800-65). A German architect, born in Mühlhausen, Thuringia. He studied first in Berlin and afterwards in France and Italy. Appointed Court inspector of buildings at Berlin in 1830, he was two years later put at the head of the architectural commission of the royal palace. His principal buildings include the New Museum (1843-55), the churches of Saint Bartholomew (1854-58), Saint James (1845), Saint Mark (1848-55), and Saint Matthew (1846), as well as parts of the royal palace in Berlin, the Academy of Sciences at Budapest, the National Museum of Stockholm (1850-66), the Museum at Cologne (1855-61), the reconstructed Winter Palace at Saint Petersburg, the University at Königsberg (1844-63), and the reconstruction of the Stolzenfels Castle and the Hohenzollern Castle (1850-67).

STUMM, stụm, KARL FERDINAND, Baron von Halberg (1836-1901). A German manufacturer and politician, born in Saarbrücken. He studied in Bonn and Berlin, and in 1858 became the head of the family firm which had for many years owned the great iron works at Neunkirchen. He was a member of the Prussian Chamber from 1867 till 1870, and of the Reichstag from 1867 till 1881, and from 1889 till his death in 1901; and was one of the founders of the German Reichspartei. Over his thousands of workmen he exercised a sort of paternalistic rule, and he furnished them with hospitals, technical schools, a library, model dwellings, and many other advantages. He was bitterly hostile to socialism.

STUMPF, stụmpf, KARL (1848—). A German psychologist, born at Wiesentheid, Bavaria. He studied at Würzburg and Göttingen, being especially influenced by the teachings of F. Brentano and R. H. Lotze. After qualifying as privat-docent at Göttingen, in 1870, he was appointed to the chair of philosophy successively at Würzburg (1873), Prague (1879), Halle (1884), Munich (1889), and Berlin (1894), where he instituted the psychological seminar. In 1895 he became a member of the Prussian Academy of Sciences. His publications include numerous monographs upon psychology, æsthetics, ethnology, epistemology, and especially upon physical and psychological acoustics. They comprise: *Ueber den psychologischen Ursprung der Raumvorstellung* (1873); *Tonpsychologie* (1883-90); *Tafeln zur Geschichte der Philosophie* (2d ed. 1900); *Psychologie und Erkenntnistheorie* (1891); *Beiträge zur Akustik und Musikwissenschaft, I. Consonanz und Dissonanz* (1898). He is best known by his contributions to the psychological study of sensations of tone and their use in music.

STUNDISTS (from Ger. *Stunde*, hour lesson; so called from their meetings to read the

Bible). A Russian sect, which owes its origin to German influences. It has gained many converts among the peasants, particularly since 1870, and has attracted the hostile attention of the Government. The Stundists bear some resemblance to the Anabaptists, give to the sacrament a purely symbolic interpretation, and hold communistic views concerning property. They are most numerous in Little Russia and Bessarabia.

STUPA. A form of Buddhist architecture in India. See TOPE.

STURDY. A disease of sheep. See GID.

STURDZA, st͞oord'zȧ, ALEXANDER (1791-1854). A Moldavian publicist and diplomat, educated in Germany and afterwards in the service of Russia. His *Mémoire sur l'état actuel de l'Allemagne,* published at the Congress of Aix-la-Chapelle in 1818, by order of Alexander I., aroused great indignation in Germany because of the unbecoming levity with which its author arraigned the German national character and branded the universities as hotbeds of the revolutionary spirit and atheism. In 1819 he settled at Dresden, married a daughter of Hufeland, and subsequently retired to his estate of Mansyr, Bessarabia. Of his other writings may be mentioned *La Grèce en 1821* (1822); a biography of Hufeland (1837); and *Œuvres posthumes religieuses, historiques, philosophiques et littéraires* (1858-61).

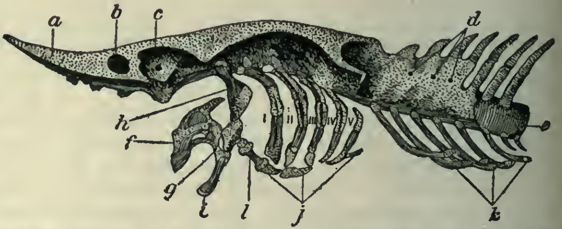
STURDZA, DEMETER (1833—). A Rumanian statesman and author. He studied political science at Munich, Göttingen, Bonn, and Berlin, became Minister of Public Instruction in 1859, and was one of the most zealous promoters of the overthrow of Cuza and the election of Prince Charles of Hohenzollern, in 1866. In the Cabinet of Bratianu, 1876-88, he held repeatedly ministerial posts, and in 1895-96 presided over a National-Liberal Ministry. Again in 1897-99 and since 1901 he was at the head of the Government as president of the Council and Minister of Foreign Affairs. He wrote *Le Marche progressive de la Russie sur le Danube* (1878); *Uebersicht der Münzen und Medaillen des Fürstentums Rumänien* (1874); *Europa, Russia, Romania* (1888); *La question des portes de fer et des cataractes du Danube* (1899); and *Charles I., roi de Roumanie* (1899 et seq.).

STURE, st͞oo're. A noble family of Sweden which played a very prominent part in the affairs of that country in the fifteenth and sixteenth centuries and became extinct in 1616. Its chief representatives were: (1) STEN STURE the Elder (d.1503). He was a son of Gustaf Sture and the nephew of King Charles VIII., on whose death, in 1470, he became Regent of Sweden, in spite of the opposition of the Swedish nobility, who supported the claims of Christian I. of Denmark. He defeated the Danish King in the battle of Brukeberg, near Stockholm (1471). He introduced printing, and founded the University of Upsala (1477). In 1497 he was forced to resign his place to John of Denmark, but regained power in 1501 and ruled till his death (1503). He was followed by (2) SWANTE NILLSON STURE, a kinsman, who also kept the Danes and the nobility in check and died in 1512. (3) The latter's son, STEN STURE the Younger, aided by the peasantry, foiled the plan of the nobles to place Trolle, one of their own number, in power, gained the Regency for himself, twice defeated (1517 and 1518) Gustaf Sture, Archbishop of Upsala, whom he had deposed in 1517, and was himself defeated and mortally wounded in a battle against Christian II. of Denmark at Bogesund in 1520. His widow, Christina Gyllenstierna, held Stockholm until the new King guaranteed a constitutional government. His son (4) SWANTE STURE, though a loyal partisan of the House of Vasa, was murdered by Eric XIV. (1567).

STURGEON (AF. *sturjoun*, OF., Fr. *esturgeon*, Sp. *esturion*, It. *storione*, from ML. *sturgio*, *sturio*, from OHG. *sturjo*, *sturo*, Ger. *Stör*, AS. *styria*, *stiriga*, sturgeon; perhaps connected with OHG. *stōran*, Ger. *stören*, AS. *styrian*, Eng. *stir*). A large fresh-water fish of the ganoid family Acipenseridæ. Sturgeons have an elongated, subcylindrical body, armed with five rows of bony plates or bucklers, each bearing a median keel. The head is covered by bony plates joined by sutures. The snout is produced; the mouth is inferior, opening on the under side of the head, protractile and without teeth. Just anterior to the mouth there are four barbels. The tail has the upper lobe much larger than the lower. There is a single dorsal fin, placed like the anal fin far back. They have a large air bladder, connected by a tube with the œsophagus. About 25 species, in two genera, are recognized, all inhabitants of the fresh waters and seas of the northern regions. Most of the species are migratory and ascend streams to spawn, but some live permanently in fresh waters. They spawn in the spring and summer, and are very prolific, a large female producing from two to three million eggs, constituting from a fifth to a third of its entire weight. They feed on small animals and plants, which they suck into their mouth. The common sturgeon (*Acipenser sturio*), of the coasts and rivers of Europe and Northeastern America, has been known to weigh 500 pounds. The lake or rock sturgeon (*Acipenser rubicundus*), once very abundant in the Great Lakes and the Mississippi Valley, attains a weight of 200 pounds,

A FOSSIL STURGEON.

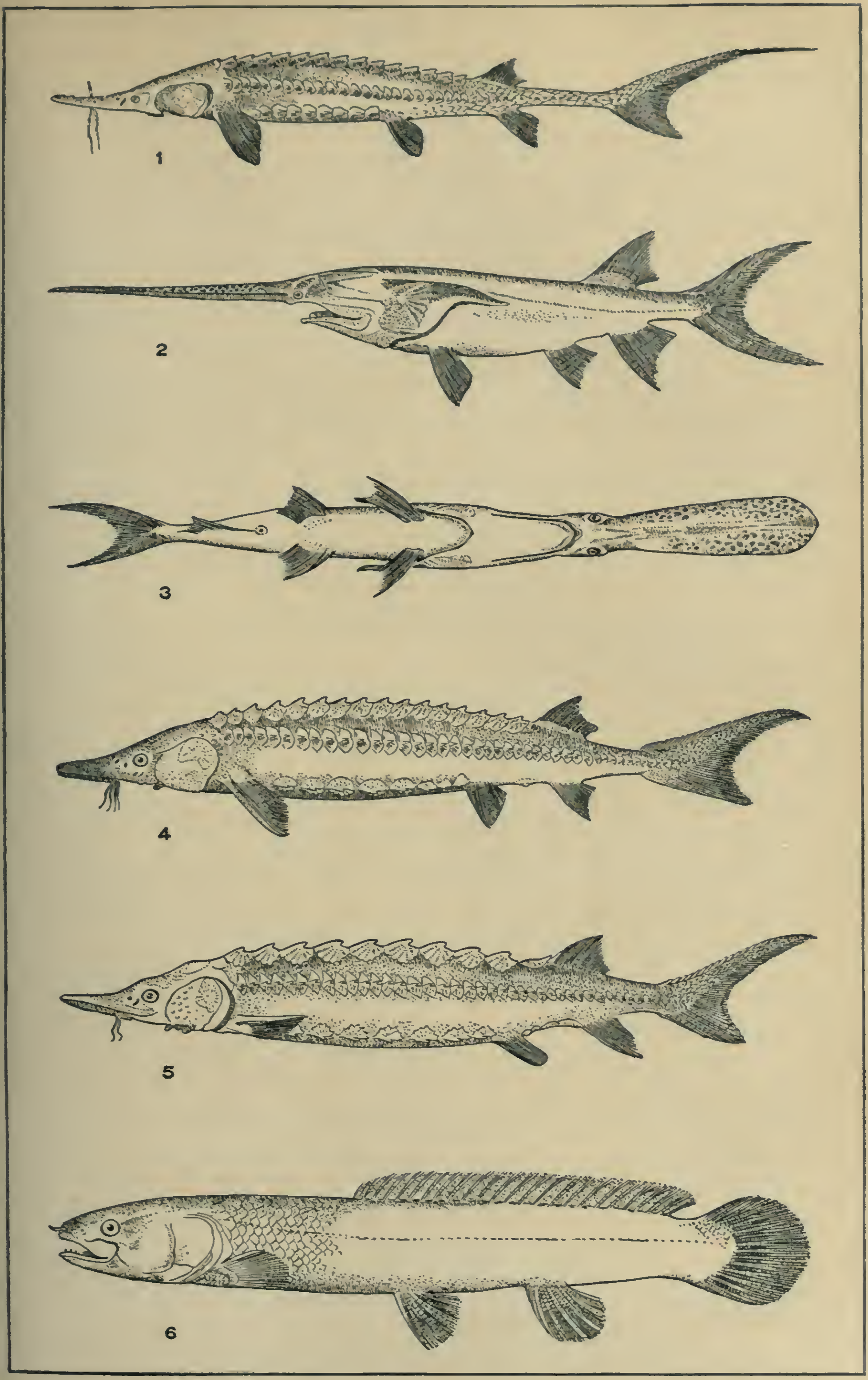
A long-beaked sturgeon (*Belonorhynchus striolatus*) fossil in the Trias and Lias formations of the Old World.



SKULL OF A STURGEON WITH MEMBRANE BONES REMOVED.

a, Rostrum; *b*, nasal capsule; *c*, eye-socket; *d*, foramina for spinal nerves; *e*, notochord; *g*, quadrate bone; *h*, hyomandibular bone; *i*, mandible; *j*, basibranchials; *k*, ribs; *l*, hyoid bone; I, II, III, IV, V, branchial arches.

STURGEONS, PADDLE-FISH, AND BOWFIN



1. SHOVEL-NOSED STURGEON (Scaphirhynchus platyrhynchus).
2. PADDLE-FISH (Polyodon spathula), side view.
3. PADDLE-FISH, ventral view.
4. LAKE STURGEON (Acipenser rubicundus).
5. COMMON STURGEON (Acipenser sturio).
6. BOWFIN (Amia calva); in proportion to the other figures much enlarged.

but the average is much less. Its sides are reddish, often with irregular blackish spots. Very peculiar in its prolonged paddle-shaped snout is the 'shovelnose' or 'white' sturgeon (*Scaphirhynchus platyrhynchus*), which is pale olive in color and about five feet long. It is a denizen of the Western and Southern States. Similar species occur in Asia. The largest of American sturgeons is that of the Pacific Coast (*Acipenser transmontanus*) called 'white' in comparison with the rare 'green' sturgeon (*Acipenser medirostris*). The former weighs 300 to 600 pounds, and is used as food, but the latter, which is nearly as large, but olive green, is not eaten. A giant beside these is the great Russian 'bielaga' or 'huso' (*Acipenser huso*), which has been known to attain a length of 20 to 25 feet and a weight of 3000 pounds. It is this species, once extremely abundant in the Danube, Volga, and other large rivers emptying into the Black and Caspian seas, which has furnished mainly the salted roe called caviar (q.v.), though some comes from the diminutive sterlet (*Acipenser ruthenus*) of the same region. The air bladder is also utilized for making isinglass.

Fossil sturgeon remains indistinguishable from the corresponding portions of the skeletons of modern species have been found in rocks as old as the Eocene. Earlier less specialized ancestral forms are Chondrosteus of the Jurassic and perhaps also the still older Palæoniscus of the Permian and Cheirolepis of the Upper Devonian. See Chirolepis; Chondrosteus; Palæoniscus.

Consult authorities cited under Fish and Fisheries; and see Plate of Sturgeons.

STURGEON, stŭr′jŭn, William (1783-1850). An English electrician, born at Whittington, in Lancashire. As early as 1823 he constructed a soft-iron electro-magnet, and in 1830 described for the first time the process of amalgamating the zinc plate of a battery with mercury. In 1832 he constructed an electro-magnetic rotary engine, the first contrivance by means of which any considerable mechanical force was developed by the electric current; and he shares the honor of this invention with Oersted. Five years afterwards he produced an electro-magnetic coil for giving shocks. About the same time he ascertained by means of kites that in fair weather the atmosphere is positive with regard to the earth. Later he devised and constructed the commutator, now in universal use. Among his works are: *Experimental Researches in Electro-Magnetism, Galvanism, etc.* (1830); *Lectures on Electricity Delivered in the Royal Victoria Gallery, Manchester* (1842); *Twelve Lectures on Galvanism* (1843); and *Scientific Researches* (1850).

STURGEON BAY. The county-seat of Door County, Wis., 45 miles northeast of the city of Green Bay, on a canal connecting Green Bay and Lake Michigan, and on the Ahnapee and Western Railroad (Map: Wisconsin, F 4). It has considerable industrial importance. There are canning establishments, ship yards, and manufactories of lumber, beer, flour, foundry and machine-shop products, etc. Population, in 1890, 2195; in 1900, 3372.

STUR′GIS, Russell (1836—). An American architect and author, born in Baltimore, Md. He studied architecture in New York and in Europe, and practiced his profession from 1865 till 1880. In that time he designed Battell Chapel, Farnam Hall, Durfee Hall, and Lawrence Hall of Yale College; the Homœopathic Medical College and Flower Hospital in New York, and many other buildings in various parts of the country. In 1878 he became professor of architecture and the arts of design in the College of the City of New York, but resigned in 1880 on account of ill health, and went abroad for five years. After 1885 he was editor of decorative art and mediæval archæology of the *Century Dictionary;* editor of fine arts of *Webster's International Dictionary;* and editor of archæology and fine arts of *Johnson's* (now Appleton's) *Universal Cyclopædia* (ed. of 1893-95). In January, 1898, he began editing the "Field of Art," a department in *Scribner's Magazine.* His published works include: *Manual of the Jarves Collection of Early Italian Pictures* (1868); *European Architecture: An Historical Study* (1895); *Annotated Bibliography of Fine Art* (1897); and *How to Judge Architecture* (1903). He contributed articles on art subjects to the *New International Encyclopædia*, and he was the editor and chief author of the *Dictionary of Architecture and Building* (1901-02).

STURGIS, Samuel Davis (1822-89). An American soldier, born at Shippensburg, Pa. He graduated at West Point in 1846, served through the Mexican War, and was taken prisoner during the operations before Buena Vista. At the outbreak of the Civil War he was obliged to abandon Fort Smith, Ark., of which he was commandant, but succeeded in saving his command. As major of the Fourth Cavalry he served in 1861 under General Lyon, and succeeded to his command at Wilson's Creek (q.v.). He was prominent at South Mountain, Antietam, Fredericksburg, and in the operations in Kentucky and Ohio in 1863-64, in January of the latter year capturing General Vance and his command and routing General Martin's Confederate cavalry. Later he took an important part in an expedition against General Forrest. In 1869 he was promoted to be colonel of the Seventh Cavalry. From 1881 to 1885 he was governor of the Soldier's Home near Washington, and the next year he retired from active service.

STURLUSON, Snorri. See Snorri Sturluson.

STURM, stu̥rm, Jacques Charles François (1803-55). A French mathematician, born at Geneva. He was educated at the Academy of Geneva, and in 1827, with his friend Colladou, took the *Grand prix de mathématiques* for the best memoir on the compression of liquids. The famous theorem that bears his name was discovered in 1829. A statement of the results secured by this theorem requires the definition of Sturm's functions: If $f(x) = 0$ be freed from equal roots, and $f(x)$ be divided by $f'(x)$ (the derivative of $f(x)$), and the last divisor by the last remainder, changing the sign of each remainder before dividing by it, until a remainder independent of x is obtained, or else a remainder which cannot change its sign, then $f(x)$, $f'(x)$, and the successive remainders, constitute Sturm's functions. The theorem asserts that if, as x increases, $f(x)$ passes through the value zero, Sturm's functions lose one change of sign; if any other of Sturm's functions vanishes, there is neither loss nor gain in the number of changes of sign; the number of roots of $f(x)=0$ between a and b is equal to the difference in the number of changes of sign in Sturm's functions, when $x=a$ and when $x=b$. In 1838 Sturm began teaching in the Ecole Polytechnique, and two years later was elected to the chair made vacant by the death of Poisson.

STURM, or **STUR′MIUS**, JOHANNES (1507-89). A prominent educator of the sixteenth century. He was born near Cologne, and was educated at Leyden and Louvain. In 1537, at the instance of the magistrates of Strassburg, he organized the Strassburg Gymnasium, which he directed for forty-three years. He was relieved from his position in 1581 on account of religious disputes and differences. Through his system of gradation of classes, practically the same that still prevails in all German gymnasia, the classification of literary material for use in schools, the writing of text-books, and the organization of school management, he shaped the practice of secondary education not only in the German schools, but also in the great secondary schools of England and France.

STURM, stōōrm, JULIUS (1816-96). A German poet, born at Köstritz, Reuss. After studying theology at Jena (1837-41), he was private tutor to the hereditary prince Henry XIV. of Reuss, then pastor at Göschitz, near Schleiz, in 1851-57, and at Köstritz from 1857 to 1885. He died at Leipzig. All his lyrics reveal him as a poet of deep religious sentiment and genuine national spirit. The religious poems are incorporated in the collections *Fromme Lieder*, three parts (1852, 1858, 1892); *Zwei Rosen oder das Hohe Lied der Liebe* (1854); *Von der Pilgerfahrt* (1868); *Gott grüsse dich* (1876); *Dem Herrn mein Lied* (1884); *Palmen und Krone* (1888); and others; while the volumes with secular contents include: *Für das Haus* (1861); *Lieder und Bilder* (1870); *Kampf-und Siegesgedichte* (1870); *Spiegel der Zeit in Fabeln* (1872); *Kinderleben* (1877), illustrated by Ludwig Richter; *Immergrün* (1880); *Natur, Liebe, Vaterland* (1884); *In Freud und Leid* (1896). For his biography consult Hepding (Giessen, 1896), and Hoffmann (Hamburg, 1898).—His son AUGUST (1852—), born at Göschitz, also won reputation as a poet. He studied at Jena, Leipzig, and Berlin, first theology, afterwards law, which he practiced at Naumburg, since 1884, having in the meanwhile lived as assessor at Rudolstadt (1880-82) and, given to literary pursuits, in Berlin (1882-84). Besides the epic poems, *Merlin* (1892), *Kaiser Friedrich der Edle* (1896), *König Laurins Rosengarten* (1897), and *Der König von Babel* (1902), he published *Hohenzollernsagen, Balladen* (1898); the lyrics *Auf Flügeln des Gesanges* (1883); *Lied und Leben* (1889); *Auf der Höhe* (1902); and others; several dramas and the sketches in prose, *Sylter Skizzen* (1887); also a series of juridical works, notably *Revision der gemeinrechtlichen Lehre vom Gewohnheitsrecht* (1900).

STURT, Sir CHARLES (1806-69). An Australian explorer. He was born in Bengal, India, of English parents; was educated in England; entered the British Army; and in 1825 went to New South Wales. In 1828 he headed an exploring expedition which penetrated the interior of Australia and discovered the Macquarie, Castlereagh, and Darling rivers, and in 1830 the Murray River, which he descended to Lake Alexandrina. Another expedition in 1844 reached the desert in the centre of the continent. He subsequently held high colonial positions. He became totally blind as a result of the hardships he had undergone, and returned to England in 1853; he was knighted shortly before his death. He published *Two Expeditions into the Interior of Southern Australia, 1828-31* (2 vols., 1833), and *Narrative of an Expedition into Central Australia in 1844* (2 vols., 1849).

STURZ, stōōrtz, HELFERICH PETER (1736-79). A German author, born at Darmstadt. He studied law (1753-58) at Jena, Giessen, and Göttingen, was appointed secretary in the department of foreign affairs at Copenhagen in 1764, soon after private secretary to Count Bernstorff, and in 1768 accompanied King Christian VII. to England and France. Involved in Struensee's downfall in 1772, he was imprisoned and banished from Copenhagen, but appointed again to a position at Oldenburg in 1773, and died at Bremen. His title to the reputation as one of the most tasteful German prose writers is amply demonstrated by the exquisite *Briefe eines Reisenden* (1777), and his *Erinnerungen aus dem Leben des Grafen von Bernstorff*. Consult the biography by Max Koch (Munich, 1879).

STUTTERING. Imperfect action of the organs of articulation resulting in defective speech. See STAMMERING.

STUTTGART, stụt′gärt. The capital of the Kingdom of Württemberg, Germany, situated at an elevation of 890 feet, about 2 miles south of the Neckar, and 45 miles north of Tübingen (Map: Germany, C 4). Stuttgart occupies a delightful site surrounded by attractive suburbs and amid lovely vine-clad heights. The pronounced adherence of its many fine architects to the Renaissance types explains the stately appearance of the city.

The spacious Königstrasse extends diagonally from southwest to northeast through the old or inner city and borders the majestic Schlossplatz—the centre of interest. Here rises the impressive King William column (93 feet) embellished with allegorical figures. Here too are the splendid Königsbau, the palace of the Crown Prince, the Residenz-Schloss (palace), the royal theatre, and the royal stables. The fine statue of Schiller by Thorwaldsen, erected in 1839 by national subscription, is near by. Adjacent also is the striking Gothic Stiftskirche, begun in 1436. Southeast of the Old Palace is the palace of King William II., where the fine modern Neckarstrasse begins its course northeastward. In the immediate vicinity are housed the Württemberg archives and also the extensive and valuable natural history collections of Stuttgart. The royal public library near at hand contains upward of 500,000 volumes, 4000 manuscripts, and many specimens of early printing. The library building holds also the museum of Württemberg antiquities, among which may be seen ceramics, weapons, and articles taken from ancient tumuli and lake dwellings. In the rear of the library is the large modern Palace of Justice. Between the library and the Residenz-Schloss stands a spacious and famous academy —the Karlsschule. Extending northeast from this vicinity and along the Neckarstrasse is the beautiful Schlossgarten. It embraces 200 acres, is 2 miles long, and is embellished with ponds, flower designs, and sculptures. Here are found the botanic garden, the mint, and the notable Stuttgart museum of art with its collections of sculpture and painting. In the northwest section of the city stands the Polytechnic Institute (over 1000 pupils) building facing the delightful Stadtgarten—one of the popular resorts. In the eastern part of Stuttgart is the immense new Liederhalle. In the vicinity of the Schlossplatz is found the modern Renaissance edifice of the Landesgewerbe Museum.

Among the prominent new buildings in Stuttgart are the Queen Olga buildings, the new Town Hall, the Catholic Church of Saint Nicholas, and the Peace Church. The Uhlandshöhe and the Jägerhaus may be especially noted among the delightful resorts in the environs, as well as the royal country seat Wilhelma—a fine Moorish structure begun in 1842. Stuttgart has an art academy, the Württemberg Art Union with a permanent exposition of modern masters, an architectural school, an exposition of export products, the provincial industrial museum, a famous conservatory of music, an industrial and commercial library, and a chemical laboratory. It is the leading printing and book-publishing city of Southern Germany. Among its prominent manufactures are furniture, carriages, pianos, paper, leather, chemicals, colors, jewelry, bells, cigars, portmanteaux, chocolate, and especially cottons. Hops, cloth, and horses form special items in the trade. The city—the seat of all the important administrative offices of the kingdom—is under the general supervision of the royal Government. There are an over-burgomaster, two advisers, and a council of some 24 members. The population, in 1900, was 176,699, mainly Protestants.

History. Stuttgart is first mentioned in 1229. It became the official capital of Württemberg in 1482; but it did not begin to improve and assume its present splendid proportions until about 1800. Consult: Klaiber, "Stuttgart," in *Europäische Wanderbilder* (Zurich, 1892); Widmann, *Wanderung durch Stuttgart und Umgebung* (Stuttgart, 1896).

STUYVESANT, stī′ve-sant, Peter (1592-1672). A Dutch Governor of New York. He was born in Holland; early entered the military service of the Dutch in the West Indies, and in 1634 was made Director of the Colony of Curaçao. In 1646 the Dutch West India Company appointed him Director-General of their colony in North America, New Netherland, where he soon gained the confidence of the colonists by his efficient administration and public improvements. He reconciled the Indian tribes who had been made hostile by former unjust treatment, and succeeded in arranging with the New England commissioners, in 1650, the boundaries between the English and Dutch territories, but this was not entirely satisfactory to the Dutch colonists, who claimed that the Governor had ceded considerable territory to which they were rightfully entitled. A convention of delegated colonists in 1653 demanded for the people, among other things a share in the appointment of local officers, but Stuyvesant ordered them to disperse forthwith, claiming that his authority was not from the people, but from God and the Dutch West India Company. The protracted contentions of the Dutch and the Swedes dwelling near the Delaware River about governmental jurisdiction became more critical in 1654, when the Swedish Governor seized the fort built by the Dutch where Newcastle now stands. To end this trouble, Stuyvesant in 1655 with 600 men sailed up the Delaware, recaptured the fort, and established the Dutch authority over the entire territory. Aften nine years of undisturbed quiet, in 1664 a force of English soldiers arrived under Colonel Nicolls, who demanded a surrender of the Government, on the ground that the whole territory had been given by royal charter to the Duke of York. The town at the time contained 1500 inhabitants and was defended by a stone fort and twenty cannon. Stuyvesant at first refused, but finding the people anxious to exchange rulers, he yielded to the English demand. Stuyvesant, in 1665, reported personally to the authorities in Holland, but soon returned to New York, where he spent the remainder of his life, cultivating an extensive farm called the Bouwerij (Bowery). He was buried where Saint Mark's Church now stands, and the elaborately inscribed stone that covered his grave is built into the eastern wall of the church. Consult the brief biography by Tuckerman (New York, 1893); and O'Callaghan, *The History of New Netherland* (ib., 1848).

STYE, or **STY** (formerly also *stian*, from AS. *stīgend*, stye, pres. part. of *stīgan*, Goth. *steigan*, OHG. *stīgan*, Ger. *steigen*, to rise; connected with OIr. *tiágaim*, I go, Lat. *ve-stigium*, footprint, Lett. *stiga*, path, OChurch Slav. *stignanti*, to hasten, Gk. *στείχειν*, *steichein*, to go). The popular name for an acute inflammation occurring around the follicle of an eyelash. It generally goes on to suppuration. It is known to surgeons under the term *hordeolum*. It begins as a small, red, tense swelling, accompanied with considerable itching, and a feeling of stiffness. As the inflammation goes on, the lid may become so swollen as to keep the eye closed. In a few days pus forms; a yellowish point appears at the apex of the swelling; and when the cuticle gives way, pus and a small slough of connective tissue escape, after which there is a general remission of the symptoms, and the eyelid soon resumes its natural state.

The treatment includes the use of cold compresses to abort the stye, hot ones to hasten suppuration, and evacuation of pus when it appears. Errors of refraction should be corrected and the general health improved in order to prevent recurrence. The stye should never be rubbed (notwithstanding the common prejudice in favor of rubbing it with a gold ring).

STYLITES. See Pillar Saints.

STYLOBATE (Lat. *Stylobata*, *stylobates*, from Gk. *στυλοβάτης*, base of a pillar, from *στῦλος*, *stulos*, pillar + *βαίνειν*, *bainein*, to go). The topmost step of the crepidoma (*κρηπίδωμα*) or substructure of a Greek temple. This consists of the foundations, or stereobate, and the surrounding steps, usually three in number. On the topmost step, the true stylobate, rest the columns. The term is sometimes extended to apply to the whole series of steps.

STY′LONU′RUS (Neo-Lat., from Gk. *στῦλον*, *stylon*, acc. sg. of *στῦλος*, *stylos*, pillar + *οὐρά*, *oura*, tail). A gigantic extinct arthropod, allied to Eurypterus, with a body about 6 feet in length and with five pairs of legs, of which the posterior pair is much elongated, and a long spine on the tail. It is found in the Silurian and Devonian of Scotland and in the Upper Devonian of New York and Pennsylvania. Consult Beecher, "Restoration of Stylonurus lacoanus, a Giant Arthropod from the Upper Devonian of the United States," *American Journal of Science*, 4th series, vol. x. (New Haven, 1900). See Arthropoda; Eurypterus; Merostomata.

STYPTIC. An agent employed in surgery for the purpose of checking the flow of blood by application to the bleeding orifice or surface. See Bleeding.

STYRAX. See Storax.

STYRIA, stĭr′ĭ-ȧ (Ger. *Steiermark*). A duchy and crownland of Austria, bounded by Lower and Upper Austria on the north, Hungary on the east, Carniola and Carinthia on the south, and Carinthia and Salzburg on the west (Map: Austria, D 3). Its area is 8670 square miles. Styria is very mountainous. Its northern part belongs to the region of the central Alps, of which Styria takes in the Niedere Tauern, Rottenmanner Tauern, Dachstein, Totes Gebirge, and the Erzberg, the last named famous for its abundance of iron. The southern part is occupied by the Styrian Alps. The plains are generally small, but there are a large number of fruitful valleys along the Mur, Enns, and other rivers. Styria is watered chiefly by the Enns, Mur, Drave, and Save. There are many mountain lakes and mineral springs. Styria has a large proportion of productive land; the forests cover nearly one-half of the surface. Wheat, rye, corn, oats, and barley are the principal cereals. Hay is grown in large quantities, and cattle-raising is very important, especially in Upper Styria. Grapes and fruits are cultivated to a lesser extent. In mineral production Styria is one of the most important crownlands of Austria. In the output of lignite it ranks next to Bohemia, while in regard to iron it occupies the first place, supplying about 60 per cent. of the total output of Austria. It has also lead, zinc, sulphur, graphite, salt, and a great variety of useful earths and stones. The value of the mineral output of 1899 was about $5,000,000. The manufacturing industries are chiefly connected with the mineral products. There are large mills for the production of rails, sheet iron, wire, and smaller iron and steel articles. There are also several extensive machine shops, glass works, distilleries, breweries, tobacco factories, and paper mills. The principal domestic exports are fruits, timber, cattle, and metal products. The Diet of Styria is composed of 60 members, of whom 12 represent the landed aristocracy, 19 the towns and industrial centres, 23 the rural communities, and 6 the chambers of commerce and trades of Gratz and Leoben. In the Lower House of Austria Styria is represented by 27 delegates. In 1898 Styria had 903 public schools, attended by 182,000 children, or 95 per cent. of the total school population. The population was 1,282,708 in 1890, and 1,356,058 in 1900. About 68 per cent. are Germans and the remainder Slovenians. The population is Roman Catholic. Capital, Gratz (q.v.).

History. Under Roman control the territory of Styria formed a portion of both Pannonia and Noricum, and was even then famous for its iron and steel. During the period of the great migration of nations the various invaders of the Italian peninsula swept through or settled in this district and at the close its population was essentially Slavic. It was a portion of the empire of Charles the Great, and was later included in the Carinthian mark erected against the Hungarians. Soon after the middle of the eleventh century the Margrave Ottokar styled himself Margrave of Steier, whence the region came to be known as Steiermark (Styria). In 1192 the region that is now the Duchy of Styria became a portion of the possessions of the dukes of Austria, and after belonging for a time to Ottokar II. of Bohemia, passed in 1276 into the possession of the Hapsburgs. The Reformation was welcomed by the people, but the intolerance of the Austrian rulers drove many of the inhabitants into exile.

Bibliography. *Die Oesterreichisch-ungarische Monarchie in Wort und Bild*, vol. vii. (Vienna, 1890); Gsell-Fels, *Die Steiermark* (ib., 1898); Imendörfer, *Landeskunde von Steiermark* (ib., 1903); Rosegger, *Das Volksleben in Steiermark* (Gratz, 1895); Zahn, *Styriaca* (ib., 1894); new series, 1896); Mayer, *Geschichte der Steiermark* (ib., 1898).

STYX (Lat., from Gk. Στύξ, from *στυγεῖν*, *stygein*, to hate, loathe). In Greek legend, one of the rivers of the lower world. Probably originally the only stream which separated the region of the dead from the living. It was said that one-tenth of Oceanus streamed down to form the Styx, while the other nine-tenths surrounded the earth. As the goddess of this stream, Styx was the eldest daughter of Oceanus, and by the Titan Pallas mother of Zelos, Nike, Cratos, and Bia (Emulation, Victory, Might, and Force), with whom she joined Zeus at the beginning of the struggle with the Titans. For this she was made the guardian of the sacred oaths which bound the gods. She was described as living in the far west, in a house with silver pillars, where the water streamed from above. Thence Iris brought the water by which the gods swore, and terrible suffering awaited the divinity who committed perjury. With the development of the conceptions of the lower world, the rivers received various names, and Charon was introduced as the ferryman of souls across the Styx. The name was also given to a waterfall in northeastern Arcadia near Nonacris. The water descends over a cliff some 600 feet high on the side of Mount Chelmos into a wild and rugged glen, and the surroundings suggested to the Greeks the gloomy entrance to the lower world.

SUABIA. See Swabia.

SUAHELI, swȧ-hē′lĭ. A people of Africa. See Swahili.

SUAKIM, swä′kĭm, or **SUAKIN.** A seaport of Egyptian Sudan, on a small island in the Red Sea in about latitude 19° N., and longitude 37° E. (Map: Africa, H 3). It is connected with the desert mainland by a railroad bridge. The town consists of two main parts. The Government buildings and the residences of the official class in the one section present an imposing appearance in direct contrast to the wretched dwellings of the natives in the other section. Suakim is conspicuous as the embarking place for African pilgrims traveling to Mecca. It has a well-protected harbor and is an important shipping point for the products of the interior. These include ivory, tobacco, and gums. The imports for 1899 were valued at $900,000. The trade is increasing. The domestic manufactures are lance-heads, cutlery, and leather cases. Suakim was founded by the Turks, and was a leading slave port until the traffic was suppressed. The vicinity of Suakim was a battle-ground between the Anglo-Egyptians and Osman Digna in 1884 and 1890.

SUANITIANS, or **SWANS**. One of the Georgian peoples of the Caucasus, dwelling in the Transcaucasian Government of Kutais between the Imeritians and the Mingrelians.

SUÁREZ, swä'râth, Francisco (1548-1617). A Spanish theologian and scholastic philosopher. He was born at Granada, entered the Jesuit Order in 1564, and came under the direction of the great ascetic Rodriguez during his novitiate at Medina del Campo. The general of the society, Aquaviva, called him in 1578 to teach in Rome, where he remained seven years. Returning to Spain for reasons of health, he taught at Alcalá, Salamanca, and Coimbra. Besides his thorough knowledge of the Schoolmen, and especially of Thomas Aquinas, whom he usually follows, he displays remarkable familiarity with the writings of the first Christian centuries. His complete works were reprinted in 28 volumes (Paris, 1856-61). Consult Werner, *Franz Suarez und die Scholastik der letzten Jahrhunderte* (Regensburg, 1861).

SUBANDHU, sōō-bänd'hōō. A Sanskrit novelist, who lived probably in the seventh century A.D. Apart from a few verses he is known only as the author of the *Vāsavadattā*, a highly artificial romance dealing with the love of Prince Kandarpaketu for the Princess Vasavadatta. The action of the novel is very slight, and the style abounds in long compounds, puns, and assonances. The novel is important in Sanskrit literary history as being the first of the romantic school, and thus being the acknowledged model for the *Kādambarī* and the *Harṣacarita* of Bana (q.v.). It has been edited, with an admirable introduction, by Hall (Calcutta, 1859) and Vidyasagara (ib., 1874), and in Telugu script at Madras (1862). See Novel.

SUBANO, sōō-bä'nō. A Malay people in Sibuguey Peninsula, Zamboanga Province, Mindanao. See Philippine Islands.

SUBCONSCIOUSNESS. A term used somewhat indefinitely to cover weak and obscure mental processes which lie just above the limen of consciousness. Common instances are the sound of a clock and the roar of a stream which pass out of attention if long continued; or the overtones which determine the 'color' or timbre of a musical note, although they are not ordinarily recognized as distinct tonal qualities. Many psychologists hold that subconscious processes, even though they do not attract the attention, do nevertheless exert a determinate influence upon the course of mental events. It is, however, important to distinguish between mind considered for itself alone, without external reference, i.e. consciousness that is properly anoetic, and the vague background against which the more luminous parts of mind are focalized. (See Attention.) The factual existence of obscure processes which elude direct introspection and analysis by the attention is not to be confused with the *hypothesis* of the subconscious, which asserts that all past experience is conserved, not physiologically merely, but in a weakened form of consciousness. Consult: James, *Principles of Psychology* (New York, 1890); Stout, *Analytic Psychology* (ib., 1896). See Noetic Consciousness.

SUBDEACON. A member of an order in the ministry of the early Church and of the Roman Catholic and Eastern churches at the present day. The subdiaconate apparently originated later than the episcopate, presbyterate, and diaconate, and probably developed from the last named as deacons rose in importance. The function of the office is to assist the deacon, in modern times especially in the celebration of the Eucharist. In the Roman Catholic Church the subdeacon of the mass, who sings the epistle and in other ways assists in the service, is usually a priest. Consult Reuter, *Das Subdiaconat* (Augsburg, 1890), and see Orders, Holy; Deacon.

SUBDOMINANT. The interval one-fifth below the tonic, and the fourth degree of the scale.

SUBIACO, sōō'bē-ä'kō (Lat. *Sublaqueum*). A city in the Province of Rome, Italy, in the Sabine Mountains, 50 miles (of which 36 is by rail, 14 by diligence) east of the city of Rome, on the Teverone (ancient Anio) (Map: Italy, H 6). Here are to be seen walls and terraces of one of Nero's villas, and the famous monasteries of Santa Scolastica (founded in 530) and of San Benedetto. Here in 1465 the Germans Arnold Pannartz and Conrad Schweinheim published the first book printed in Italy, and copies of their editions of Lactantius, Cicero, and Augustine are still in the monastery library, which has lost, however, most of its precious manuscripts. San Benedetto contains thirteenth-century frescoes and paintings. Population (commune), in 1881, 7017; in 1901, 8005.

SUBINFEUDATION (from Lat. *sub*, under + ML. *infeudatio*, infeudation, from *infeudare*, *infeodare*, to confer in fee, from *in*, in + *feudum*, feud, fee, from OHG. *fihu*, AS. *feoh*, cattle, Lat. *pecu*, Skt. *paśu*, cattle). The act by which a feudal lord granted a portion of his lands to a tenant upon condition that the latter hold of the former subject to the incidents of feudal tenure. This was accompanied with the feudal ceremonies usual in those times. It was by this means that the feudal manors of England were created. As this practice tended to evade the feudal rules against alienation it was forbidden by the famous statute of Quia Emptores. See Feudal System; Manor.

SUBJECT (OF. *subject*, *suject*, *sujet*, *suget*, Fr. *sujet*, from Lat. *subjectus*, subject, inferior, p.p. of *subjicere*, to place under, from *sub*, under + *jacere*, to throw). A person who by reason of birth in a country or naturalization under its laws owes allegiance to its sovereign power. The term is almost exclusively employed to denote such a person under a monarchical form of government; whereas, the word citizen is applied to a member of a republic. The rights, privileges and duties of subjects, of course, depend upon the form of government, and they may differ in political rank and station; thus a duke or an earl is as much a subject of the crown of England as a peasant, although the former is entitled to certain dignities and honors which the latter does not possess. Until comparatively recent times (until 1870 in England) the governments of Europe almost universally refused to recognize the right of a subject to change his allegiance, but they now generally concede this privilege. The policy of the United States in permitting aliens to become citizens by naturalization has probably influenced such nations in changing their arbitrary and despotic attitude on this question, as, of course, it would lead to international difficulties if a naturalized citizen of the United States were to be treated as a subject of the nation whose sovereignty he had renounced in order to become a citizen of the Republic. See ALIEN; ALLEGIANCE; CITIZEN; NATURALIZATION, and the authorities referred to under these titles. Consult Morse, on *Citizenship*.

SUBKINGDOMS, ANIMAL. See CLASSIFICATION OF ANIMALS.

SUBLAPSARIAN. See INFRALAPSARIAN.

SUBLICIAN BRIDGE (Lat. *Pons Sublicius*). The most ancient of the bridges over the Tiber at Rome, ascribed by tradition to Ancus Marcius. The Sublician remained the only bridge at Rome until the second century B.C. It was twice carried away and restored and its piers remained through the Middle Ages. The last remnants were destroyed in 1877.

SUBLIMATION (Lat. *sublimatio*, an uplifting, from *sublimare*, to uplift, from *sublimis*, lofty, from *sub*, under + *limen*, threshold). A term applied to the distillation of those volatile solids that, when heated, pass into the gaseous state without melting. Such substances, including iodine, arsenic (i.e. arsenious acid), the chlorides of iron and aluminus, certain organic compounds, etc., may be readily freed by sublimation from non-volatile impurities. It may be observed that all solids, theoretically without exception, give off more or less vapor, i.e. sublime, even at extremely low temperatures, and of course the evaporation (q.v.) is accompanied by absorption of heat. Ordinarily the rate of evaporation of solids is too small to prevent the temperature from rising to the melting-point on the application of heat. But in the case of solids that are very volatile and have a somewhat high melting-point the heat applied may be largely used up by the rapid evaporation, and so the temperature cannot rise high enough for the substances to melt. Of course, by placing such substances in a closed vessel and thus preventing free evaporation, they may be readily caused to melt.

SUBLIME (from Lat. *sublimis*, lofty). A term applied either to objects arousing a certain æsthetic emotion, or to the emotion itself. The treatise "On Sublimity" ascribed to Longinus (q.v.), but probably belonging to the first century of our era, represents the first attempt to deal with the differentiating characteristics of the sublime. See ÆSTHETICS.

SUBLIME PORTE. See PORTE.

SUBLIMINAL CONSCIOUSNESS (from Lat. *sub*, under + *limen*, threshold). Literally a degree of consciousness below a certain theoretical limit of intensity and clearness.

Such a consciousness cannot be proved to exist by direct introspection, but has been assumed to account especially for four groups of facts. (1) People often execute blind, impulsive actions or feel curious likes and dislikes (e.g. shivering at grating sounds), for which no adequate reason can be found in consciousness. Hence they may be the product of subconscious processes. (2) Many complicated movements, like piano-playing, which at first necessitate highly attentive conscious control, become, with time, decreasingly conscious and finally automatic, yet they seem too complex ever to be purely mechanical. (3) Ideas sometimes appear in consciousness from no assignable source, i.e. neither connected with previous thoughts nor traceable to sense-perception. These may have originated subliminally and thence risen to clear consciousness. (4) A mass of 'borderland' and pathological phenomena, such as automatic writing, trance, post-hypnotic suggestion, double personality, reveals many instances in which complex, seemingly quite intelligent, and hence apparently conscious, actions are executed by individuals who are, nevertheless, entirely ignorant of what they say or do. In the phenomenon of alternating personality such experiences are so frequent and so well organized as to become aggregated into a so-called subconscious 'mind' or 'personality,' which, under certain conditions, e.g. trance, hysteria, and the like, becomes the conscious, dominating personality.

If, with the best authorities, we deny a subliminal consciousness, all four groups of facts must obviously be explained in terms of nervous action without consciousness. Organic tendencies, constitutional dispositions, and various hereditary instincts will then account for the first group of facts, secondary reflexes for the second, inaccurate introspection and unconscious (or marginally conscious) association for the third, and similar principles, supplemented perhaps by neuropathic conditions, for the fourth. The most elaborate argument in favor of a subliminal self is that of F. W. H. Myers.

See ATTENTION; NOETIC CONSCIOUSNESS; SUBCONSCIOUSNESS.

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SUBMARINE BOAT. See TORPEDO BOAT, SUBMARINE.

SUBMARINE GUN (from Lat. *sub*, under + *marinus*, pertaining to the sea, from *mare*, sea). A gun which discharges its projectile beneath the surface of the water. In 1797 a Frenchman, M. Reveroni Saint-Cyr, proposed to arm a catamaran with a submarine gun, but it does not appear that any attempts were made to do so. Robert Fulton and several other Americans attempted the actual construction of effective submarine guns, but with no practical results. Ericsson was the most successful, and his experiments with a submarine gun mounted in the bow of the specially built vessel the *Destroyer* extended over several years. The difficulty of securing accuracy, the shortness of range, and the improvement of the automobile torpedo have tended to discredit the gun. The *Destroyer* was sold to the Brazilian Government in 1892, but it was never thereafter used, and no subsequent attempts to employ a submarine gun have been made. Torpedoes are now discharged from submerged tubes, but these are not properly guns, as the projectile force is merely sufficient to force the torpedoes clear of the ship's side. See TORPEDO.

SUBMARINE MINES. See TORPEDO.

SUBMARINE TELEGRAPH. See TELEGRAPH, SUBMARINE.

SUBMAXILLARY GANGLION (from Lat. *sub*, under + *maxilla*, jaw, jaw-bone). One of the four sympathetic ganglia lying in the cephalic region, sometimes called cranial ganglia. The latter term is rather misleading, as none of the ganglia are within the cranial cavity. The submaxillary ganglion is situated above the deep portion of the submaxillary gland. (See SALIVARY GLAND.) It is connected by filaments with the lower border of the gustatory nerve (nerve of taste, supplying the tongue). It also receives motor filaments from the chorda tympani nerve, a branch of the facial. It is small, rounded, and of a reddish-gray color; its filaments of distribution, five or six in number, arise from the lower part of the ganglion, and supply the mucous membrane of the mouth and Wharton's duct, some being lost in the submaxillary gland. The other three ganglia are Meckel's, the ophthalmic, and the otic (qq.v.).

SUBORDINARY. A class of charges in heraldry (q.v.).

SUBORNATION OF PERJURY. The offense of procuring a person to commit perjury. Although only a misdemeanor at common law, in most jurisdictions to-day it is punished with the same severity as perjury. See PERJURY.

SUBPŒNA (Lat. *sub pœna*, under penalty, the initial words of the writ in its original form). A mandatory writ or process issued by a court, a quasi-judicial body, or an official having judicial powers, commanding a person or persons named therein to appear at a certain time and place and testify or furnish documentary evidence in an action or judicial proceeding. Originally a subpœna was used only to compel attendance of witnesses in court, but by statute in most States many officials and bodies having judicial powers, such as boards of commissioners, coroners, etc., are authorized to compel the attendance of witnesses by this process.

A subpœna intended only to compel the attendance of a witness for the purpose of giving testimony is known as a subpœna *ad testificandum.* Where it is necessary to put in evidence documents which are in the possession of a witness, he may be compelled to appear and produce them by a subpœna *duces tecum.* This form of subpœna is substantially like the one above mentioned, except that it specifically enumerates as far as possible the books, papers, and documents desired. In some code States a 'notice to produce' served by one attorney in an action on his opponent serves the same purpose.

In most States a subpœna may be served by any person of discretion, who usually must be eighteen years of age or upward, and service is made by delivering a copy of the subpœna to the witness personally, at the same time showing him the original, and paying or tendering his legal fees and expenses, which are fixed by statute.

Failure to appear in obedience to a subpœna is a contempt of court. It is usual for the party who caused the service of the subpœna to apply to the court for an order directing the witness to show cause why he should not be punished for contempt. Such a witness is also liable in a civil action for all damages which may have been caused by his non-appearance to the party calling him. A witness may be excused, in the discretion of the court, upon showing a reasonable cause for his absence, such as illness, death in family, etc.

Prior to 1852 a defendant was summoned to answer an action in a court of chancery in England by a subpœna *ad respondendum.* This practice has been superseded there by service of a copy of the bill instead, but still obtains in some jurisdictions in the United States. Such a subpœna corresponds more nearly in its purposes to a summons than a subpœna as above described. See SUMMONS; WITNESS; EVIDENCE. Consult the authorities referred to under PROCESS.

SUBROGATION (ML. *subrogatio*, from Lat. *subrogare*, *surrogare*, to substitute, from *sub*, under + *rogare*, to ask). The treatment of one who has paid the debt of another, which as between himself and that other should have been paid by the latter, as though he were the assignee of the creditor's claim. The payer is then said to be subrogated to all the rights and remedies of the creditor against the primary debtor. The doctrine upon which this subrogation is based was originally applied by courts of equity, but is now generally applied by courts of law to all cases where one pays a debt on which he is secondarily liable, although the debt may be legally discharged by the payment. Equity, for the purpose of working out justice between the parties by repaying the advances made, deals with the case as though the debt were still in existence, and gives to the person paying the debt precisely the same rights and remedies as belonged to the original creditor, but in no case does one by subrogation acquire any higher or different rights. It will thus be seen that the analogy between subrogation and assignment is complete, one who is entitled to be subrogated to a claim or demand being treated as though he were an assignee of the claim or demand. The only difference between them is the source and not the character of the right, the right to subrogation arising by operation of law and the right of an assignee arising by voluntary act of the parties.

Some of the more important cases in which the doctrine is applied are: (1) Where a junior mortgagor pays off a mortgage prior to his own, when equity will compel an actual assignment of the mortgage by the prior mortgagee. (2) When one pays a debt to the payment of which he is entitled to contribution by others, or for which others are primarily liable and he only secondarily, as in the case of a surety. In these cases, since the sole relief sought is payment of money, courts of law apply the doctrine, and give a complete remedy. (See CONTRIBUTION; SURETYSHIP; QUASI CONTRACT.) (3) In some jurisdictions, particularly in England, when one paying money to a corporation under an *ultra vires* contract cannot recover in quasi contract, although it is used by a corporation in paying its corporate indebtedness, in which case the person so advancing money is subrogated to the rights of the original creditor. (4) In the case of insurance contracts and contracts of indemnity generally whenever the insurer or indemnitor pays the indemnity due under his contract, when he is entitled to be subrogated to the rights of the person indemnified against third parties which may in any manner reduce the loss or obligation indemnified against. See INSURANCE; INDEMNITY; also CHANCERY; EQUITY.

SUBSCRIPTION (Lat. *subscriptio*, from *subscribere*, to subscribe, write under, from *sub*, under + *scribere*, to write). A popular rather than a technical term in law signifying a written contract by which a person agrees to contribute a sum of money for a specified purpose. The subscription may be made either as a gift, or it may be made as an offer to pay the money subscribed in exchange for property to be delivered to the subscriber. Whenever the person or corporation in whose favor the subscriptions are made has performed work or incurred expense or liability, relying upon such subscriptions, the courts have generally held that such expense or liability is a sufficient consideration for the subscription to make it a legally enforceable contract, entitling such persons or corporation to sue upon it. It has also been held that when there are several subscribers and each subscriber has fair notice that others are expected to subscribe to the same object or purpose, the promise of each subscriber is consideration for the promises of all the others. The soundness of such a doctrine may well be doubted and the authorities upon this point are in conflict. A subscription for stock of an existing corporation is generally deemed to be a mere offer which may be withdrawn at any time before acceptance, but which may be accepted at any time before withdrawal of the subscription by an allotment of the stock to the subscriber. Upon such acceptance the subscription becomes a valid contract which may be enforced by the corporation. See CONTRACT; CONSIDERATION.

SUBSIDIES (Lat. *subsidium*, relief, aid, auxiliary force, from *subsidere*, to sit down, remain, subside, from *sub*, under + *sedere*, to sit). A term in English history having reference to special tax assessments upon persons and not directly upon real property; in general European politics it has reference to grants of money to an ally to aid in the prosecution of war; while as a current economic term it applies to grants of money made by the State in aid of individual enterprises.

SUBSIDY AS A TAX. The subsidy was an income tax of 4s. in the pound upon the annual value of lands and a property tax of 2s. 8d. in the pound upon the actual value of goods. In this sense it was first used in the later part of the fifteenth century, but did not come into prominence until the reign of Henry VIII. From then until the Commonwealth it was the most important of the Parliamentary levies. The amount of the subsidy varied. In the eighth year of Elizabeth it brought £120,000; in the fortieth it was not above £78,000; it afterwards fell to £70,000. The subsidy finally became so unequal and uncertain that Parliament changed it into a land tax. This was first done under the Commonwealth, and, owing to its popularity, Charles II. continued it, though he did get one or two grants of subsidy.

SUBSIDIES TO ALLIES. Examples of subsidies of this kind are numerous in English history. Thus during the Seven Years' War England granted large sums to Prussia, one of her allies, as a means of enabling Frederick the Great to cope with his enemies, which included France. Again during the Napoleonic wars England furnished subsidies to several foreign powers.

GRANTS TO INDIVIDUALS. With regard to this class of subsidies, which is by far the most important at present, it may be said that almost the only enterprises that are the direct beneficiaries from Government aid are transportation companies, although it sometimes happens that other enterprises receive indirect benefit on account of Government patronage. Certain bounties, too, very nearly approach the idea of a subsidy. This is especially true of those on beet sugar, which, beginning in the days of Napoleon, have steadily increased in amount, until to-day the question of bounties on sugar has become one of great international importance.

RAILWAY SUBSIDIES. In most of the States of Continental Europe a large part of the original cost of railway construction was defrayed by Government aid. In Great Britain no railroads were subsidized, though some in Ireland were. In Canada the Canadian Pacific received large subsidies in the form of land grants from the Government. In the United States it has been a common practice to encourage and aid railway construction by State and municipal grants, chiefly in the form of subscriptions to their stock. The national Government has also contributed considerable toward the construction of certain railroads, and with one exception this has been in the form of land grants. (See LANDS, PUBLIC.) During the Civil War the importance of attaching the Far West to the Union by means of more direct railroads was seen, and in 1862 Congress passed an act granting to the Union and Central Pacific railroads a subsidy of more than $25,000 per mile in the form of a loan, which it was practically understood would never be repaid, together with 30,000,000 acres of land.

STEAMSHIP SUBSIDIES. See the article SHIPPING SUBSIDIES.

SUBSOILING. See PLOW, PLOWING.

SUBSTANCE (OF. *substance*, *substaunce*, Fr. *substance*, from Lat. *substantia*, being, essence, material, from *substare*, to stand under or among, from *sub*, under + *stare*, to stand). A term frequently used in logic and metaphysics. Substance is correlative with quality or attribute. Every substance must have attributes, and every attribute must be the attribute of some substance. The substance gold has the attributes weight, color, etc. But as every power or property of a thing, every way that the thing affects us, may be called an attribute or quality, if all the attributes are counted off, there is nothing left except the relations in which they stand to each other. But popular thought and popular philosophy assume that everything whatsoever possesses, besides its attributes, an unknown substratum; that they rest upon or inhere in a mystical and inscrutable thing, that holds the attributes together, without being itself an attribute.

This view appears at the very dawn of philosophical speculation, having been doubtless an inheritance from pre-scientific and pre-critical thinkers, and has persisted through all the centuries up to the present. It appears in the doctrine of the Ionic philosophers (see IONIC SCHOOL) as air or earth or water, in Heraclitus (q.v.) as fire, and in Parmenides (q.v.) as pure being. In Aristotle we have a more critical view, according to which the individual realities of experience are substances, while species are second substances. But Aristotle did not answer the question what it is in the individual realities of experience that constitutes their substantiality. The Stoics returned to the idea of a substrate as the bearer of attributes, and this view persisted through the Middle Ages as the only one advocated, except by the Nominalists (q.v.). In modern philosophy Descartes and Spinoza share this substrate theory. Leibnitz moved away from this static conception and regarded substance as a being 'capable of action or 'primitive force,' but it was his great opponent Locke who put definitely away the old substrate theory. "All our ideas of the several sorts of substances are nothing but collections of simple ideas, with a supposition of something to which they belong, and on which they subsist, though of this supposed something we have no clear distinct idea at all." "All the simple ideas, that thus united in one substratum make up our complex ideas of several sorts of substances, are no others but such as we have received from sensation or reflection," while "most of the simple ideas that make up our complex ideas of substances, when truly considered, are only powers."

Berkeley went further. Locke had accepted the existence of material as well as spiritual 'powers;' Berkeley maintained that "the supposition of external bodies is not necessary for producing our ideas; since it is granted they are produced sometimes, and might possibly be produced always in the same order we see them in at present, without their concurrence." Hence "there is not any other substance than *Spirit*, or that which perceives." About this substance, however, Berkeley could give no consistent account. At one time we are told that thing or being "comprehends under it two kinds entirely distinct and heterogeneous, and which have nothing in common but the name, viz. Spirits and Ideas. The former are active, invisible substances—the latter are inert, fleeting, or independent beings, which subsist not by themselves, but are supported by or exist in minds or spiritual substances." But in another place we are told that "*the soul always thinks;* and in truth whoever shall go about to divide in his thoughts, or abstract the *existence* of a spirit from its *cogitation*, will, I believe, find it no easy task." Hume developed the idea contained in the last quotation and arrived at the result that all substance is an 'unintelligible chimæra.'

Kant emphasized these 'relations' which united perceptions, and found in them the essence of substance. Substance with him is a category of relation, which when schematized, i.e. brought into relation with time and space, becomes "the permanence of the real in time, or the idea of the real as presupposed in the empirical determination of time, and as persisting while all else changes." But this view has a defect. There is too much absoluteness in the conception. It is not necessary that there should be anything which persists through all changes. It is only necessary that there should be some quality which remains *relatively* unchanging, while other qualities change. The quality forms then the nucleus around which the changes gather as variations of a thing. The same thing does not always remain unchanged in the same quality. Now it may be this quality, now that. Were it necessary that some one quality should remain unchanged, that quality would come to be considered the substance of the thing. But the fact that the relatively permanent quality of one stage of change becomes the relatively changing quality of another stage makes it impossible to identify the substance with any one quality. On this account some philosophers prefer to regard substantiality as shifting from time to time.

But perhaps a more satisfactory definition of substance can be obtained from the true theory of judgment. Going back to Aristotle's conception of substance (*οὐσία*) as that of which predication is made, we find (see JUDGMENT) that predication is always made of a synthesis of attributes. The orange of which yellowness is predicated is an object which is yellow, grows on a tree, developed from a flower, is going to be eaten by me next minute, etc. The orange is the synthesis of all these quantities or attributes, some of which may be past and some not yet existent. The only object of which all the qualities of an orange are predicable is the totality of the predicable qualities. This totality exists at any one time, not as a whole, but in part. At no one moment is it consummated as a whole. All the stages of its history are necessary to its totality, but it is not necessary that these stages should be taken out of the real order of succession in which they stand and made to exist contemporaneously before the totality of the process can exist. A temporal whole is from its very nature not a whole at any one time shorter than the whole time of its existence, and the whole time of its existence has within it the distinctions of priority and subsequence which make it impossible to summate the whole into one moment. Now the synthesis of all the qualities which appear to common sense as the qualities of a thing is itself the substance of that thing. Used in this sense substance is no longer what its etymology indicates, viz. a something standing behind phenomena, but it is what the Greek term *οὐσία* means, viz. the being of which attributes are predicable. See PHILOSOPHY; METAPHYSICS; SCHOLASTICISM.

SUBSTANTIVE LAW (Lat. *substantivus*, self-existant, substantial, real, from *substantia*, being, essence, material). That branch or division of the whole law which defines and establishes human rights and privileges with reference to property and prescribes rules of conduct to be observed by mankind in the various relations of life. All other law may be classed as adjective or remedial, that is, as dealing with the methods of enforcement and maintenance of the normal conditions established by the substantive law, and the rectification of such abnormal social conditions as may arise. For convenience, the substantive law is subdivided into various branches according to the subject matter to which it relates. For example, we speak of the law of real property, of personal property, the law of domestic relations or persons, etc. It is to be found both in legislative enactments and in the rules and precedents of the common law. See LAW and the authorities there referred to.

SUBSTITUTION (Lat. *substitutio*, a putting in the place of another, from *substituere*, to put in the place of another, from *sub*, under + *statuere*, to place, from *stare*, to stand). A mathematical operation by which one expression is replaced by another. The term has, however, come to have a technical meaning in modern mathematics, and this has led to an important branch known as the theory of substitutions. If n elements, $a_1, a_2, a_3, \dots a_n$ are given, and $a_1, a_2, a_3, \dots a_n$ and $a_2, a_1, a_3, \dots a_n$ are two arrangements of these elements, the operation of passing from the first of these arrangements to the second is called a substitution of the n elements. It follows that there are no substitutions of n elements, including the identical substitution, which leaves the order of the letters unchanged. A substitution which in place of the arrangement $a_1, a_2, a_3, \dots a_n$ gives $a'_1, a'_2, a'_3, \dots a'_n$, is represented by the symbol

$$\begin{pmatrix} a_1 & a_2 & a_3 & \dots\dots & a_n \\ a'_1 & a'_2 & a'_3 & \dots\dots & a'_n \end{pmatrix}$$

If, however, a_1 is replaced by a_2, a_2 by $a_3, \dots$ a_{n-1} by a_n, and a_n by a_1, the substitution is said to be *cyclic*, and is more conveniently represented by $(a_1, a_2, a_3 \dots\dots a_n)$, or even by $(1, 2, 3, \dots n)$, than by the more elaborate symbol

$$\begin{pmatrix} a_1 & a_2 & \dots\dots & a_{n-1} & a_n \\ a_2 & a_3 & \dots\dots & a_n & a_1 \end{pmatrix}$$

Similarly a substitution like $\begin{pmatrix} abcdef \\ cedafb \end{pmatrix}$

may be written (acd) (bef), meaning that while a changes to c, c to d, and d to a, b at the same time changes to e, e to f, and f to b. This symbolism is further extended thus: Consider (ab) (ac); this means that a changes to b, b to a, and a to c, and c back to a, a result which evidently may also be indicated by (abc), so that $(ab)\,(ac) = (abc)$. But the same reasoning shows that $(ac)\,(ab) = (acb)$. Hence if $s_1 = (ab)$ and $s_2 = (ac)$, $s_1s_2 \pm s_2s_1$. For convenience, s_1s_2 is called the *product* of s_1 and s_2 in the order given, from which it appears that the commutative law of multiplication does not hold true in the theory of substitution. If in the product $s_1s_2s_3 \dots s_n$ we have $s_1 = s_2 = \dots s_n$, the product is called the *power* of each substitution. If a substitution leaves all the elements unchanged in order it is called an *identical* substitution and is represented by 1. If the product of two substitutions, like

$$\begin{pmatrix} a_1 & a_2 & \dots & a_n \\ a'_1 & a'_2 & \dots & a'_n \end{pmatrix} \text{ and } \begin{pmatrix} a'_1 & a'_2 & \dots & a'_n \\ a_1 & a_2 & \dots & a_n \end{pmatrix}$$

is 1, each is called the *inverse* of the other, and if the first is represented by s, the second is represented by s^{-1}, ss^{-1} equaling 1.

A collection of substitutions is said to form a *group*, if the product of any two is another of the same collection. This may be illustrated outside the field of substitutions by the three cube roots of unity $1, -\frac{1}{2} + \frac{1}{2}\sqrt{-3}, -\frac{1}{2} - \frac{1}{2}\sqrt{-3}$, the product of any two being another of the same collection. The six substitutions $s_0 = 1$, $s_1 = (xyz)$, $s_2 = (xzy)$, $s_3 = x(yz)$, $s_4 = y(zx)$, $s_5 = z\,(xy)$ also form a group. The number of substitutions of a group is its *order*, and this is always a factor of $n!$. Thus in the group given the order is 6, and this is a factor of $3!$. If all substitutions of a group H are contained in another group G, H is called a *sub-group* of G and the order of H is a factor of that of G. A group whose operations are all permutable with one another is called an *Abelian group.*

Lagrange (1770) was one of the first to undertake a scientific treatment of substitutions in connection with the theory of the quintic equation. He invented a 'calcul des combinaisons,' the first real step toward the theory of substitutions. Ruffini (1799) was the next to undertake a serious study of the subject, again in the attempt to show the impossibility of solving the quintic. To Galois (q.v.), however, the honor of establishing the theory is usually ascribed. He found that if $r_1, r_2, r_3, \dots r_n$ are the n roots of an equation, there is always a group of permutations of the r's such that (1) every function of the roots invariable by the substitutions of the group is rationally known, and (2), reciprocally, every rationally determinable function of the roots is invariable by the substitutions of the group, a discovery that eventually led to the proof of the insolubility of the quintic. Liouville's *Journal*, vol. xi. Consult also *Œuvres mathématiques de Galois* (Paris, 1897). Cauchy was the first of the well-known French mathematicians to recognize the importance of the theory, and numerous important propositions are due to him (*Journal de l'école polytechnique*, 1815; *Exercices d'analyse et de physique mathématique*, vol. iii., Paris, 1844). Serret was the first to give a connected account of the theory (*Cours d'algèbre superiéure*, in the 3d ed., Paris, 1866). This was followed by Jordan's *Traité des substitutions et des équations algébriques* (Paris, 1870). Sylow (1872) was the first to treat the subject apart from its applications to equations (*Math. Annalen*, vol. v.). He was followed by Netto, whose *Substitutionstheorie* (Leipzig, 1882) was translated by Cole (Ann Arbor, 1892), thus making the theory accessible to English readers. Burnside, *Theory of Groups of Finite Order* (Cambridge, 1897), has brought the theory even more prominently before English and American scholars. The first to attempt to simplify the applications of the theory to the subject of equations in an elementary text-book was Petersen, *Theorie der algebraischen Gleichungen* (Copenhagen, 1878).

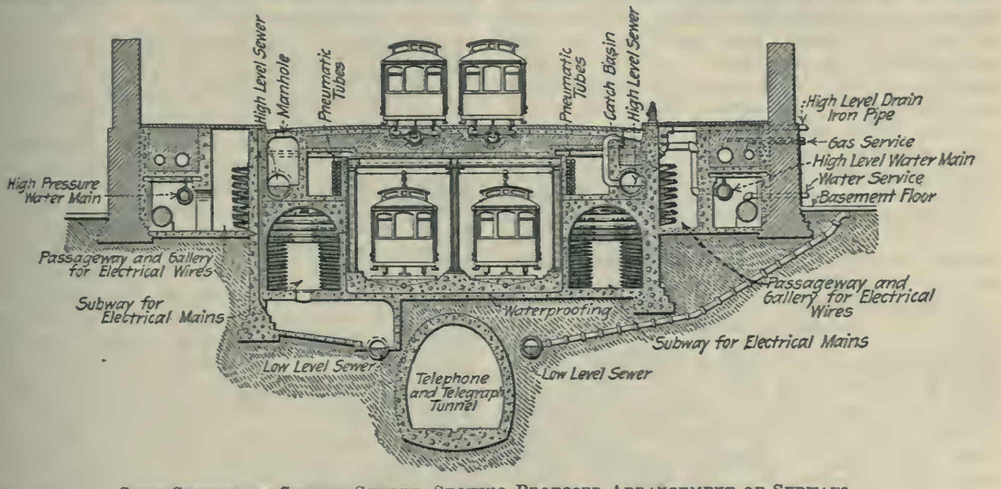
SUBSTITUTION, THEORY OF. See CHEMISTRY (historical section).

SUBTRACTION (Lat. *subtractio*, a taking away, from *subtrahere*, to take away, from *sub*, under + *trahere*, to draw, drag). The inverse of addition, and one of the fundamental processes of arithmetic and algebra. It is the operation which has for its object, given the sum of two expressions and one of them, to find the other. The given sum is called the *minuend*, the given addend is called the *subtrahend*, and the addend to be found is called the *difference* or the *remainder*.

SUBUR'RA. A district of ancient Rome in the valley between the Esquiline, Quirinal, and Viminal Hills. It was thickly populated and bore an evil reputation as the resort of peddlers, footpads, and prostitutes.

SUBWAYS (for Pipes and Wires). Underground galleries which contain and render accessible at any point the multitudinous pipes and wires beneath city pavements; or else ducts for inclosing underground wires only, in such a way as to make them accessible at intervals. Subterranean passages for the accommodation of street traffic are either nothing more than streets or footpaths placed in tunnels, which need no description, or they are underground railways, which are described under Tunnel; Railways.

The chief advantages of subways for pipes and wires are: (1) They increase the life and general serviceability of pavements and prevent the interruption to traffic caused by street excavations to gain access to pipes when simply buried in the ground. (2) They facilitate both the inspection and repair of all classes of underground furniture, and thus lessen the number of troublesome and dangerous leaks from water and gas mains; they also aid in the prevention of electrolysis, or the electrical decomposition of iron and lead conduits through stray electrical currents from overhead trolley systems. (3) Ventilated and relatively dry subways may greatly lengthen the life of pipes and wires through better protection against corrosion than is possible when such furniture is laid directly in the earth.



Cross-Section of Chicago Street, Showing Proposed Arrangement of Subways.

One of the earliest attempts to avoid the disturbance of pavements was carried out in Liverpool, where a gallery 2½ feet wide was built under the sidewalk and in it were placed an oval pipe sewer 27×18 inches, a 10-inch water main, and a 10-inch gas main. The bottom of the trench was 13 feet below the surface of the sidewalk. Little or no provision for repairs was made. The London subways date from 1861 or 1862, when one was built in a new street from Covent Garden Market to Saint Martin's Lane. A few months later a subway was built at Nottingham, England. Subsequently a number of subways were added to the first ones built in London and Nottingham. The London subways range in size from 14 feet wide and 7 feet high to 8×7 feet. The walls are of brick, laid in cement. The roofs are formed by semicircular brick arches, with ventilators extending to the streets at intervals of 100 feet. The London subways contain gas, water, electric light, hydraulic power supply, telephone, and telegraph mains. The placing of wires and a great variety of pipes in the sewers of Paris is one of the notable features of that city.

In the United States the nearest approach to subways like those of Europe is at Saint Paul, where a number of miles of sewers have been constructed in the form of tunnels in the soft sand-rock which underlies the city, and water mains have also been placed, separately, in similar tunnels. Branch tunnels connect with the houses, in the same general way as branches lead to the buildings along the line of the European subways. Besides the sewers and water mains at Saint Paul some private companies have placed telephone lines in like tunnels. Tunnels for telephone cables have been constructed in Chicago.

Electrical Subways. Although there are no instances of subways for both pipes and wires in the United States, the practice of putting wires underground is rapidly growing. It is getting to be a comparatively common practice, even in small towns, for telephone companies to bury their wires; and though the work is often done cheaply and rather crudely, the wires are nevertheless removed from overhead and at the same time are so arranged that little subsequent disturbance of the street is necessary. In a growing number of the larger cities electrical wires for light and power, together with the ordinary and the police and fire alarm telegraph lines, are also placed underground. Electrical subways consist of a single pipe or tube, or a group of such, designed to protect underground wires from injury due to settlement of the earth or the picks and shovels of workmen. At the same time these subways afford access to the wires through manholes placed at intervals, for repairs, connections, or the drawing in of new wires. Some of the underground systems have the conductors built in the tubes before the latter are laid, in which case new wires cannot be added without laying additional tubes, but provision is made for service connections without digging up the street. The most common materials used for the conduits or ducts are wrought iron, earthenware, and wood, but sometimes cast iron, and again ordinary or more rarely bituminous cement concrete is used. In place of tubes troughs of cast iron, earthenware, or wood, covered with the same material, are sometimes employed. The diameters of the various ducts are about three inches, and if one is not sufficient for the various wires to be buried any desired number may be placed in the same trench. Wrought iron pipes similar to gas pipes are commonly imbedded in concrete, and they may be laid in trenches lined with cement or wood. Earthenware or terra-cotta ducts are generally surrounded with concrete, but the latter sometimes gives place to boards at the top. Each piece of conduit is eighteen inches long. If a group of ducts is desired they are laid up one on another, breaking joints, much like brickwork; or multiple ducts may be bought from the manufacturers. Concrete ducts are formed in place. Wooden ducts are in the form of square timber, with holes bored through the centre, or constructed more cheaply from boards Wood-fibre pipes are also used. (See PIPES.) In the Edison three-conductor tube system three copper rods are so wound, separately and collectively, with rope, as to insulate them from wrought iron pipe, some twenty feet long, in which they are placed. These sections are filled with a fluid insulating compound before being shipped from the factory. Special insulated joints are made in the trenches, both for ordinary joints and for branch lines. Edison tubes of a simpler type but embodying the same principles are also made. The various classes of electrical wires and cables are generally insulated before being placed in subways. (See ELECTRIC LIGHTING; ELECTRIC RAILWAYS; TELEGRAPH; TELEPHONE, etc.) The wires and cables are drawn into the closed electrical subways through manholes at intervals of 200 to 300 feet by means of ropes or rods. If ropes are used a steel wire with a round metal head is first pushed through, and by means of this a rope sufficiently large to haul the electric cable is drawn in. The rods are pushed through from manhole to manhole, one short rod after another being jointed onto the line. Ordinarily electrical subways need be placed but three feet or so underground.

Consult: Mason, "Street Subways for Large Towns," and discussion thereon, in *Transactions of the Society of Engineers* (London, 1895); article in *Engineering News* on "Street Subways for Pipes and Wires" (New York, March 15, 1900), describes all subways for both pipes and wires known to be in use up to early in 1900; also chapter on underground electrical construction in vol. ii. of Crocker, *Electric Lighting* (New York, 1901), and similar chapters in Hopkins, *Telephone Lines and Their Properties* (ib., new ed., 1901).

SUCCESSION (Lat. *successio*, from *succedere*, to follow, succeed, from *sub*, under + *cedere*, to yield). At civil law (q.v.) succession signifies in general the substitution of one person for another in an existing legal relation. Acquisition of a right previously held by another is termed *active* succession; subjection to a duty previously resting upon another, *passive* succession. When single rights or duties are thus transferred the succession is said to be *singular.* When a person receives all the rights and duties of another that are capable of transfer the succession is said to be *universal.* The most important case of universal succession is inheritance, which at civil law signifies the transfer to one or more heirs of the rights and obligations of a person deceased. Heirs may be designated by a last will or testament (q.v.); in the absence of a valid testament they are designated by general laws. In the latter case civilians speak of inheritance or succession *ab intestato* (q.v.). Inheritance may also be determined, in part, by laws which give certain persons rights of succession of which they cannot be deprived by a testator except on legally defined grounds. For such limitations upon the power of testation at civil law, see TESTAMENT.

SUCCESSION AB INTESTATO (Lat., from one intestate). I. ROMAN LAW. In early Roman law, as in early law in general, succession was governed by the organization of the family. According to the Twelve Tables the inheritance vested (1) in the *sui*, i.e. the members of the decedent's family, who were under his household authority. (See PATRIA POTESTAS.) The sons and the unmarried daughters and the widow who had been *in manu* (see MARRIAGE) had equal shares. Children of a pre-deceased son received their father's share. Failing *sui*, the inheritance passed (2) to the nearest agnate (i.e. the nearest collateral relative in the male line). If there was no agnate the inheritance went (3) to the *gens* or clan. Under this system kinship gave no right except in so far as it coincided with the family organization. Emancipated sons and daughters, married daughters and their descendants, and all cognates (relatives in the female line) were excluded from succession. On the other hand, adopted children and the wife *in manu* had the same rights as the other *sui*. In the subsequent development of the law there was a steady movement toward fuller recognition of kinship. This movement began with the prætorian reforms at the close of the Republican period. Emancipated sons and daughters and married daughters were admitted to inherit with the *sui*, on condition of 'collating' (i.e. putting into hotch-pot) their separate property. Failing agnatic relatives, cognates were admitted; and failing cognates, the husband and wife who had established a free or 'consistent' marriage succeeded one to the other's estate. Later Imperial legislation placed cognates and agnates on the same footing, as far as the direct line was concerned (ascendants and descendants). Justinian in his 118th novel abolished all preference of agnates. Under Justinian's rules the inheritance went (1) to descendants; (2) to ascendants, brothers and sisters of the full blood and their children; (3) to brothers and sisters of the half blood and their children; (4) to the nearest collateral relative; (5) to the surviving spouse; and (6) to the fiscus. Illegitimate children had no rights of succession except from the mother.

II. MEDIÆVAL EUROPEAN LAW. The early

German law of inheritance, with the Roman, was based on the family, but it gave no such preference to kinship in the male line, except as regarded succession to real property. As regarded such property, however, a preference not only of the male line over the female, but of male heirs over female, is visible in the earliest written laws; and this preference was emphasized and made general in mediæval Europe by the development of the feudal system. In German law there appeared also a distinction between sword-goods and spindle-goods, i.e. between things used by men and things used by women, and a tendency to prefer male heirs as regarded sword-goods and female as regarded spindle-goods. Another German idea was that, when the nearest heirs were of the half blood, property that had come to the decedent from the father's side should go to the paternal relatives, while property that had come from the mother's side should go to the maternal relatives ('paterna paternis, materna maternis;' in Spanish law, 'troncalidad'). Sporadically manifested, moreover, was a disinclination to allow property to ascend, with resultant rules preferring brothers and sisters and their descendants to parents.

As between collaterals rights of succession at German law did not depend wholly on nearness of kinship. Descendants of a nearer common ancestor were regularly preferred to descendants of a more remote common ancestor. Inheritance vested (1) in descendants of the decedent; (2) in descendants of his parents; (3) in descendants of his grandparents; (4) in descendants of his great-grandparents, and so on. Within each such group the nearest of kin took the inheritance. This is described by modern writers as the 'lineal-gradual' or 'parentela' system. Coupled with a preference of the male line and of males within that line it became the (original) feudal law of succession, and (with preference of the eldest male added) it determined the English law of inheritance of real property.

III. Modern Civil Codes. In modern European legislation the Roman principle of universal succession has generally reasserted itself: the same rules generally govern inheritance of realty and of personalty. In all the codes the inheritance vests primarily in descendants. Failing these different rules prevail. At French law the inheritance passes, in second instances, to parents, brothers, and sisters and the children of brothers and sisters, all of whom take precedence of grandparents. The Spanish code prefers all ascendants, and the German code prefers parents, to brothers and sisters. In the absence of descendants, ascendants, and of brothers and sisters and their descendants, the French, Italian, and Spanish codes confer the inheritance upon the nearest collateral; but the French code provides that if there be collaterals both on the paternal and the maternal side the inheritance shall be divided. The Austrian and the German codes follow the parentela system.

The surviving spouse is better treated than at Roman law. Under the Code Napoléon, indeed, the surviving spouse had no right except by ante-nuptial contract or, in the absence of such contract, by operation of the general law of matrimonial property; but by the law of March 9, 1891, he or she has a life interest in a portion of the property, which is at most one-fourth if there are children, but rises to one-half if there are no children. There are similar provisions in the Italian and Spanish codes; but at Spanish law if the decedent has neither descendants, ascendants, nor brothers or sisters or nephews, the surviving spouse takes the whole estate absolutely; and at Italian law, if there are no legitimate children, the surviving spouse takes from one-fourth to one-third absolutely as against parents and illegitimate children, two-thirds as against collaterals, and the whole estate if there is no collateral within the sixth degree (e.g. a second cousin). The German law is even more liberal: the surviving spouse takes one-fourth absolutely as against children; one-half to three-fourths as against parents, brothers and sisters, and grandparents; and the whole as against the decedent's other relatives.

As to illegitimate children different rules prevail. The French, Italian, and Spanish codes give no rights of inheritance to such children unless they have been 'recognized.' Such a recognized child inherits in concurrence with legitimate children, taking, however, only half the share of a legitimate child. When there are no legitimate children the rights of recognized illegitimate children are greater. By the French law of March 25, 1816, they take the whole estate as against all collaterals, except brothers and sisters and their children. In the German code the illegitimate child, although 'recognized,' has no right of succession in the estate of his father or in those of his father's relatives; but in the mother's estate and in those of her relatives such a child has the same rights as if born in wedlock. For a treatment of subjects in English and American law, see Descent; Distribution; Heir; and Inheritance.

SUCCESSION WARS. The name given to wars arising out of conflicting claims of succession to the throne. Among such wars that have been waged in Europe the following deserve special notice: (1) The War of the Spanish Succession, 1701-14; (2) that of the Polish Succession, 1733-35; (3) that of the Austrian Succession, 1740-48; and (4) that of the Bavarian Succession, 1778-79.

The War of the Spanish Succession arose on the death without male heirs of Charles II. (q.v.), King of Spain, of the House of Hapsburg, November 1, 1700. The nearest natural heir to the throne was of the royal Bourbon line of France, Charles's elder sister having married Louis XIV.; but, to prevent any possible union of the two crowns, a solemn renunciation had been exacted both from Louis and his Queen, for themselves and their heirs. Failing the Bourbons, the next heirs were the descendants of the younger sister of Charles, who had married the German Emperor Leopold I., ruler of the Austrian realm, and from whom no renunciation had been exacted; and the only issue being a daughter, who had married the Elector of Bavaria, and borne a son, Joseph Ferdinand, this prince was during his lifetime regarded both by Charles II. and the Spanish people as the rightful heir. As he died in 1699, the question of succession was reopened. Louis XIV. claimed the throne for himself, as the son of Philip IV.'s eldest sister, being, however, again legally barred here by another solemn renunciation. The Emperor Leopold maintained that the Bourbons had by these two renunciations lost all rights of succession, and he claimed the throne as the son of Philip IV.'s younger sister. (See genealogical table, *The Hapsburg Family,* under HAPSBURG.) Leopold handed over his claim to his second son, the Archduke Charles. The Austrian party at first preponderated in Spain; but Louis succeeded in undermining the Austrian influence, and his grandson, Philip of Anjou, was declared the heir (October 2, 1700). On the death of King Charles, Philip appeared in Spain and was recognized as monarch. The Emperor Leopold at once took up arms and sent an army into Italy under Prince Eugene, who defeated the French general Villeroi at Chiari on September 1, 1701, William III., regarding the union of France and Spain under the Bourbons as a menace to the naval interests of England and Holland, and stirred up by the action of Louis XIV. in recognizing the Pretender, James Edward Stuart, determined to revive the Grand Alliance against France, and entered into a coalition with Austria and her allies in the German Empire, including Prussia. Savoy, Bavaria, and some of the other German States joined the Bourbons. William's policy was continued by Queen Anne, who succeeded to the English throne in March, 1702, and immediately declared war.

In 1702 Churchill (the future Marlborough), at the head of an English-Dutch-German army, made a victorious advance against the French in the Spanish Netherlands. While a German army under the Margrave of Baden crossed the Rhine and encountered Villars, who proved too powerful for him. In Italy, Prince Eugene, after taking Villeroi prisoner at Cremona (January, 1702), was checked by Vendôme. In 1703 Marlborough gained fresh successes and the Duke of Savoy joined the Grand Alliance. The first great blow was struck on August 13, 1704, when the combined Austrian-German-British army under Marlborough and Prince Eugene totally defeated the French and the Bavarians under Tallard at Blenheim (q.v.). A few days before Gibraltar had fallen into the hands of the English. The campaigns of Marlborough in Germany and of Eugene in Italy in 1705, while successful, were not very important. In 1706 Marlborough suddenly attacked the French and Bavarians under Villeroi at Ramillies (q.v.), and routed them with great slaughter. The victory of Eugene over Marsin at Turin in the same year shattered the French power in Italy.

In the meanwhile in 1704 the Archduke Charles landed at Lisbon with a British and Dutch army and invaded Spain. In the following year the Earl of Peterborough and Sir Clowdisley Shovell landed with a small body of troops in Catalonia. Then, attacked from both east and west, the Bourbon forces were beaten and driven across the Pyrenees. After the departure of Peterborough, however, the Bourbon commander, the Duke of Berwick (q.v.), made head against his antagonists, and by his victory at Almanza (April 25, 1707) he recovered the whole of Spain except Catalonia. In the Netherlands Marlborough and Prince Eugene fell upon Vendôme's army at Oudenarde (1708) and inflicted upon it a severe defeat. The capture of Lille, Ghent, and Bruges followed. France now began to show symptoms of exhaustion, and made overtures of peace, but the demands of the allies were of so exorbitant a character that Louis XIV. preferred to continue the war. The French under Villars suffered another great defeat in September, 1709, at the hands of Marlborough and Prince Eugene at Malplaquet (q.v.). The death of the Emperor, Joseph I., the successor of Leopold I. (April 17, 1711), and the accession in the Austrian dominions and in the German Empire of his brother, Charles VI., came to the rescue of France, for England became immediately lukewarm in support of a cause the success of which would result in the union of Austria and Spain; and the English Tories having come into power, England concluded an armistice with France in 1712. Prince Eugene still carried on the war, aided by Holland, but was compelled to give way; and in the following spring (1713) Holland, Prussia, and Savoy joined England as parties to the Peace of Utrecht (q.v.). The Emperor Charles VI. found himself forced to conclude a treaty of peace at Rastadt, March 7, 1714, and later on the more formal treaty of Baden (in Aaragau), September 7, 1714, ended the struggle, leaving Philip in possession of the Spanish throne, but with the provision that the crowns of France and Spain should never be united in the same person, while Austria obtained the Spanish Netherlands, the former Duchy of Milan, Naples, and Sardinia. Sicily was awarded to Savoy, which exchanged it for Sardinia. Gibraltar and Minorca were ceded to England, which acquired Arcadia from France. The conflict waged between the English and French in America as part of the War of the Spanish Succession is known as Queen Anne's War.

Consult: Stanhope (Lord Mahon), *History of the War of the Succession in Spain* (London, 1836); Coxe, *Memoirs of the Kings of Spain of the House of Bourbon* (ib., 1813); Von Noorden, *Europäische Geschichte im 18ten Jahrhundert,* "Der spanische Erbfolgekrieg" (Düsseldorf, 1874-83), perhaps the best work on the subject. See LOUIS XIV.

THE WAR OF THE POLISH SUCCESSION. In 1733 Augustus II. of Poland and Saxony died and Stanislas Leszczynski (q.v.), whose daughter had married Louis XV. of France, was elected King by the Diet through French influence. Some of the nobles, however, were determined that the crown should pass to Augustus (Frederick Augustus II. of Saxony), son of the late King. Russia and Austria supported Augustus and a Russian army placed him on the throne. Stanislas withdrew to the fortress of Danzig, where he held out until June, 1734. France, in retaliation for Austria's support of Augustus III., declared war on the Emperor. The French forces invaded Lorraine and fought successfully on the Rhine (1733-34). Charles Emmanuel III. of Sardinia took up arms against Austria, and in 1734 Don Carlos, son of Philip V. of Spain, seized the opportunity to undertake the conquest of the Two Sicilies, which had been wrested from Spain in the War of the Spanish Succession. The Austrians were overthrown at Bitonto on May 25, 1734, and in 1735 Don Carlos was crowned King of the Two Sicilies. By the preliminaries of Vienna (October 3, 1735), Austria relinquished the possession of these regions. Augustus III. was recognized as King of Poland, though Stanislas retained the royal title and was given for his life the duchies of Lorraine and Bar, which were afterwards to revert to France. Francis Stephen, the dispossessed Duke of Lorraine, received the Grand Duchy of Tuscany as compensation. France lent its guarantee to the Pragmatic Sanction (q.v.) and Parma and Piacenza were handed over to the Emperor by Don Carlos. The definitive Peace of Vienna was not signed till 1738.

THE WAR OF THE AUSTRIAN SUCCESSION. This struggle arose after the death of the Emperor Charles VI. (q.v.), in 1740. In accordance with the Pragmatic Sanction (q.v.) Charles VI.'s daughter and heiress, Maria Theresa, had received assurances of support from most of the European powers, but hardly had she ascended the Austrian throne when she found her dominion contested on every side. Frederick the Great of Prussia reasserted an old claim and invaded and seized Silesia. Charles Albert, Elector of Bavaria, claimed to be the rightful heir to the Hapsburg possessions as a descendant through the female line of Ferdinand I., and in virtue of old arrangements. Augustus III. of Saxony and Poland put forward his claims as the husband of the eldest daughter of the Emperor Joseph I. The Bourbon courts of France and Spain seized the opportunity to make war upon Austria. England thereupon entered into an alliance with Maria Theresa. Charles Emmanuel III. of Sardinia was also among the princes who sought the dismemberment of the Austrian realm. Holland joined the Anglo-Austrian Alliance, and the Bourbon King of Naples joined the enemies of Maria Theresa. Some of the minor German princes engaged in the struggle, as allies of Prussia and France. On April 10, 1741, Frederick II. defeated the Austrians at Mollwitz. The Bavarians, the French, under Belleisle, and the Saxons poured into the Austrian dominions. Maria Theresa appealed for support to her Hungarian subjects at the Diet assembled at Pressburg and they responded chivalrously to her call. She was, however, unable to save Prague, which surendered to Belleisle on November 26, 1741, but at the beginning of 1742 her forces entered upon a victorious campaign against Charles Albert. General Khevenhüller overran Bavaria, and on the very day of the Elector Charles Albert's coronation as Emperor Charles VII. took Munich (February 12, 1742). On May 17, 1742, Frederick won a victory over the Austrians at Chotusitz, which was followed by the Treaty of Breslau (terminating the first Silesian War), which provided for the cession of most of Silesia to Prussia. The French General Belleisle effected a masterly retreat from Prague.

In May, 1743, Bavaria again fell into the hands of the Austrians. In June the English, under George II., defeated the French at Dettingen. In the same year Saxony and Sardinia were won over to the side of Austria. France and Spain now remained the sole representatives of the coalition. Seeing the tide turn so strongly in favor of Austria, Frederick became alarmed and renewed hostilities in 1744 by an invasion of Bohemia (second Silesian War). In January, 1745, Charles VII. died and his son, Maximilian Joseph, made peace with Austria. On June 4, 1745, Frederick won a victory over the Austrians at Hohenfriedberg, and on December 15th the Prussians defeated the Saxons at Kesselsdorf. Frederick, displeased with the overbearing conduct of France, was willing to make terms with Austria, and the Peace of Dresden (December 25, 1745) between Austria, Saxony, and Prussia terminated the second Silesian War. On September 13, 1745, the husband of Maria Theresa had been elected Emperor as Francis I. In the meanwhile the French were being led to victory in the Austrian Netherlands by Marshal Saxe, who, on May 11, 1745, defeated the English, Hanoverians, Dutch, and Austrians at Fontenoy. One after another the principal towns of the region fell before his attacks, and on October 11, 1746, he won a splendid victory over the allies under Charles of Lorraine at Raucoux. In Italy the war was waged with varying fortune. In 1745 the French were successful. In 1746 the Austrians and Sardinians made a victorious advance, and Genoa, which had joined the enemies of Austria, was occupied. The city, however, had soon to be evacuated, and an attempt to recapture it in 1747 was frustrated by the French. In 1747 Saxe routed the Duke of Cumberland at Laffeld, near Aix-la-Chapelle (July 2d), while his celebrated chief of engineers, Count Löwendal, after a two months' siege, took Bergen-op-Zoom, a fortress believed by the Dutch to be impregnable. On the sea, however, the English gained victories in 1747 under Admirals Anson and Hawke. At this juncture the Empress Elizabeth of Russia came to the aid of Maria Theresa and sent her forces into the field. France was now willing to listen to proposals of peace. On October 18, 1784, the Treaty of Aix-la-Chapelle put an end to the war. It left the Hapsburgs in possession of their hereditary dominions, with the exception of Silesia. Parma and Piacenza (acquired in 1735) were handed over by Austria to Don Philip, brother of Ferdinand VI. of Spain. The principal event of the contest waged by the British and French in America (King George's War) was the taking of Louisburg in 1745. The French held their ground in India.

THE WAR OF THE BAVARIAN SUCCESSION. The Elector Maximilian Joseph of Bavaria died without issue on December 30, 1777. The natural heir was Charles Theodore, Elector Palatine, head of the elder line of the House of Wittelsbach.

This prince had no legitimate heirs, and with a view of furthering the interests of his illegitimate children, he had, in January, 1778, entered into a convention with the Emperor Joseph II. (the son of Maria Theresa, sovereign of Austria and Queen of Hungary) by which he agreed to transfer Lower Bavaria to Austria, which put forward an antiquated claim to a part of the Bavarian dominions. Frederick the Great would not consent to such an aggrandizement of Austria in South Germany, the more so as he felt that it might interfere with the claim of Prussia to the succession in the principalities of Ansbach and Bayreuth. As Austria refused to withdraw her pretensions, Frederick proceeded to make war on her, and in the summer of 1778 he invaded Bohemia. He was joined by the Elector of Saxony, who, as the husband of the only daughter of Maximilian Joseph, claimed a portion of the Bavarian inheritance. Maria Theresa and Joseph II. were in no haste to plunge into a war with Prussia, and the Austrian forces confronted the enemy without coming to an engagement. The hostile attitude of Catharine II. of Russia toward Austria induced her to give way, and in the Treaty of Teschen, signed on May 13, 1779, she had to content herself with the acquisition of the Innviertel, a district on the east side of the Inn, with the exception of which the whole of the Bavarian inheritance passed to Charles Theodore. The Elector of Saxony received a money indemnity.

SUCCINIC ACID (from Lat. *succinum*, *sucinum*, amber), $COOH.CH_2.CH_2.COOH$. A di-basic organic acid found in amber, in unripe fruits, in brown coal, etc. In the animal organism it occurs in the spleen, the hydrocephalic and hydrocele fluids, and, according to some authors, also in normal urine. It has been known to chemists since the sixteenth century, and its acid character was discovered by Lemery in 1679. It may be obtained by a variety of synthetic chemical methods. Usually, however, it is prepared by the fermentation of a solution of ammonium tartrate. It is a crystalline substance melting at 180° C. and boiling at 235° C., though when distilled it loses the elements of water and is partly converted into its anhydride. Succinic acid is almost insoluble in ether; it is moderately soluble in cold and very soluble in hot water and alcohol.

SUCCORY. Another name for chicory (q.v.).

SUC′COTH (Heb. *sukkōth*, booths, thickets). A place name occurring several times in the Old Testament. In Joshua xiii. 27 a Succoth is described as situated in the territory of Gad, 'in the valley,' and within the ancient bounds of Sihon, King of Heshbon. A location east of the Jordan is indicated here and also in Genesis xxxiii. 17 and Judges viii. 5-16 (cf. Psalms lx. 6, cviii. 7). In I. Kings vii. 46 (II. Chron. iv. 17) it is stated that the metal work for Solomon's temple was cast "in the plain of Jordan between Succoth and Zarthan." It has been thought that this Succoth was in the west Jordan country. No satisfactory identifications, however, have been proposed. Succoth was also the name of the second station in the Exodus from Egypt (Ex. xii. 37, xiii. 20, Num. xxxiii. 5-6).

SUC′COTH-BE′NOTH. According to II. Kings xvii. 30, the name of a deity whose worship was carried on at Samaria by the colonists from Babylon settled there by Shalmaneser IV. No such god has been found in Babylonian inscriptions, and it is reasonable to conclude that the form is corrupt. In Amos v. 26 a deity (or a star), Sikkut, is mentioned by the side of Chiun (perhaps the planet-god Saturn-Ninib), and a deity Sakkut occurs in Babylonian literature. The bad state of the text in the passage from Amos, however, requires caution in drawing conclusions, and there is no necessary connection between Succoth and Sikkut.

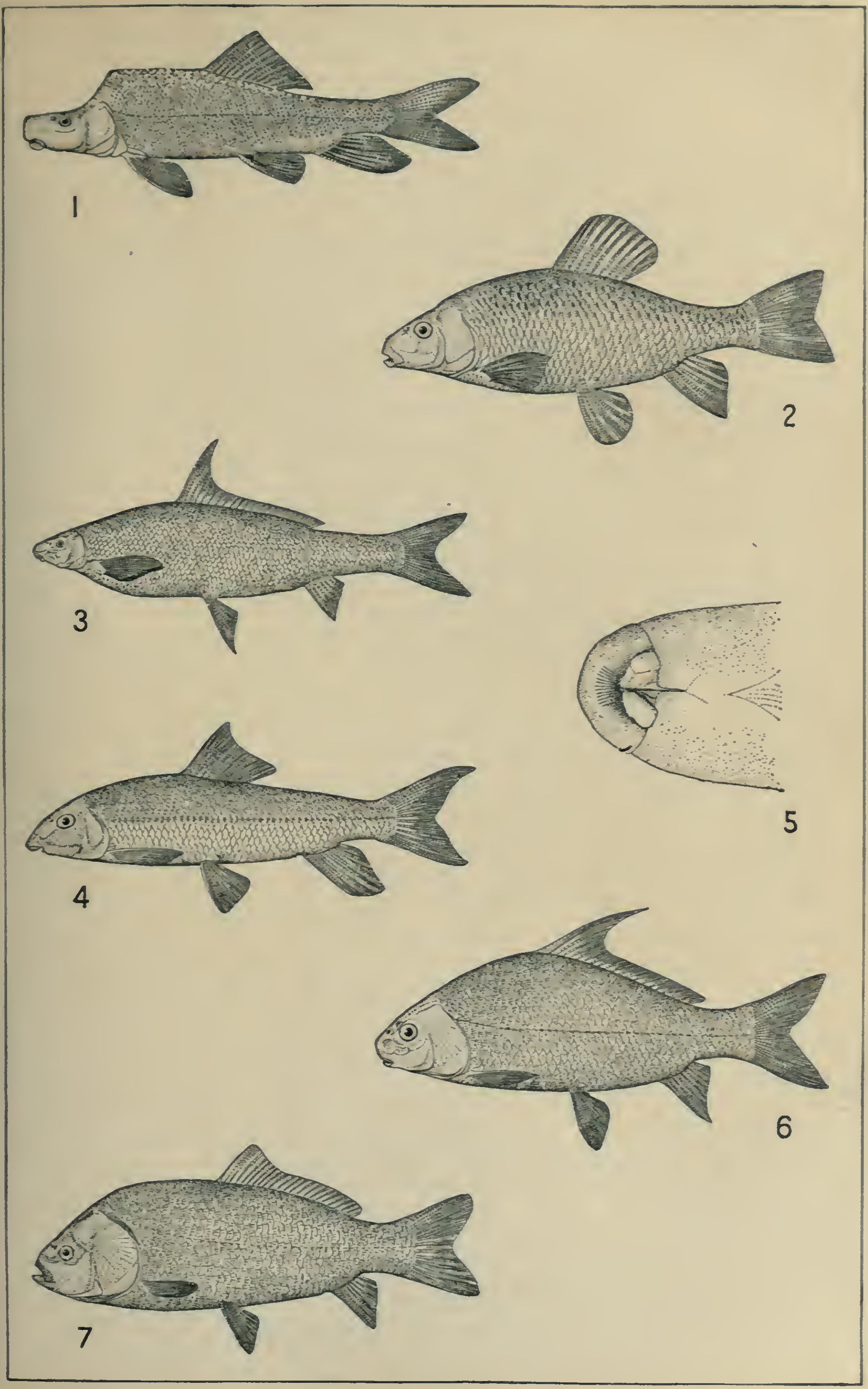
SUCHER, sōō′kẽr, Josef (1844—). A prominent Austrian musical conductor and composer, born at Dōbör, Eisenburg County, Hungary. First instructed in music as a chorister in the Imperial chapel at Vienna, he afterwards studied law at the university and composition under Sechter, became conductor of the Akademische Gesangverein and assistant conductor at the opera, and in 1876 went to Leipzig as kapellmeister at the Stadtheatre, where his rehearsals of Wagner's music dramas, especially of the *Ring of the Nibelung*, placed him in the front rank of modern conductors. In 1879 he was called to Hamburg and in 1888 to the Royal Opera in Berlin. As a composer he has earned reputation through choral and orchestral works, church music, and many lofty and spirited songs.—His wife, Rosa (1849—), born (Hasselbeck) at Velburg, Upper Palatinate, is a highly gifted dramatic singer, widely known as an interpreter of Wagner rôles. She appeared first in Munich, was subsequently connected with the stages at Treves, Königsberg, and Danzig, then at Leipzig, where she was married, and went with her husband to Hamburg and Berlin. Since 1898 she confined herself to starring engagements, notably for the Festspiele at Bayreuth, her impersonations of Isolde, Sieglinde, and Brunhilda being most highly commended.

SUCHET, sụ′shâ′, Louis Gabriel, Duke of Albufera (1770-1826). A marshal of France, born at Lyons, March 2, 1770. He began his military career by volunteering as a private in the Lyons National Guard in 1792. His intelligence and valor at Lodi, Rivoli, Castiglione, Arcole, and in battles of less note, laid the foundation of his military reputation. In 1797 he became a general of brigade and in the following year general of division, serving in Switzerland and Italy. In 1800 he kept Melas in check, with a force far inferior to that of the Austrian commander, and prevented the invasion of France. He took part in the campaigns against Austria (1805) and Prussia (1806-07), was sent to Spain in 1808, and in 1809 was appointed to the command of the French army in Aragon. He won the battle of Belchite (June 16-18, 1809) and took Lérida (May, 1810), and Tortosa and Tarragona (1811), earning the marshal's bâton for his achievements. In January, 1812, he conquered Valencia, and was made Duke of Albufera. The misfortunes of the other French armies in Spain compelled Suchet gradually to relinquish his conquests. He was created a peer by Louis XVIII., but took service under Napoleon after his return from Elba, and was charged with the defense of the southwestern frontier. Deprived of his peerage at the Second Restoration, he did not return to Court till 1819. He died at the Chateau of Saint-Joseph, near Marseilles, January 3, 1826. Consult Suchet, *Mémoires sur ses campagnes en Espagne* (Paris, 1829-34).

SUCHIER, su′shyâ′, Hermann (1848—). A German Romance philologist, born at Karlshafen, Hesse-Nassau, of a family of French refugées. After studying at Marburg and Leipzig, he qualified at Marburg in 1873 and became successively professor at Zurich (1875), Münster, and Halle (1876). Of his publications in the field of French and Provincial philology may be noted: "Ueber die französiche Sprache," in Gröber's *Grundriss der romanischen Philogie* (1888), also separate in French, *Le Français et le Provençal* (1891); *Altfranzösische Grammatik* (1893). He edited *Aucassin et Nicolette* (4th ed., 1899); *Bibliotheca Normannica* (1879); *Denkmäler provençalischer Litteratur und Sprache* (1883); *Œuvres poétiques de Philippe de Remi* (1884-85). In collaboration with Birch-Hirschfeld he wrote a *Geschichte der französischen Litteratur* (1900).

SU-CHOW, sōō′chou′, or **SOO-CHOW**. A *fu* or departmental city of the Province of Kiang-su,

SUCKERS



1. RAZOR-BACKED SUCKER (Xyrauchen cypho).
2. CHUB SUCKER (Erimyzon sucetta).
3. MISSOURI SUCKER (Cycleptus elongatus).
4. MAY SUCKER, or CUTLIPS (Lagochile lacera).
5. MOUTH OF CUTLIPS (No. 4).
6. CARP SUCKER (Carpiodes cyprinus).
7. BUFFALO FISH (Ictiobus cyprinella).

China (Map: China, F 5); the residence of the provincial judge, the *chih-fu* or head of the department of the same name, and three district magistrates. It is situated on the Grand Canal, 80 miles west of Shanghai and 40 south of the Yang-tse. Its walls are 30 feet high, are pierced with 6 gates and 5 water-gates, and have a circuit of 12 miles. Outside of five of these gates are large suburbs, the largest and busiest being that outside of the northwest gate or Ch'ang-mên, within which is the chief business quarter of the city. Su-chow was founded about B.C. 500. It is a great commercial and manufacturing place, and is the centre of a great silk and satin industry in which thousands of looms are employed. It has also steam factories, two cotton mills, a flour mill, and thousands of workers in wood, gold, silver, brass, iron, tin, ivory, glass, lacquer, etc. It has long been noted for its wealth and luxury, and the gayety and elegance of its life and manners. In 1860 it was captured by the Taiping rebels and reduced almost to a heap of ruins. Among the buildings that escaped destruction is a pagoda 240 feet in height, said to be the highest in China. There are several others both within and without the city. The streets are not wide enough for much traffic, but a great network of canals ramifies through the city and the surrounding country and supplies easy means of transportation. Population, estimated at about 500,000.

In September, 1896, Su-chow was opened by treaty as a place of foreign residence and trade.

SUCKER (from *suck*, AS. *sūcan*, *sūgan*, OHG. *sūgan*, Ger. *saugen*, to suck; connected with OIr. *sugim*, Lett. *sūkt*, OChurch Slav. *sŭsati*, Lat. *sugere*, to suck). A fresh-water fish of the catfish family and belonging to the genus Catostomus and its allies, characterized by having the mouth inferior, and the lips thick and fleshy, the lower usually deeply divided. There are many species, all of moderate size and natives of the United States, except one in Siberia. Their general form is shown in the Plate of Suckers; in color they are dull, and with little tendency to markings, except that breeding males in most species acquire a rosy or orange lateral band. They inhabit rivers, lakes, and bayous, and obtain their food mostly by sucking up the mud and soft organic matter from the bottom. The most widely distributed species is the Northern or red sucker (*Catostomus catostomus*); the best known one, the common white sucker (*Catostomus Commersonii*), which is excessively abundant from Massachusetts to Kansas.

SUCKER STATE. Illinois. See States, Popular Names of.

SUCK′LING, Sir John (1609-42). An English poet, born at Whitton, in Middlesex, where he was baptized February 10, 1609. His father, Sir John Suckling (knighted 1616), held high posts at the courts of King James and King Charles. In 1623 the poet entered Trinity College, Cambridge, but left without a degree. On the death of his father in 1627 he became heir to large estates. In 1628 he set out on extensive travels on the Continent and is said to have fought under Gustavus Adolphus. Returning to England in 1632, he soon became noted for wit, gallantry, and prodigality. Suckling took an active part in the plot to rescue Strafford from the Tower, and found it convenient to flee to the Continent. Impoverished and in despair, he seems to have poisoned himself in Paris in the summer of 1642. He was buried, says Aubrey, in the cemetery attached to the Protestant Church in Paris. Suckling's writings, few of which were published during his lifetime, were collected under the title, *Fragmenta Aurea* (1646). The volume contains three plays, *Aglaura*, *The Goblins*, and *Brennoralt; Letters to Divers Eminent Personages;* a Socinian tract called *An Account of Religion by Reason;* and *Poems*. In a later edition (1658) appeared an unfinished tragedy, *The Sad One*. The fame of Suckling rests wholly upon his lyrics, inimitable for grace and gayety. Among the most beautiful are "Upon My Lord Brohall's Wedding," and the songs beginning "Why so pale and wan, fond lover?" and "I prithee send me back my heart." Consult *Selections*, with a memoir, by A. I. Suckling (1836; revised and enlarged by W. C. Hazlitt, London, 1874), and see the articles on the group of Cavalier or Court poets to which Suckling belongs: Thomas Carew, Robert Herrick, and Richard Lovelace.

SUCRE, sōō′krȧ. A department of Bolivia. See Chuquisaca.

SUCRE. The official capital of the Republic of Bolivia, known also as Chuquisaca (Map: Bolivia, D 7). It is 8840 feet above the sea on a plateau of the Eastern Cordillera of the Andes, to the left of the upper valley of the Cachimayo, a branch of the Pilcomayo, and is 250 miles southeast of La Paz. It has the Supreme Tribunal of Justice. It contains the oldest university of South America, a fine cathedral, and the President's palace. Its industries are mining and agriculture, the latter being the more important; its population is about 26,000. Sucre was founded in 1536. The Spaniards first gave it the name La Plata, from the rich silver mines of the vicinity. Later as the seat of the *audiencia* of Charcas it served as the capital of Upper Peru. The city was the scene of the declaration of Bolivian independence from Spain, August 6, 1825, and later took the name of Sucre in honor of the Republic's first President. Though it has continued to be the official capital of Bolivia, the sessions of Congress, during the civil wars, have often been held at La Paz.

SUCRE, Antonio José de (1793-1830). A Venezuelan general, born at Cumaná, and educated at Caracas. He served in the various wars of independence in South America, from 1811 to 1824, was one of Bolivar's most valuable officers, and gained the victories of Pichincha (May 24, 1822), which freed Ecuador, and Ayacicho (December 9, 1824), which drove the Spaniards from Peru. He was elected first President of Bolivia in 1826, but resigned in 1828 to prevent a war with Peru, his resignation having been demanded by that country. The ex-President retired to Colombia, then at war with Peru, and gained for the Colombians the battle of Girón (February 26, 1829), which ended the war. He was elected President of the first Congress of the Republic of Colombia, and sent as commissioner to Venezuela. Upon his return from the Congress he was assassinated, it is supposed by political enemies, June 4, 1830.

SUCZAWA, sōō-chä′vȧ. A town of Bukowina, Austria, on the right bank of the Suczawa, 47 miles south of Czernowitz (Map: Austria, K

3). The chief manufactures are linens, cottons, and fine leather goods; there are breweries, petroleum refineries, and potteries. The population, in 1900, was 10,946, of whom four-fifths were Germans.

SUDAMINA. See MILIARIA.

SUDAN, sōō-dän′, or **SOUDAN.** A term now designating the vast region in Northern Africa lying between the Atlantic and the Red Sea, and between the Sahara Desert, on the north, and the Gulf of Guinea and the watersheds between Lake Chad and the Congo and between the Nile and the Congo, on the south. The northern line is about latitude 18° N., the southern about 4° N. The Sudan has been known as the 'Black Zone'—the home of the true negro race. The term is of somewhat confused signification both geographically and ethnically. Except Portuguese Guinea, Togo, and Kamerun, which belong to Germany, and the independent Liberia, all of the region of the Sudan is now virtually divided up between Great Britain and France. To Great Britain belong Gambia, Sierra Leone, the Gold Coast, Lagos, and Nigeria (both Northern and Southern); the government of the Egyptian Sudan (q.v.) is shared by England and Egypt; and Darfur is within the British sphere of influence. Under French control are Senegal, French Guinea, the Ivory Coast, Dahomey, French Congo, Bagirmi, and Wadai. The French Sudan (q.v.) was formerly the name of the territory in Western Africa lying between longitude 12° W. and Lake Chad and between the Sahara on the north and the countries (including Nigeria) along the north coast of the Gulf of Guinea. By the French decree of October 17, 1899, this region—generally known as West Sudan—was divided up. The western portion fell to Senegal, French Guinea, the Ivory Coast, and Dahomey. The remainder was formed into the three military territories of French Sudan (q.v.), the third of which reaches to Wadai on the extreme east. All the above French possessions, except French Congo, Bagirmi, and Wadai, are under a French Governor-General, whose seat is at Saint-Louis, Senegal. The third military territory above referred to connects on the southeast with French Congo, and thus forms the link uniting all the French possessions in Africa. This Governor-Generalship embraces also practically all of the Sahara (q.v.) in accordance with the French decree above named; for Great Britain has recognized the claims of France to all the region west of the Nile basin, thus embracing substantially all of the Sahara Desert (including the Libyan Desert).

For particulars as to topography, climate, commerce, races, etc., see articles on the different countries mentioned.

ETHNOLOGY. Within this broadest belt of Africa lying south of the Sahara, the following races and peoples are to be discriminated:

(1) *Semites,* consisting of Arabs, who under many names live in Kanem and Bornu about Lake Chad and eastward to Khartum and Kordofan.

(2) *Hamites,* whose main divisions are the Tibus, in many subdivisions, about Lake Chad; the Tuaregs, within the Niger bend and on the left bank of the Senegal; and the Fulah, Futa-Toro, and Futa-Jallon, scattered from Senegambia to Darfur and south to Adamawa.

(3) *Negroes,* who are divided into several groups. The west coast Negroes, including the Wolof, Serer, Sarakole, Toucouleur, Mandingo, Felup, and innumerable other tribes from the Senegal River to Sierra Leone; the Sierra Leone Negroes, comprising the Temne family and a multitude of pagan tribes; the Liberian Negroes, or Colonials, Kru, and many pagan tribes; the Ivory Coast Negroes, from Cape Palmas eastward, akin to the Kru; the Gold Coast Negroes, composed of the Tshi group, including the Fanti, Ashanti, and others, and the Ga groups, all pagans; the Slave Coast Negroes, making up the Ewe group, including the Dahomans (see DAHOMEY), and the Yoruba group; Niger Basin Negroes, including the Bambarra, Sonrhay, and Hausa (see HAUSA STATES); the Benue Negroes, composed of Moslem and pagan tribes in the region of the Benue River; the Lower Niger Negroes, or the Ibos (Niger delta), the Igbara (above the Benue confluence), and a multitude of pagan and Moslem tribes; the Chad Basin Negroes, comprising the Kanuris, the Baghirmi, the Mosgu, and many thousands of others chiefly pagan and mixed with Semites and Hamites; the Wadai Negroes, including the Maba and many other tribes all of more or less mixed blood, with a large percentage of Moslems; the Darfur and Kordofan Negroes, or Furs (Moslems), and Nuba (pagans); the Upper Nile Negroes, extending from Lake Victoria northward, and including the Madi, the Mittu, and a host of others, nearly all pagan; the Welle Negroes, comprising the Mombottu, the Momfu, the Niam Niam, the Akka, and a number of other tribes.

HISTORY. THE EGYPTIAN SUDAN. The Sudan has been apportioned by the events of the last few years into British and French spheres of influence. The Egyptian Sudan, now under British control, is practically coincident with the ancient Nubia (q.v.). It embraces the modern Egyptian mudirias, or provinces, of Khartum, Dongola, Berber, Kassala, Sennar, and Kordofan; and the muhafzas, or administrative districts, of Wadi Halfa, Suakim, and Fashoda. (See EGYPTIAN SUDAN.) The Eastern Sudan was brought under Egyptian control by Mehemet Ali (q.v.) in 1820-22 and so remained until in 1870 Ismail Pasha found it necessary to ask for assistance in restoring the waning authority of the Khedival government in the interior. The Englishman Sir Samuel Baker was made Governor-General of the Sudanese provinces and began their reduction and the suppression of the slave trade. He established his capital at Gondokoro, which he renamed Ismailia. Supposing that his work was accomplished, Baker returned to England. After his departure the slave trade was immediately revived and the administration of the provinces was intrusted to Charles George Gordon (q.v.), who with an able staff began the organization and development of this rich but little known region. Gordon continued his work in the face of all manner of discouragements and difficulties until his recall in 1879 upon the deposition of Ismail, and, though Gordon's organization was continued under his successor, Rauf Pasha, there was a gradual reversion to earlier conditions. In 1882 the Sudanese tribesmen, for a long time restless under the greed and misgovernment of the Egyptian officials, took advantage of the difficulties in Lower Egypt and revolted. This, like the rising under Arabi Pasha (q.v.), with which it coincided in point of time, was primarily a revolt against foreign influence, but, unlike the latter, which was a political movement, it had its immediate origin in religious fanaticism. The incitement came from one of the alleged messiahs, known as mahdis (see MAHDI), who have been so common in Mohammedan countries. This man, Mohammed Ahmed, had some political genius and united the tribes in great numbers under his banner. For fifteen years he and his successor held the country under a religious and military tyranny. England had become so deeply involved in Egyptian affairs that she was compelled to take part in this struggle for the control of the Upper Nile country. A force of 11,000 English and Egyptian troops was dispatched to the Sudan under Hicks Pasha. This force was annihilated in a battle with the tribesmen at El-Obeid (November 3-4, 1883). England then determined to abandon the Sudan, but several posts were held by British garrisons and it was necessary to withdraw these troops. For this difficult task and for the settlement of the troubled affairs of the country, Gordon, because of his former success and his knowledge of the tribesmen, was given a new commission as Governor-General, and on February 18, 1884, he arrived at Khartum. In the meanwhile Osman Digna (q.v.) was making his power felt in the vicinity of Suakim, which became the scene of bloody fighting, Osman Digna being finally defeated (February-March, 1884). Gordon was surrounded at Khartum by the Mahdi's forces and cut off from all of his communications. After many delays, in part due to the fatal hesitation of the Gladstone Government, a relief force was sent out under Lord Wolseley, which after severe fighting arrived at Khartum, January 28, 1885. Two days before the city had been captured and Gordon killed. The English then retired and until 1894 gave up the attempt to reconquer the revolted provinces; but the growing British interest in East and Central Africa made it inevitable that England should seek to control a position of so great strategic importance. Upon the death of the Mahdi in 1885 his power passed to his chief lieutenant, the Khalifah Abdallah. In the interval of peace the Egyptian Army was reorganized and brought to an admirable state of discipline under its English officers, and in 1894, under the Sirdar, Sir Herbert Kitchener (q.v.), the struggle for the possession of the Sudan was resumed. This movement was stimulated by the threatened movement of Osman Digna (q.v.), the ablest Dervish leader, upon the Italian post at Kassala, where a victory might throw the Dervishes again upon the Egyptian frontier. After slow and patient preparation the advance up the Nile was made and Dongola was captured, September 23, 1896. Pushing forward his railway across the desert at the rate of about two miles a day, General Kitchener advanced steadily, always maintaining communication with his base on the Nile. The Khalifah was gradually hemmed in and on September 2, 1898, at Omdurman, opposite Khartum, he was defeated, his army annihilated, and his power completely broken. He himself was killed near Gedid in November, 1899.

The French had sent out a tentative expedition under Major Marchand (q.v.) to Fashoda, with a view to entering a wedge of French influence in the Eastern Sudan, but the French were themselves threatened by the tribesmen and were rescued by General Kitchener a few days after the victory at Omdurman. The aggressive attitude of England forced France to enter a diplomatic disclaimer. This led to the recognition by France in the supplementary treaty of 1899 of the English sphere of influence in the Sudan from Darfur and the Bahr-el-Ghazal eastward. By the Anglo-Egyptian convention signed January 19, 1899, the government of the Sudanese provinces was to be intrusted to a Governor-General appointed by the Egyptian Government with the approval of the British Government, the slave trade was prohibited, as well as the importation of arms and ammunition, and the British and Egyptian flags were to be used conjointly. The first Governor-General was General Kitchener. When he was called to South Africa, Col. Sir Reginald Wingate, his successor as Sirdar of the Egyptian Army, succeeded to the post.

FRENCH SUDAN. French exploration of the Sudan began in 1860, when Maze and Quintin penetrated east of Senegal as far as Segu Sikoro, which was again visited by Soleillet in 1878. The next year Bafoulabé was founded and a railway survey begun. The conquest of the country as begun in 1880 and pushed for fifteen years. Forts were erected, telegraph lines constructed, and acknowledgments of the French protectorate were gradually obtained from the native rulers. In 1894 Timbuktu was taken. On August 5, 1890, an Anglo-French agreement laid down the southern line of the French Sudan from Say on the Niger to Barrawa on Lake Chad. A further convention delimiting the French territory on the side of British Nigeria was framed June 14, 1898.

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SUDERMANN, zo͞o′dĕr-män, HERMANN (1857—). A German dramatist and novelist, born at Matzicken, East Prussia, September 30, 1857. He studied history, philology, and literature at Königsberg and Berlin, and after some obscure years as tutor and journalist he won European fame and assured literary position by a drama *Die Ehre* (1888), and the novel *Frau*

Sorge (1888; trans. as *Dame Care,* 1892). He followed these up with the novel *Der Katzensteg* (1889; trans. as *Regina,* 1898); the stories *Im Zwielicht* and a sensational drama, *Sodoms Ende* (1890); the humorous novel *Iolanthes Hochzeit* (1893); and his greatest drama, *Heimat* (1893; trans. as *Magda,* 1895); a fine novel of moral psychology, *Es war* (1894); an inferior drama, *Die Schmetterlingsschlacht* (1894); and *Das Glück im Winkel* (1896), a strong but unpleasant play. Then came three one-act dramatic scenes in verse collected under the appropriate title *Morituri* (1896); *Johannes* (1897), a realistic dramatic presentation of the story of John the Baptist; *Die drei Reiherfedern* (1898), an ethical and literary mystery in dramatic form. *Es lebe das Leben* (1902, translated *The Joy of Living,* 1902), is a powerful drama of the struggle between soul affinity and marital obligation. His work since 1894 shows failing power and has been much interrupted by sickness, but that for the six years preceding is, with the dramas of Hauptmann, the most significant in contemporary Germany, powerful in conception, admirable in technique, virile in its grasp of humanity in the more sombre aspects, and with occasional touches of delicate humor, though Sudermann is more skilled with the sterner weapons of satire. *Frau Sorge* is a pathetic Odyssey of duty with some romantic aberrations; *Katzensteg* is a declaration of 'naturalism;' *Iolanthes Hochzeit* breathes the serener realism of common life; *Es war* is a protest against the fruitlessness of brooding repentance. The dramas *Die Ehre, Sodoms Ende,* and *Heimat* are all social satires and militant democratic protests. By comparison the later dramas are increasingly out of touch with modern life. In *Die drei Reiherfedern* the evolution has become complete transformation. To some it seems a deepening, to others a sinking of his dramatic power. All Sudermann's greater works are translated into English. Consult: Brandes, *Menschen und Werke* (2d ed., Frankfort, 1895); Litzmann, *Das deutsche Drama* (Hamburg, 1896).

SUDET'IC MOUNTAINS (Ger. *Sudeten*). A mountain system on the southwestern border of Silesia, Germany, which some of its ranges separate from Bohemia and Moravia (Map: Germany, G 3). It extends in a southeast direction from the water gap of the Elbe to the Moravian depression through which the Oder passes, and which separates the system from the Carpathian Mountains. The system is composed of a number of short, broken, more or less isolated and partly parallel ranges, consisting chiefly of crystalline slate, serpentine, and granite. These ranges inclose a number of large valleys. The best defined as well as the highest of the ranges, the Riesengebirge, lies near the centre of the system, and attains an average altitude of about 4000 feet, culminating in the Schneekoppe, 5266 feet above the sea. The higher ridges have an alpine flora, appearing above the large pine forests which cover the slopes. Many of the slopes afford fine pasturage and the foothills are well cultivated. The Sudetic Mountains are very rich in minerals, especially iron, zinc, lead, and copper, and in the southeastern portion there are large coal deposits.

ŚUDRA, shōō′drȧ (Skt. *śūdra;* possibly connected with Lith. *szúdas,* excrement). The name of the fourth caste of the Hindus. See CASTE.

ŚŪDRAKA (shōō′drȧ-kȧ). A Hindu king to whom tradition attributes the Sanskrit drama *Mriechakatika* (q.v.), which was probably composed in reality by Dandin (q.v.). The name Sudraka is not found in the history of India, and he seems to have been altogether mythical. He was, however, the centre of a number of legends, according to which he reigned either at Vidiśa, or Śobhavati, or Vardhamana. He is said to have been saved from death by a Brahman who killed himself to insure the king a life of a hundred years. According to another tradition he was the minister of a king named Ṣatavahana, who gave him half of his kingdom. Śudraka was the hero of two poems, the *Ṣūdrakakathā* of Ramila and Soimla, and the *Śūdrakavadha,* as well as of a drama, the *Vikrāntaśūdraka,* all of which have been lost. Consult Lévi, *Théatre Indien* (Paris, 1890).

SUE, sụ, MARIE JOSEPH (known as EUGÈNE) (1804-57). A French novelist, born in Paris. He studied medicine, became an army surgeon, was transferred to the navy, cruised in the East, resigned in 1829, having inherited wealth, and gave himself successively to literature, dissipation, and socialistic agitation, writing *feuilletons* that rivaled those of Dumas in rapidity of production, fertility of imagination, and carelessness of execution. In 1831 he published *Plick et Plock,* the success of which led to *Atar Gull* (1831), a novel of the sea, suggested by his own experience and by the American novels of Cooper. It revealed a gift of story-telling, but showed a reckless mingling of tragic and comic, pathetic and grotesque. Debts and disgust at his equivocal social position turned him into a socialist and convert to the propagandism of Fourier and Proudhon. His work in this spirit consists of long novels printed in cheap newspapers, but winning such hold on the masses and so swaying democratic opinion that the Government actually sought to check or divert his activity. As a critic of that day said, Sue was entering on an unexplored path when he began the *Mystères de Paris* (1842). As the novelist of the people he was undertaking to paint the sufferings, the needs, the possibilities of the working class with the intent of influencing their political action, and in doing this he won for the novel a new audience and a new interest. He entered on the task with an enthusiasm that fired his genius to the creation of types of character that still have power to horrify or charm. Both the *Mystères de Paris* and *Le Juif errant* (1844-45) were dramatized by Sue, and both have attained world-wide circulation. He wrote an *Histoire de la marine française* (1835-37) and two historical novels, *Latréaumont* (1837), and *Jean Cavalier* (1840). The later work of Sue is vast. He was elected to the Assembly in 1850, and was exiled in December, 1851. He died at Annecy in Savoy. Consult Mirecourt, *Eugène Sue* (Paris, 1858).

SUECA, swā′kȧ. A town of Spain, in the Province of Valencia, 23 miles south of the city of that name, on the left bank of the Júcar (Map: Spain, E 3). It is in a fertile valley. Population, in 1900, 14,422.

SUERA, swä′rȧ. A seaport of Morocco. See Mogador.

SUESS, sụs, Eduard (1831—). An Austrian geologist. He was born in London, studied the natural sciences at Prague and Vienna, and from 1857 to 1891 was professor of geology at the University of Vienna. From 1873 to 1896 he was a member of the Austrian Lower House. In 1897 he became president of the Imperial Academy of Sciences. His more important contributions to geology, which have opened up a new path in geological inquiry, and laid the foundation for what is now frequently termed the 'new geology,' deal with the construction and relations of continents and mountain ranges, the dynamics of volcanoes and earthquakes, and the general movements of the earth's crust. His *Antlitz der Erde* (begun in 1885 and not yet completed) is a masterful exposition of the relations of the dominant features of the earth's surface, and the first luminous effort to correlate their multiform aspects and give to them their true geographic expression. His other works include: *Böhmische Graptolichten* (1852); *Brachiopoden der Kössener Schichten* (1854); *Brachiopoden der Kallstätter Schichten* (1855); *Ueber den Löss* (1860); *Die tertiären Landfaunen Mittelitaliens* (1871); *Die Entstehung der Alpen* (1875).

SUETO′NIUS TRANQUIL′LUS, Gaius. A Roman historian, born probably a few years after the death of Nero. Pliny procured him the dignity of military tribune, which, by Suetonius's desire, was transferred to another. He was afterwards secretary of the Emperor Hadrian, whose favor he had secured. The date of his death is unknown, but it probably occurred about A.D. 160. All his works (among which, as we learn from Suidas, there were several on topics usually treated by grammarians) have been lost, except his Lives of the Cæsars, his Lives of Eminent Grammarians, and (in part only) his Lives of Eminent Rhetoricians. It is by the first of these works that he is most favorably known, containing information about the twelve Cæsars, from Julius Cæsar to Domitian, which is to be had nowhere else, and abounding with anecdotes which, while they too often prove the profligacy of his heroes, testify to the impartiality of their chronicler. The best editions are by Baumgarten-Crusius (Leipzig, 1816-18), Reifferscheid (ib., 1860), and Roth (ib., 1886). There are English translations of the Lives by Clark (London, 1732), and by Thomson and Forrester (ib., 1855).

SUE′VI. The collective designation of a great number of Germanic peoples, as mentioned in Cæsar, *De Bello Gallico*, iv. 1. They occupied a district of indefinite extent on the eastern side of the Rhine, and may have been the same tribes as those subsequently known as Chatti, Longobardi, etc. Cæsar states that their territory comprised 100 cantons, and was densely wooded, that they had towns (*oppida*), but no strongholds, and that every year a part of the population left their homes to seek employment in war. The Suevi of whom Tacitus speaks (*Germania*, 38, etc.) seem to have dwelt north and east of the country of the Suevi of Cæsar, extending as far as the Elbe and the Baltic, which Tacitus calls the 'Suevic sea.' The peoples united under the rule of Maroboduus, the Marcomannic chief, were Suevic, and hence the Marcomanni and Quadi who figure in the reigns of Marius Aurelius and Aurelian are often called Suevi. After the name had fallen into disuse as a collective designation, it reappeared in Ammianus Marcellinus, an historian of the third century A.D., as the name of a people occupying the same territory as the Suevi of Cæsar. We find them in alliance with the Burgundians, Alemanni, Alani, Vandals, etc. They are among the most notable of the barbaric peoples that broke up the Roman Empire in the northwest and west. Bursting through the passes of the Pyrenees (A.D. 409), they, along with the Vandals, overran and wasted Spain (q.v.). Those who remained at home in Germany seem to have spread during the fifth century east of the Neckar and the Rauhe Alb, and south as far as Switzerland. The mediæval Swabians were their direct descendants.

SUEZ, sōō-ĕz′. A town of Egypt, situated on the south coast of the Isthmus of Suez, at the northern extremity of the Gulf of that name, and near the southern terminus of the Suez Canal (Map: Egypt, F 3). It is built on a desert peninsula, and consists chiefly of unpretentious-looking houses. The European quarter, however, is regularly laid out, and contains the large warehouses of the Peninsular and Oriental Steamship Company. There are also a large English and a French hospital, and the town is supplied with water from a long distance through a fresh-water canal. To the south a large stone causeway, carrying a railroad, runs to the immense harbor of Port Ibrahim, at the entrance to the canal, 2 miles south of the town. Suez has railroad connection with Cairo and Ismailia, but its commerce is not very large, as only a small portion of the transit trade passing through the canal affects the town. Population, in 1882, 10,909; in 1897, 17,457. Previous to the discovery of the sea route to India around the Cape of Good Hope Suez was a flourishing emporium for the trade between Europe and the East. It subsequently fell into decay, and before the opening of the canal it was a wretched village of 1500 inhabitants.

SUEZ, Gulf of. One of the two arms in which the Red Sea terminates, and which inclose the Sinai Peninsula (Map: Egypt, F 3). It is the western and larger of the two, and its head is the extreme northern end of the Red Sea. It lies between the peninsula and the main portion of Egypt, and has an extreme length of 187 miles with a breadth of from 14 to 39 miles. It is artificially connected with the Mediterranean Sea by the Suez Canal.

SUEZ, Isthmus of. The neck of land connecting Africa with Asia, and separating the Mediterranean from the Red Sea (Map: Africa, H 1). The shortest straight-line distance across it, between the site of the ancient Pelusium and the head of the Gulf of Suez, is 72 miles. The isthmus consists of a low, sandy, and stony desert, the lowest depressions being occupied by salt lakes and marshes, and it is almost wholly destitute of fresh water. A series of such depressions extends across the isthmus from the great coast lagoon in the north to the Gulf of Suez, and affords the route for the Suez Canal (q.v.).

SUEZ CANAL. A canal about 100 miles in length, which crosses the Isthmus of Suez and connects Port Said on the Mediterranean Sea with Port Thewfik on the Red Sea, by an artificial channel about 120 feet wide at the bottom, about twice as wide at the surface, and about 28 feet deep. In 1854 Ferdinand de Lesseps (q.v.) obtained permission from Said Pasha to form a company to construct a waterway from sea to sea without locks, and in 1855 an 'International Consultative Commission' selected from among the most celebrated civil engineers of Europe was appointed to report upon the scheme. The final report of this Commission was submitted to and accepted by the Viceroy in June, 1856. Its conclusions were in effect as follows: The system of indirect routes through the Delta of the Nile was rejected and a direct route through the isthmus from Suez to the Mediterranean was adopted. The dimensions of the channel were to be as follows: From the Red Sea to the Bitter Lakes, depth 26¼ feet, bottom width 210 feet, top width 320 feet; from the Bitter Lakes to the Mediterranean Sea, depth 26¼ feet, bottom width, 144 feet, top width 262 feet. At Port Said the plan of extending jetties directly seaward to protect the entrance was adopted. (See JETTY.) Basing his efforts on these conclusions, M. de Lesseps succeeded, in 1858, in forming a company, with a capital stock of £8,000,000, to build the canal.

TOPOGRAPHY. The construction of the canal was greatly facilitated by the existence along the route of four dried-up depressions which were formerly and have again become lakes of considerable area, namely, the two Bullah Lakes, the Great and Small Bitter Lakes, and Lake Timsah. (See Map of EGYPT.) These low-lying basins have an aggregate length of 27 miles. Excavation was required, however, through the Bullah Lakes, Lake Timsah, and the Small Bitter Lake, and also through a portion of the Great Bitter Lake. Consequently it was only for a length of eight miles of the Great Bitter Lake, where the natural depth exceeded that of the canal, that no excavation was necessary. The total distance from Port Said to Suez, Port Thewfik, is 88 nautical miles, or 100 English miles. The only serious obstacles to be overcome in the line of the canal were at El-Gisr, the summit of the work, situated between the Bullah Lakes and Lake Timsah, where the hills crossing the canal vary from 30 to 60 feet above sea-level over a length of 6 miles, and at the deep cutting of Serapeum, between Lake Timsah and the Great Bitter Lake. From Port Said to Kantara, a distance of 24 miles, the canal passes through Lake Manzaleh, a shallow lagoon which covers an area of nearly 1000 square miles. The soil encountered along the route was sand, sandy clay, and hard clay, with rare stretches of rock, and thus favorable to rapid and easy excavation. No serious engineering difficulties were presented by the harbor works at Port Said and Suez. In short, the canal works in general were of a very simple nature, but of vast magnitude, involving as originally proposed, the removal of 60,000,000 cubic meters of dry earth and 56,000,000 cubic meters of earth under water; and as they were situated in a country destitute of fresh water, a well-conceived organization was required to bring the colossal work to a successful issue.

PROGRESS OF THE WORK. Work on the canal was begun on April 25, 1859. The work progressed slowly at first, but the installation of a large fleet of dredges by means of which the dredged material carried by long and high projecting chutes was rapidly delivered on either bank of the canal at some distance from the slopes of the cuttings without the intervention of barges, and other mechanical appliances, had the effect of reducing by three-fourths the number of workmen needed to open the canal by the time originally estimated. More important than these, however, was the completion, in 1863, of a fresh-water canal and pipe line from Cairo by the way of Ismailia to Port Said. Financial difficulties were overcome, first, by decreasing the width of the bottom of the canal to 72 feet, and, second, by virtually increasing the capital of the company to £17,100,000. To compensate for the greatly reduced width of the canal, sidings were provided at every five or six miles between Port Said and Lake Timsah to allow vessels to bring up either for the purpose of passing each other or to moor for the night. In April, 1867, water from the Mediterranean was let into the marshy bed of Lake Timsah, and in March, 1869, it was allowed to flow into a near-by dry salt-incrusted basin of the Bitter Lakes. On November 17, 1869, the canal was opened to traffic with great pomp and ceremony. According to the expense account the canal had cost up to December 31, 1869, a sum of £16,632,953.

ENLARGEMENT OF THE CANAL. In 1883 it became evident that, owing to the great increase of traffic, a radical plan of improvement was demanded. In 1884, therefore, a second International Consultation Commission was appointed to consider the whole question and to report plans. This commission made its report in 1885, and shortly thereafter the enlargement works were begun according to the general plan recommended by the commission. The first stage of these enlargement works was completed in 1898; it consisted in an increase of the bottom width of the canal to 121⅓ feet, and of an increase of the navigable depth to 27 feet 10 inches. In addition to this uniform enlargement of section there were completed in 1899 nine new sidings, each 49 feet wide and 2460 feet long. In 1900 the average time of passage was 18 hours and 32 minutes for vessels navigating by night as well as day.

LIGHTING FOR NIGHT NAVIGATION. At the close of 1885 it was decided to make use of electric light in such a manner as to insure a safe passage by night through the canal, the company hoping in this way to diminish the traffic by day and thus to render the navigation less difficult until the full enlargement of the waterway was accomplished. After some experimenting with a system of landing marks, supplemented by Pintsch light buoys, it was decided that every vessel in motion during the night should itself be provided with the necessary apparatus to illuminate its passage through the canal. Accordingly it was arranged that every vessel passing by night should carry four lights, one astern, one on each side, and one ahead, to the last of which should be applied a powerful reflector capable of spreading light 4000 feet ahead of the vessel. The Mangin reflector is generally used. Men-of-war and large postal steamers carry their own apparatus. Smaller vessels generally use portable apparatus which they hire upon entering and return upon leaving the canal. The effect of this system of lighting so as to permit night navigation has been virtually to double the carrying capacity of the canal.

Traffic and Revenue. The toll charged for the passage of the canal was 10 francs per ton and 10 francs per passenger when the canal was first opened. Various changes were made in succeeding years, and in 1903 the toll was 8½ francs per net ton for loaded vessels, 7 francs for empty ships, and 10 francs per passenger. The accompanying table shows the traffic of the canal from 1869 to 1900, inclusive:

YEARS	Vessels	Gross tonnage	Net tonnage	Transit receipts
				Francs
1869	10	10,558	6,576	54,460
1870	486	654,915	436,609	5,159,327
1875	1,494	2,940,708	2,009,984	28,886,302
1880	2,026	4,344,520	3,057,422	39,840,484
1885	3,624	8,985,412	6,335,753	62,207,439
1890	3,389	9,749,129	6,890,094	66,984,000
1895	3,434	11,833,637	8,448,383	78,103,718
1900	3,441	13,699,238	9,738,157	90,623,608

In 1899, according to the United States Consular Reports, the tonnage passing the canal was 9,893,022, and the revenue was $17,510,142; in 1900 the corresponding figures were 9,738,152 tons and $17,480,356.

History. The plan of a water connection between the Mediterranean and the Red Sea goes back to early Egyptian history. Such a canal seems to have been constructed in the reigns of Seti I. and Rameses II. (about B.C. 1350-1300), extending from the Nile to Lake Timsah and thence to the Red Sea. When this had been choked up by the sands in the course of ages, a new canal was begun by Necho, a son of Psammetichus I. (about B.C. 600), between Bubastis on the Nile and the Red Sea, but was left unfinished till the time of Darius Hystaspis (B.C. 521-486), who completed the work. About the beginning of the Christian Era the canal was no longer navigable, but it was probably restored under Trajan. The last restoration was made in the seventh century by Amru, the Mohammedan conqueror of Egypt, who connected Cairo with the Red Sea. During Napoleon's invasion of Egypt (1798-99) the project of piercing the isthmus was carried to the extent of preliminary surveys being made, but, owing to a miscalculation on the part of the engineers which seemed greatly to enhance the difficulties of the work, the execution of the plan was delayed till the French were forced to abandon Egypt. An international commission of engineers made a preliminary survey in 1846 to ascertain the practicability of a level-water canal. The English engineer on the commission, George Stephenson, strongly opposed a canal and recommended to his Government a railroad from Cairo to Suez, and this was constructed by British capital in 1858. By the terms of the Lesseps concession (see above) the canal was to be constructed without expense to Egypt, which was to receive 15 per cent. of the gross receipts for ninety-nine years, at the expiration of which period the canal was to revert to the Egyptian Government. When, however, De Lesseps found it impossible to enlist the large amount of capital necessary, he turned to Said Pasha, secured from him a large loan for preliminary work and promoting, and later a subscription for nearly half of the stock, which was about £17,000,000. Said was not able to pay his subscription and his warrants had to be cashed in London. The Egyptian Government had agreed to furnish labor at a nominal price, the fellaheen to be well treated and their health to be cared for. The violation of the latter condition on the part of the canal company aroused a protest in the name of humanity, especially from England, which had never looked with favor on the canal and suggested to the Sultan that the work be stopped. His approval of the concession, as suzerain, which had been provided for in the original contract with Egypt, had never been obtained. He now approved the concession, but decided that the fellaheen must not be forced to do the work. The company complained of the Egyptian Government's compliance with this order from Constantinople as a breach of contract, made heavy claims for damages, induced the Khedive to accept Napoleon III. as arbitrator, and on this and a later claim wrung from the exhausted resources of Egypt over eighty million francs. The direct and indirect cost of the canal to Egypt is estimated at about $85,000,000. In 1875 Ismail Pasha (q.v.) appealed to Europe for aid in his financial difficulties. Among other measures that were taken was the sale of his canal stock to England, 176,602 shares, for £4,000,000. This made England, which had originally opposed the canal project, the heaviest owner in it, and combined with the general financial assistance rendered to Egypt gave that power a direct interest in Egyptian affairs. A very short time sufficed to show that the canal was of the utmost value as the passageway between England and her Oriental possessions. England and France at first exercised together that tutelage over Egypt which the financial situation rendered necessary. Later events led England to assume this responsibility alone. The Suez Canal was the key to this political development, as it has become in part to the complicated situation in the near East. See Eastern Question; Egypt.

SUFFOLK, sŭf′ok. A southeastern maritime county of England, bounded on the east by the North Sea, on the north by Norfolk, and on the south by Essex (Map: England, G 4). Area, 1489 square miles. Population, in 1891, 371,235; in 1901, 384,198. The surface is for the most part flat, falling away into marshes on the northwestern and northeastern borders. The tributaries of the Waveney and of the Stour, together with the river Lark, an affluent of the Great Ouse, and the Gipping, with its estuary, the Orwell, are the chief streams. The soil is of various kinds, some of which are very productive for the ordinary crops. Capital, Ipswich.

SUFFOLK. A town and the county-seat of Nansemond County, Va., 22 miles southwest of Norfolk; on the Nansemond River, and on the Norfolk and Western, the Seaboard Air Line, the Southern, the Atlantic Coast Line, and the Suffolk and Carolina railroads (Map: Virginia, H 5). It is an important railroad centre, and one of the largest peanut-cleaning markets in the State. There are car works, a stove foundry, various wood-working mills, iron works, hosiery mills, and brick plants. The surrounding region is fertile and is well adapted to farming. Population, in 1890, 3354; in 1900, 3827.

SUFFOLK, Earls and Dukes of. Dignities held by several noted English families. The title Earl of Suffolk was conferred on Robert de Ufford (1298-1369), who held high office under Edward III. He was made admiral of the northern fleet in 1344, fought at Crécy and Poitiers and was repeatedly intrusted with diplomatic missions. He was succeeded by his son William de Ufford, who was one of the most popular statesmen of the later part of Edward III.'s reign, took a share in the suppression of the peasant revolt of 1381, and died in 1382, leaving no male heirs. A new line of Suffolk was founded by Michael de la Pole (1335?-89), who fought in the French wars, became in 1376 admiral of the northern fleet, negotiated the marriage of the young Richard II. with Anne of Bohemia, and in 1383 was made chancellor. By marriage he acquired extensive possessions in Suffolk and these were added to by royal grants. In 1385 he was created Earl of Suffolk. His rapid elevation and the great influence which he exercised over the King aroused the hostility of the nobles and in 1386 he was dismissed from office on the demand of Parliament, which proceeded to impeach him of treason and malfeasance. The King's favor could not protect him and in 1387 he fled the country. In his absence he was condemned to be hanged. He died at Paris. His son Michael de la Pole (1361-1415) was restored to his father's dignities in 1397 and fell at Harfleur in 1415. He was followed by his eldest son, who was killed soon after at Agincourt, being succeeded by his younger brother William de la Pole (1396-1450), best known of all that have born the title. He served in the French wars under Henry V., the Duke of Bedford, and the Earl of Salisbury, upon whose death in 1428 he became head of the English forces in France. He failed to capture Orleans, which was relieved by Joan of Arc in 1429, and in the same year was taken prisoner. Ransomed at a heavy cost he took little part in military affairs, but for twenty years played a most important rôle in the government. As a member of the King's council he sought to bring about peace with France and was one of the English representatives at the abortive congress of Arras in 1435. The death of the Duke of Bedford in the same year left him one of the two most powerful men in the kingdom, his great rival being Humphrey Duke of Gloucester, uncle of the young Henry VI. In 1844 Suffolk was at the head of an embassy which arranged a truce with France and brought about the marriage of Henry VI. with Margaret of Anjou. This alliance gained him tremendous though temporary popularity. The government fell entirely into his hands and after the death of Gloucester in 1447 he was master in the kingdom. He became in rapid succession chamberlain, lord warden of the Clinque Ports, admiral, governor of Calais, and Duke of Suffolk. He was hated, however, by a large faction of the nobility, at whose head stood Richard, Duke of York. He lost his popularity owing to the surrender of Anjou and Maine, to which he had assented as one of the conditions of the King's marriage, and the feeling of hostility was intensified by the renewal of war with France in 1349, in the course of which Normandy was lost to the English. Popular opinion accused him also of having encompassed the death of the 'good Duke Humphrey.' In 1450 the Commons accused him of having betrayed the King to the French and brought articles of impeachment against him. The King whose favor he never lost sentenced Suffolk to five years' exile. On May 1, 1450, the Duke set sail for France, but the ship on which he embarked was intercepted by a royal man-of-war, Suffolk was compelled to go on board, and on the following day was taken into a small boat and beheaded. His body was cast upon the beach at Dover. The sanguinary deed was probably due to Richard of York, his mortal enemy.—John de la Pole (1442-91) second Duke of Suffolk, only son of the preceding, regained the ducal title in 1455. He joined the York party, married a sister of Edward IV., and was in favor under the rulers of that family and under Henry VII. His eldest son John took part in Lambert Simnel's rebellion and fell at Stoke in 1487. He was attainted and the greater portion of the family estates was lost.—Edmund de la Pole, a younger brother, received a part of the confiscated estates with the title of earl. He plotted to seize the throne with the aid of German troops but the plan miscarried and he fell into the hands of Henry VII., who, however, spared his life and sent him to the Tower. He was beheaded with his brother Richard in 1513, and left no male issue. The title Duke of Suffolk was subsequently borne by Charles Brandon (died 1545), the favorite of Henry VIII. and husband of his sister Mary Tudor. He was succeeded by his two young sons, who died in 1551, on the same day.—Henry Grey, third Marquis of Dorset, who had married a daughter of Charles Grandon, was next made Duke of Suffolk. He was the father of the unhappy Lady Jane Grey (q.v.). In 1553 he attempted to raise the north, was betrayed and beheaded. In 1603 Thomas Howard, second son of Thomas, fourth Duke of Norfolk, was created Earl of Suffolk. His second son was created Earl of Berkshire in 1626 and in 1645 the two titles merged. The present bearer of the title is Henry, 19th Earl of Suffolk and Berkshire, born in 1877.

SUFFRAGAN (ML. *suffraganus*, *sufraganus*, from Lat. *suffragari*, to assist, to vote for, from *suffragium*, vote, originally probably a broken potsherd used in voting, from *suffringere*, *subfringere*, to break, from *sub*, under + *frangere*, to break). The name given to a bishop to express his relation, in a province, to the archbishop or metropolitan (q.v.). The name is also applied to coadjutor or assistant bishops, especially in the Church of England, where suffragan bishops are usually known by territorial titles, although they have no independent jurisdiction, and their local commission, given by the bishop of the diocese, terminates with his death. In the Roman Catholic Church similar assistant bishops are usually designated by the titles of extinct sees. See Titular Bishops.

SUFFRAGE (Lat. *suffragium*, vote). In a representative government, the act of a qualified voter in participating in the choice of government officials or in voting on laws or constitutions submitted to the electorate. There are two views as to the basis of suffrage. One holds that it is a privilege bestowed by the State upon such of its citizens as are capable of exercising it intelligently and for the public welfare. The other view regards it as the natural right of all adult male citizens. This was the doctrine of the eighteenth-century philosophy, but has been rejected by most States, suffrage having been restricted by them on some of the following bases: ownership of property, payment of taxes, educational attainments, moral character, residence, religious profession, etc. An almost universal rule has been to exclude women, children, lunatics, idiots, convicted criminals, and aliens from the exercise of the suffrage, although there have been and are still exceptions.

In the American colonies the qualifications for suffrage varied greatly. Thus in Virginia the suffrage was restricted to 'freeholders and housekeepers;' in Massachusetts until 1664 it was restricted to church members; in the New Haven Colony it was the same; under the Massachusetts charter of 1692 it was restricted to freeholders of a certain amount of property. The religious tests were the first to be abolished, the last survival of the kind existing in South Carolina from 1778 to 1790. The right of each State to regulate the whole matter of the suffrage within its limits was recognized by the Federal Constitution and in hardly any two States were the requirements the same. During the early part of the nineteenth century a freehold qualification was required in Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Virginia, Maryland, North Carolina, and South Carolina, the amount ranging from £20 in New York to £60 in Massachusetts or from 25 acres of improved land in Virginia to 50 acres in Maryland and South Carolina. The payment of taxes alone was required in Pennsylvania, Delaware, and Georgia. During the first three decades of the nineteenth century the freehold requirement was abolished in nearly every State. Likewise the tax and ownership of personalty qualifications disappeared in most of the States, so that adult male suffrage became the general rule long before the outbreak of the Civil War. Free negroes were almost everywhere excluded.

A readjustment of the suffrage followed the Civil War. The Reconstruction Acts of 1867 conferred the right of suffrage on the freedmen. In all the States that had rebelled the negroes voted for the first time in 1867 in the elections for delegates to the reconstruction constitutional conventions, and in the following year on the question of adopting or rejecting the new constitutions. The States having once been readmitted to the Union, however, there was nothing to prevent them from withdrawing the right temporarily bestowed on the freedmen by Congress. The Fourteenth Amendment was intended to guard against such action on the part of the reconstructed States. On account of the difficulty of enforcing this amendment and the inadequacy of protection which it afforded the negro population, the reconstructionists advanced another step. In the first place, it was made a condition precedent to the readmission to the Union of the remaining unreconstructed States that they adopt constitutions with unamendable provisions guaranteeing the right of suffrage to negroes. At the same time the Fifteenth Amendment to the Federal Constitution was carried. But the Constitution confers the right of suffrage directly on no one, so that there are no United States voters. This is a prerogative of the individual States, and they may exclude any number of persons on other grounds than race or color, such as illiteracy, lack of citizenship, non-payment of taxes, etc., subject to the penalty of a reduction of representation in Congress.

The attainment of the twenty-first year of age is a qualification in every State. In a number of States women are allowed to vote in school elections and in several Western States they vote in State elections. The States may and generally do require voters to register within certain periods as a means of preventing frauds at the election, and this requirement indirectly excludes some. Residence within the State and district for a certain period previous to the election is an almost universal requirement. Educational tests have long existed in Massachusetts and Connecticut and have been introduced in a number of the Southern States, as a result of which the suffrage has been practically restricted to the whites in Mississippi, South Carolina, Louisiana, North Carolina, Alabama, and Virginia. In Louisiana and North Carolina the hereditary principle has also been introduced into the suffrage by the so-called 'grandfather' provision, which extends the right to vote to all adult males, without regard to intelligence or property, whose fathers or grandfathers possessed the right to vote on January 1, 1867. See the sections on government of the various countries and States for suffrage requirements.

SUFFEREN DE SAINT-TROPÈZ, sụ'fräɴ' d*e* säɴ trŏ'pȧ', Pierre André de (1726-88). A French naval hero, born at Saint-Cannat, near Lambesc. He was captured by Hawke in 1747 and after his exchange served for years with the Knights Hospitalers of Malta. From 1767 to 1771 he was again in the service of Malta. He was created Baillie in the order of the Knights and was thereafter popularly known as the Baillie de Suffren. In 1772 he was commissioned captain in the French Navy. His most noteworthy services were rendered at the very close of his career, against the English, in the Indian Ocean, where he went in command of a squadron in 1781.

SUFIISM, so͞o'fē-ĭz'm (from Ar. *sūfī*, mystic, clad in woolen, from *ṣūf*, wool; less plausibly derived from Gk. *σοφὸς*, *sophos*, wise). A coherent and organized system of Mohammedan mysticism.

Formerly Sufis were called *Urafa*, 'Gnostics' or 'theosophists.' To-day the most common name is Fakirs, or Dervishes, 'the poor,' but it must be understood that not all the poor in Persia, Egypt, or Turkey, the main homes of Sufiism, are Dervishes, and that not all who are called or pretend to be Dervishes are Sufis. Aship Pasha (A.D. 1332) aptly said: "He who forsakes the world is a Dervish; he whom the world forsakes is a beggar."

The origin of Sufiism is disputed. Some Sufis say that "The seeds of Sufiism were sown in the time of Adam, germed in that of Nuh (Noah), budded in that of Ibrahim (Abraham), and began to develop in the time of Musa (Moses); reached maturity in Isa (Jesus), and produced pure wine in Mohammed." The word Sufiism seems to have been first adopted by Abu Hashim, a Syrian (A.D. 780). Abul Said Abul Khair (about 820) is mentioned as founder, while Al-Ushairi (1073) states that the name was in common use about 815. Mythical tales give the origin to Rabia al Adawiyya (752), a pious woman much spoken of in Sufiism. There seems to be historic evidence to prove that, in spite of Mohammed's precautions against mysticism, it originated in his own family, with his favorite Ali. Those who maintain that Sufiism has its origin in the Vedanta (q.v.) place it, of course, much further back in time. Despite certain analogues, as the Persian *pīr*, or sage, who corresponds to the *guru*, or teacher, of India, who initiates the neophyte into the esoteric mysteries, there are many fundamental differences between the two systems. Both overlook the fundamental difference between the two. Sufiism is radically theistic and seldom swerves far from the Koran's intense belief in the One. The Vedanta is pantheistic with occasional theistic phraseology. The Sufis are so completely absorbed in their devotion to the Beloved (viz. God) that they look for Divinity everywhere and see Divinity anywhere; the superficial observer therefore easily comes to regard the Sufis' love in a pantheistic way, and compares it with the Vedantic doctrine of absolute pantheism, summed up in the phrase *tat tvam asi,* 'That (the Universal Spirit) thou art.' It may, however, be admitted that later Sufiism shows forms of expression very similar to Vedanta, but also that no historic connection has been proved by anybody. It cannot be denied that the intellectual forms given to most of the Sufi doctrines in Persia, where Sufiism always was most powerful, are from foreign sources. Among historic forces which thus have molded Sufiism must be mentioned especially the Peripatetic philosophy, Neo-Platonism, and Zoroastrianism. The latter's formalism lent itself admirably to the Arabic intellect, and its doctrines of Light harmonized well with Sufiistic ascetic notions of the One. From Greek sources came dialectics and cosmological notions. The latter, though common in Sufiism, are alien to its primitive nature. The Greek influence is traceable to the seven philosophers, Diogenes, Hermias, Eulalius, Priscian, Damascius, Isidore, and Simplicius, whom Justinian's intolerance drove into exile and who came to reside at Nushirwan's court. The rich symbolism of Sufiism is either of Zoroastrian origin or indigenous, with the exception of its Alexander legends.

A few really great Sufis lived before the close of the second century of the Hejira (815). Among them and those immediately after are to be mentioned the Egyptian Dhun-Nun (859), who introduced the doctrine of ecstasy and mystical stages; Sirri Sagvati (867), who introduced unification; Junaid (910), who reduced Sufiism to writing; and Al-Nallaj, who became famous because he went about crying "I am the true One," for which he was put to death by torture (921). The *Fihrist* (987) represents him as a 'wily conjurer,' but Sufis consider his death the result of the workings of the occult law which brings death upon him who divulges divine secrets. Ghazali (q.v.) (d. 1111) and Jalal-ud-Din Rumi (q.v.) (d. 1273) were the two most famous Doctors in Sufiism. Omar Khayyam (d. 1123), reckoned by some as a Sufi, became known to the West through FitzGerald's brilliant quatrains. Nizami (q.v.), Farid-ud-Din Attar (q.v.), Sadi (q.v.), Shamsi, Hafix (q.v.), Anvari, Jami (q.v.), and Hatifi (q.v.) are sub-poets of renown. Jami (d. 1492) has been called the last Sufi, and with some justice. After him Sufiism slowly declined, but the nineteenth century saw its powerful revival in Turkey, though its Turkish representative names are almost unknown outside of Turkey. From Turkey and Egypt comes what may be called a Neo-Sufiism.

Primitive Sufiism is not doctrinal; it is an 'experience,' a 'feeling of God,' a 'mystery of godliness,' and does not primarily have anything to do with the notions of the intellect. Within two hundred years from its origin, however, it assumed doctrinal forms and it remained settled in them, though it never gave up the main characteristics of its beginning. The two chief doctrines of Sufiism are that of the One (*Ahad*) and that of 'the Way to the One' (*tarīqat*). A Sufi first of all endeavors to realize that 'the One' is the only existence, that there is not only 'no god but God,' but that there is nothing but God. Next, he enters upon 'the journey to the rose-garden of Union.' The Sufi's belief is not pantheism in the Greek sense; he does not 'make everything God except God himself;' on the contrary, everything is naught except Divinity and it is Divinity that gives life to the dead Non-Being. The world is a phantasmagory, and the time will come when it shall pass away. God's reason for creating the world is found in this saying: "I was a Hidden Treasure and I wished to be known, so I created Creation that I might be known." The form of creation is not only truth and goodness, but also and essentially beauty. Sufis lay more stress upon the conception of Divinity as beauty than other mystics or religions.

The Sufi 'way to God' is similar to the well-known ideas on that subject among Western mystics. With the help of a guide, 'the traveler' ascends step by step to union with God or through awakening to regeneration and sanctification to union. The 'Way' is ascetic and full of occult practices, such as dances, silences, etc. All men may reach union. Every man is essentially both a *microtheos* and a *microcosmos*, or, as Shamsi of Tabriz sings in echo of numerous other Sufis: "My place is in the Placeless; my trace is in the Traceless." "I gazed into my own heart; there I saw One."

Sufi symbolism is a mystery and permeates the entire system of Sufiism. A symbol to a Sufi is not merely an object which stands for some other object or idea. For him every object has besides its own immediate signification also an ideal content, and it is this latter which is the real object of the Sufi's search. He finds it by means of Love (*isq*). The object is to the ecstatic a vivid, instantaneous revelation of the inscrutable. Objects are therefore 'veils,' not veils that hide, but 'veils' that reveal the One. All Sufi poetry is written with a double sense and the initiates can read five others besides. The now comparatively well-known ghazels of Hafiz, Sadi, Jami, and others abound in 'veils,' which the Occidental calls voluptuous and bacchanalian, but to the Sufi, Oriental as he is, they are not low or degraded, but simply descriptive of emotions or soul-life. As such they suggest to him deeper and more universal states of life. The *embrace* means discovery of the mysteries of Godhead; *wine* divine love and wisdom; a *tavern* signifies what we call a church, because through the rapture of the wine and the wonder of the embrace the Sufi is filled with thoughts of the Beloved; a *red rose* is the beloved damsel and the *nightingale* is the lover; but the Beloved is always God.

There are many sects among the Sufis, but their differences are not strictly Sufiistic; they have arisen on external and unessential ground and are of little interest outside of Sufiism. Sufiism has exerted a powerful influence where Mohammedanism rules, especially in Arabia, Persia, and Egypt, and it is flourishing to-day in Turkey. India also has a large number of Sufis. Persian literature, more than any other, bears strong impress of it.

Consult: Jalal ud-Din Rumi, *Mathnawī*, translated by Redhouse (London, 1881) and by Whinfield (ib., 1887); Farid ud-Din Attar, *Mantiq at-Tair,* edited and translated by Garcin de Tassy (Paris, 1857-63); Mahmud Shabistari, *Gulšān-i-Rāz*, edited and translated by Whinfield (London, 1880); Tholuck, *Ssufismus, sive Theosophia Persarum Pantheistica* (Berlin, 1821); id., *Blütensammlung aus der morgenländischen Mystik* (ib., 1825); Palmer, *Oriental Mysticism* (Cambridge, 1867); Brown, *The Dervishes, or Oriental Spiritualism* (London, 1868); Kremer, *Geschichte der herrschenden Ideen des Islam* (Leipzig, 1868); Ethé, "Der Çûfismus und seine drei Hauptvertreter in der persischen Poesie," in his *Morgenländische Studien* (ib., 1870); id., *Die mystische, didaktische und lyrische Poesie und das spätere Schrifttum der Perser* (Hamburg, 1888); id., "Neupersische Literatur," in Geiger and Kuhn, *Grundriss der iranischen Philologie,* vol. ii. (Strassburg, 1896-97); Frank, *Beitrag sur Erkenntnis des Sufismus* (Leipzig, 1884); Pizzi, *Storia della Poesia persiana* (Turin, 1894); Gibbs, *History of Ottoman Poetry* (London, 1900); Browne, "Sufiism," in *Religious Systems of the World* (ib., 1892); id., *Literary History of Persia* (ib., 1902); Bjerregaard, *Sufi Interpretations of the Quatrains of Omar Khayyam and Fitzgerald* (New York, 1902); Macdonald, *Development of Muslim Theology, Jurisprudence and Constitutional Theory,* (ib., 1903).

SUGAR, MANUFACTURE OF. Cane sugar is found in varying quantities in many plants, but sugar-cane (*Saccharum officinarum*), the sugar beet (*Beta vulgaris*), the sugar maple (*Acer saccharinum*), and various species of palms are its only commercially important sources. (See table below.) At one time the United States Department of Agriculture experimented with sorghum (*Sorghum vulgare*), which seemed a promising source of cane sugar, but though several varieties containing from 10 to 20 per cent. of cane sugar were produced by seed selection, sorghum has never been more than locally important as a source of syrup, because great difficulty has been experienced in purifying the juice by any known process except that recommended by the department, a process which failed to attract investors, because alcohol, its principal factor, was subject to unfavorable revenue regulations. Several sorghum sugar factories were erected in Kansas and elsewhere about 1890, but development failed to pass the experimental stage. In 1889 the production of syrup was 24,235,219 gallons; in 1899, 16,972,783 gallons. (See SORGHUM.) Experimentally, small quantities of cane sugar have been made from corn stalks and from melons. Owing to the presence of impurities, including saccharine substances other than cane sugar, raw sugars obtained from the various plants mentioned differ greatly in flavor, but, contrary to popular belief, the granulated or refined sugar derived from them differs not at all in sweetening power, since it consists of more than 99 per cent. of cane sugar and less than 1 per cent. of impurities including mineral matter, water, etc.

CANE SUGAR. During the middle of the eighteenth century sugar-cane (q.v.) was introduced from Southern Europe into Louisiana, where the successful manufacture of sugar began during the last decade of that century. Formerly the juice obtained by more or less crude processes was evaporated in open pans ('kettles') and the molasses allowed to drain in barrels or other forms of coolers. The molasses, which was generally not reboiled, was superior in flavor and lighter in color than that remaining after the removal of several crops of crystals in a modern sugar factory, because of its smaller proportion of impurities.

The modern sugar factory is equipped with every apparatus suggested by scientific research. The juice of the cane is extracted in 'mills' consisting mainly of a system of rollers, often eight, arranged in three sets, through which the cane successively passes; first, two corrugated rolls, which break and prepare the cane for the heavier pressures applied by the succeeding sets of three rolls each. Between the second and third set the crushed cane is sprayed with water to facilitate the removal of sugar by the last set. This process removes from 50 to 85 per cent. of the sugar, according to the efficiency of the apparatus and the care with which it is operated. The crushed cane, called 'bagasse,' is used for fuel to furnish steam for the engines and pumps, and for the evaporation of the juice. The diffusion process, which is used in relatively few cane-sugar factories (see BEET SUGAR, below), secures from 90 to 97 per cent. of the sugar, but the bagasse is unfit for fuel.

Aside from the minor details the process of manufacture is essentially the same in each case. For white sugar the juice is bleached with the fumes of burning sulphur. Lime is next added to neutralize it or to leave it faintly acid. In the subsequent heating the insoluble compounds of lime formed with the organic acids, the albuminous bodies, and other impurities rise to the surface and are removed by skimming or are precipitated. Since the quality of the sugar produced depends upon this process of clarification, considerable skill and care are bestowed upon it. The skimmings and stillings, which were formerly thrown away, are now filtered and saved, and in many factories the clear juice is often filtered also to remove all traces of insoluble matter.

In a new and efficient process adopted by many factories during the closing decade of the last century the limed juice is pumped continuously under high pressure through pipes surrounded by steam in a chamber ('superheater'); thence it passes through a cooler in which the same pipes, extended, are surrounded by the cold juice, which absorbs the surplus heat; and lastly it passes direct to the filter presses and settling tanks. The process is continuous, accomplishes a high degree of purification, eliminates the labor of skimming, and is conducted in a closed apparatus.

The clarified juice containing from 10 to 18 per cent. of sugar is evaporated in multiple-effect vacuum evaporators, so called because the heating effect of the steam is utilized in vacuo as many times as there are pans in the series, steam being applied to the first pan and the vapor from the boiling juice to the second pan, and so on. From the last pan the vapor passes to a condenser, kept in constant vacuum by a continuously acting pump from which it flows away. The juice is pumped continuously through the pans, from the last of which it issues as a syrup containing about 50 per cent. of dissolved matter, including from 40 to 45 per cent. of sugar and 5 to 10 per cent. of impurities.

The syrup is then admitted to the 'strike' pan, a cylindrical cast-iron vessel provided with a vacuum pump, condenser, and several coils of copper tubing, to which steam may be admitted as desired. After further condensation, and when about one-fourth or one-third full of thick liquor, a fresh charge of cool syrup is admitted to cause the formation of minute sugar crystals ('grain'), the size of which can be controlled by the sugar-boiler, who regulates the boiling and the admission of fresh syrup so as to avoid the formation of new crystals, 'false grain.' The pan is emptied when it becomes filled with a dense mass of sugar crystals and syrup, 'massecuite,' which is conveyed to cylindrical metal vessels (centrifugal machines) with perforated walls and supported upon vertical shafts making from 1000 to 1500 revolutions a minute, the force throwing the syrup out through the walls. After the sugar is sprayed with water in which a little ultramarine or other harmless blue is added to correct the yellow tint, it is removed, and in the case of granulated sugar is dried in revolving drums (granulators) through which a current of warm air passes.

The molasses may be reboiled even three times for a 'second,' 'third,' and, if exceptionally pure, even a 'fourth' sugar. In these cases the massecuites, which contain no crystals when they leave the vacuum pan, are placed in 'sugar wagons,' tanks, or metal boxes on wheels, for a few hours or days until crystals form. These second and third massecuites are frequently granulated in cylindrical 'crystallizers' while constantly stirred by revolving paddles, a method ('crystallization in movement') very generally adopted in modern beet-sugar factories.

Beet Sugar. The manufacture of sugar from beet roots is a comparatively modern industry, having its inception in the investigations of Margraff, who in 1747 announced to the Berlin Academy of Sciences the analyses of several sugar-containing plants and predicted that the sugar beet (q.v.), being the most saccharine of the plants examined, would become the basis of a great industry. Nearly half a century later the problem was solved by a pupil of Margraff, Achard, who made a considerable quantity of beet sugar and announced his methods to the Berlin Academy of Sciences and to the Institute of France in 1797 and 1799, respectively. In Germany several beet-sugar factories were built within the next decade, and beginning with 1810 the industry, being stimulated by governmental aid in both countries, developed steadily. Astonishing improvements have been wrought in all branches. The percentage of sugar in the roots has been increased by selection from less than 7 per cent. at the beginning to an average in 1900 exceeding 14 per cent. and a maximum of more than 20 per cent.; the quality of the roots, the yield in tons per acre, and the improved processes of manufacture, which according to German statistics have reduced the weight of roots necessary to yield a pound of sugar from 18 pounds in 1837 to 7.02 pounds in 1899, have combined to make the industry profitable both in Europe, with its cheap labor, and in America, with its cheap lands.

In the manufacture of beet sugar the roots, already trimmed of leaves, are conveyed by water in little canals which extend through the bottoms of the V-shaped storage sheds, to the washing machine, where every particle of soil is removed by revolving brushes, the roots constantly progressing against a current of water toward the automatic weighing machine. After the weight has been recorded the roots go to the slicer. Here they are cut by corrugated knives into little V-shaped slices (cossettes) that drop into large iron tanks (cells), a series of 12 to 14 of which constitute a 'diffusion battery,' so called because the sugar is removed from the cossettes by water into which the sugar diffuses and which passes by a complicated system of pipes and valves through all the charged cells of the series, always from the longest filled cell, containing nearly exhausted cossettes, to the most recently filled, thus removing the largest possible quantity of sugar with the smallest quantity of water. One of the two uncharged cells is always being filled with fresh cossettes, the other being emptied, its cossettes containing less than 0.5 per cent. of sugar. Thus the process is continuous. The exhausted cossettes, which are used as stock food, are pressed to remove the excess of water and in some cases are dried to enhance their transporting and storing qualities.

Number and Nominal Daily Capacity of Establishments in 1900, 1899, and 1889

[From the Twelfth Census]

STATES AND TERRITORIES	1900		1899		1889	
	Number of establishments	Nominal daily capacity in tons of beets	Number of establishments	Nominal daily capacity in tons of beets	Number of establishments	Nominal daily capacity in tons of beets
The United States........	37*	22,310	31†	19,110	15	7,560
California........	8	9,900	8†	9,900	5	4,400
Colorado.........	3	1,850	1	350	...	....
Illinois............	1	700	1	700	...	....
Michigan.........	10	4,450	9	4,100	1	400
Minnesota.......	1	400	1	400	1	400
Nebraska.........	3	1,260	3	1,260	2	660
New Mexico.....	1	200	1	200	1	200
New York........	3	1,000	2	400	2	400
Ohio................	1	400	...	....	...	....
Oregon...........	1	350	1	350	1	350
Utah...............	4	1,450‡	3	1,100§	2	750
Washington....	1	350	1	350	...	....

* Includes two idle establishments. † Includes one idle establishment. ‡ Includes two auxiliary factories. § Includes one auxiliary factory at which no sugar is manufactured, but juice is extracted from the beets and pumped to a central factory for treatment. In November, 1903, other factories not mentioned in the above table were opened as follows: Michigan, 6; Utah, 2; Colorado, 1.

When the 'diffusion juice' leaves the battery the coarse particles of beet pulp are filtered out and from two to three pounds of lime added for each hundred pounds of beets used. Carbon dioxide is then forced through the liquid to precipitate the lime, together with certain impurities, after the removal of which the operations of liming, carbonizing, and filtering are repeated. If the final product is to be a white sugar, the clear juice is then bleached with sulphurous acid and again filtered. The subsequent treatment corresponds more or less closely with that employed in the factories using sugar-cane.

The United States Department of Agriculture and various experiment stations, by means of special appropriations, have assisted greatly in the development of the beet-sugar industry, which is established on a firm footing in America. Especially since 1897 (see table) has the growth been rapid, the capital invested being, in 1900, more than $25,000,000.

Maple Sugar. The manufacture of maple sugar is carried on more or less wherever sugar-maple trees are abundant, especially in the Northern Atlantic and Northern Central States, the leading producers, according to census returns, being Vermont and New York. In some cases the natural groves have been extended by planting. The busy period depends upon the locality and upon the season, sometimes commencing in February and sometimes lasting until the middle of May, the best flow of sap being when there is a diurnal alternation of thawing and slight freezing. See Maple.

The most popular modern method of tapping the trees is to bore a one-half inch hole not more than 1½ inches into the tree near the ground and to drive in a metal or wooden 'spile.' This conducts the sap and also serves to support the bucket, from which the sap is collected once or oftener each day and taken to a central plant to be boiled as soon after it arrives as possible, to avoid deterioration. All sorts of apparatus, including culinary utensils, are used for boiling the sap, but the most approved is a steam-heated evaporator, of which several makes are upon the market. In these the sap flows through a winding channel, emerging as the finished product, which, owing to its freedom from molasses, quickly solidifies if sufficiently evaporated.

On an average the sap contains about 3 per cent. of sugar, but occasionally exceeds 6 per cent., and at this average a yield of three pounds a year is considered profitable. Large trees and trees with rich sap often yield far more. The impurities of the sap as found in the sugar rarely exceed 5 per cent. There is, however, a small amount of insoluble material which is removed by skimming. Sometimes milk or white of egg is used as a clarifier, but usually no purifying agents are employed, reliance being placed on quick boiling and skimming to produce a light-colored and otherwise satisfactory sugar. The only impurity that causes trouble is the so-called 'sugar sand,' composed mainly of acid malate of lime, which collects on the bottom of the pans, interferes with the boiling, and makes the syrup cloudy and the sugar gritty.

Palm-Tree Sugar. The 'jaggery,' made principally in the East Indies from various species of palms (Phœnix, Borassus, Coccos, and other genera), is a dark-colored raw sugar made in a crude way by methods not essentially different from those described, except that a little lime is added as a clarifying agent. It plays a minor part in the world's markets.

Sugar Refining. Since all of the raw beet sugar and much of the raw cane sugar are unsuitable for table use, and since even the lighter grades of unrefined sugar are in small demand when compared to the snow-white granulated, loaf, and powdered sugars, the refining of raw sugars has become an important branch of the sugar industry. As usually conducted the process consists in dissolving the raw sugar in water, filtering through cloth to remove suspended matter, decolorizing by filtration through bone black (bone charcoal), and granulating in a vacuum pan as above described for sugar-cane sugar. For the manufacture of high-grade sugars with large, hard crystals, the process is sometimes modified, the raw sugar being washed with a dense syrup that removes the adhering molasses without perceptibly dissolving the crystals, which, when dissolved, form a syrup so light-colored as greatly to reduce or entirely obviate the necessity of filtering through bone black before the solution is placed in the strike pan for granulation.

Statistics of the Sugar Industry. The world's production of sugar in 1902-3, excepting that obtained from maple trees, is quoted below from the estimates given in Willett and Gray's *Weekly Statistical Sugar Trade Journal*, for September 17, 1903:

Sugar Crop of the World

Cane Sugar	Tons
Louisiana	300,000
Porto Rico	85,000
Hawaiian Islands	349,000
Cuba	975,000
West Indies (exports)	256,772
Mexico	115,000
Central America	23,500
British Guiana (exports)	105,000
Dutch Guiana	13,000
Venezuela	3,000
Peru	140,000
Argentina	130,000
Brazil	187,500
British India	15,000
Siam	7,000
Java	842,812
Philippine Islands (exports)	80,000
Queensland	76,626
New South Wales	21,000
Fiji Islands (exports)	35,500
Egypt	90,000
Mauritius	135,000
Reunion	35,000
Spain	28,000
Total cane-sugar production (Willett & Gray)	4,048,710
European beet-sugar production (Licht)	5,605,000
United States beet-sugar production (Willett & Gray)	195,463
Grand total cane and beet-sugar production	9,849,173

According to the reports of the Twelfth Census the maple sugar made on farms in the United States during the year 1899 amounted to 11,928,770 pounds and the maple syrup 2,056,611 gallons.

The annual per capita consumption of sugar in various countries is given in Willett, and Gray's *Weekly Statistical Sugar Trade Journal*, for March 14, 1901, as follows:

	Consumption per capita, 1899-1900	
Germany	33.9	pounds
Austria	17.6	"
France	36.9	"
Russia	14.0	"
Holland	32.4	"
Belgium	23.3	"

	Consumption per capita, 1899-1900	
Denmark	54.8	pounds
Sweden and Norway	38.2	“
Italy	6.1	“
Rumania	7.8	“
Spain	10.6	“
Portugal	14.7	“
England	91.6	“
Bulgaria	7.7	“
Greece	7.2	“
Servia	5.2	“
Turkey	8.0	“
Switzerland	60.3	“
All Europe (Licht)	27.1	pounds
United States (W. and G.)	66.6	“

Molasses. Molasses is a viscid, usually dark-colored uncrystallizable liquid which seeps from the massecuite of sugar-cane or is thrown out by the centrifugal machine. The latter kind is reboiled as noted above; the former, however, being highly valued for its flavor and sweetness, is used as a food and for cooking. Since the introduction of the vacuum pan and the centrifugal machine it has become annually less plentiful in the market, the small quantities made being used in the regions where cane sugar is manufactured. Most of the so-called New Orleans molasses is composed of glucose flavored with some molasses from the sugar factories. Spurious maple syrup and sugar (see above) are made of cane sugar and glucose often flavored with an extract of hickory bark. No table molasses is made from the sugar beet, because the impurities cannot be removed by any known process. Processes have been patented for the manufacture of table syrup from beet roots, but they have hitherto been of little commercial importance.

Normally, cane molasses made by the open-kettle process contains about 30 per cent. cane sugar, 23 per cent. reducing sugar, and 47 per cent. water, ash, and impurities; that made in a large modern factory, 20 per cent. cane sugar, 25 per cent. reducing sugar, and 51 per cent. water, etc. Beet molasses contains 47 per cent. cane sugar, 5 per cent. reducing sugar, 20 per cent. water, 22 per cent. organic matter other than sugars, and 6 per cent. ash, etc. In sugar-manufacturing regions molasses is mixed with such bulky materials as cottonseed meal, cottonseed hulls, etc., to be easily handled and fed to stock as a cheap source of carbohydrate food. In Europe several ‘molasses feeds’ have been proposed and one has been manufactured in commercial quantities from four parts bran, three parts beet-sugar molasses, and one part palm-nut cake. Another preparation composed of dried blood, peat, extracted beef pulp, and molasses has also been tried with favorable results.

Milk Sugar or Lactose. Sugar of milk, occurring only in the milk of mammals, is found to the extent of 4 or 5 per cent. in the milk of herbivorous animals. It is obtained by first curdling the milk with rennet or other agent to remove the casein and the fat, and then drawing off and evaporating the clear whey to a syrup in which, when cold and still, the milk sugar crystallizes and sinks. The deposit is recrystallized, after being dissolved in hot water, sometimes as hard cylindrical masses on strings. Sugar of milk is employed very largely for modifying cow's milk for the use of infants, in pharmacy, and as a food. See Milk; Food.

Food Value of Sugar. Since milk sugar and dextrose are used for human food to a far less extent than cane sugar, which they resemble somewhat closely in action, the statements in the following paragraphs are confined to cane sugar. In its food value sugar resembles starch, being considered a fat-former and a source of energy with a fuel value of 1860 calories a pound. Thus it is ranked as a more readily available heat-producer and force-conserver than starch (q.v.). From dietary statistics the conclusion is drawn that persons in well-to-do families in the United States consume about two pounds of sugar weekly, an amount that seems to be well utilized. The consumption of larger amounts is considered questionable economy both with respect to the purse and to the system. But excessive indulgence in food of any other sort is also wasteful and unwise. Thus the wholesomeness and utilization of sweetened foods is largely a matter of quantity or concentration, a simple dish flavored with sugar being considered easy to digest, but a heavily sweetened one eaten singly, more or less difficult because of its concentration. The bad effects popularly charged to sugar are misapplied.

Bibliography. *Literature*—Roth, *Guide to the Literature of Sugar* (London, 1890); Barnett, “References to the Literature of Sugar Beet,” in *Library Bulletin, No. 16, United States Department of Agriculture* (Washington, 1897). *History*—Lippmann, *Geschichte des Zuckers* (Leipzig, 1890); id., *Entwicklung der deutschen Zuckerindustrie von 1850 bis 1900* (ib., 1900); Boizard and Tardieu, *Histoire de la législation des sucres, 1664-1891* (Paris, 1891); Helot, *Le sucre de betterave en France de 1800 a 1900* (Cambrai, 1900). *Culture of Sugar-Producing Plants, Manufacture of Sugar*—Myrick, *American Sugar Industry* (New York, 1899); Stohmann, *Handbuch der Zuckerfabrikation* (Berlin, 1878, rev. ed. 1899); Horsin-Deon, *Traité theorique et pratique de la fabrication du sucre* (Paris, 1882, rev. ed. 1900); Beaudet, Pellet, and Saillard, *Traité de la fabrication du sucre de betterave et de canne* (ib., 1894); Stubbs, *Sugar-cane: A Treatise on the History, Botany, and Agriculture of Sugar-cane* (Louisiana Bureau of Agriculture, 1897); Krüger, *Das Zuckerrohr und seine Kultur* (Magdeburg, 1899); Rümpler, *Die Nichtzuckerstoffe den Rüben in ihrer Beziehung zur Zuckerfabrikation* (Brunswick, 1898); Bivort, *Etude sur la législation des sucres dans les divers pays d'Europe et aux Etats-Unis* (Paris, 1880); Lippmann, *Die Chemie der Zuckerarten* (2d ed., Brunswick, 1895); Maquenne, *Les sucres et leurs principaux dérivés* (Paris, 1900); Passche, *Zuckerindustrie und Zuckerhandel der Welt* (Jena, 1891); Spencer, *Handbook for Sugar Manufacturers and Their Chemists* (New York, 1897); Tollens, *Handbuch der Kohlenhydrate* (Breslau, 1895).

Numerous bulletins on the sugar industry and sugar manufacture have been published by the Division of Chemistry, United States Department of Agriculture. Some of the more recent of these are as follows: *Sugar-cane Culture*—Bulletins 70 and 75; *Sugar from Sorghum*—Bulletins 26, 29, 34, 37, and 40; *Sugar Beet Culture*—Bulletins 27, 30, 33, 36, 39, 52, 64, and 74. A series of publications on the progress of the beet-sugar industry in the United States has also been published. Those for 1900, 1901, and 1902 are issued as Reports Nos. 69, 72, and 74 respectively. See Sugars.

SUGAR BEET (*Beta vulgaris*). A vegetable of the natural order Chenopodiaceæ, botanically the same species as the garden beet, important commercially as the source of a very large part of the world's supply of sugar. (See SUGARS, section on BEET SUGAR. The sugar beet flourishes upon a rich, deep, loamy soil in a climate having a temperature of about 70° during the growing season. The seed is planted and the crop cultivated and harvested by the finest machinery. The rotation of the crop with others is carefully planned and the proper fertilization of the fields has been a subject of much study by the experiment stations. Since the sugar content and yield are influenced by many factors, the sugar companies employ field experts to instruct the farmers how to grow beets in the proper way. Being a product of intensive cultivation, the sugar beet is especially suited to a thickly settled population. The average cost of growing an acre of sugar beets in the United States is about $30. The average yield in the best districts is about 12 tons, with an average sugar content of 14.5 per cent. This represents a yield of about 3900 pounds of sugar per acre, though higher yields have been reported up to 4800 pounds.

SUGAR-BEET INSECTS. The recent introduction and rapid spread of the sugar beet have resulted in the attacks of several insects not before known as injurious and have given a new food to others. A leaf-miner (*Pegomyia vicina*), 30 or 40 larvæ of which may be found in a single leaf, has produced serious damage in California. Many leaf-hoppers (q.v.) feed upon the leaves; also several plant and leaf bugs, and plant-lice, notably the common melon aphis (*Aphis gossipii*). Various cutworms (q.v.) are troublesome while the beets are young. Considerable damage has been done by the greenhouse leaf-roller (*Phlyctænia ferrugalis*). The so-called garden webworms, however, especially in the West, have done the greatest damage of all. Certain leaf-beetles injure the leaves, and the larvæ of some of them feed upon the roots. Much damage has been done by grasshoppers, non-migratory locusts, and blister beetles (q.v.), the imbricated snout beetle, and the army worm (q.v.). Toward the close of the last century the so-called beet army worm (*Laphygma flavimaculata*) defoliated thousands of acres of sugar beets in Colorado. The purslane caterpillar (*Copidryas Gloveri*), the purslane sphinx (*Deilephila lineata*), and several of the woolly-bear caterpillars also feed upon the leaves. Great damage has been done in the State of Washington by a root-louse known as the beet aphis (*Pemphigus betæ*), and a root mealy-bug has been found on the crown of the plant in Colorado. Several of the wireworms (q.v.) and white grubs (q.v.) also damage the roots.

Consult: Forbes, *Twenty-first Annual Report State Entomologist of Illinois* (Chicago, 1900); Forbes and Hart, *Bulletin No. 60 Illinois Agricultural Experiment Station* (Urbana, 1900).

SUGAR-CANE (*Saccharum officinarum*). A tropical and subtropical grass, originally a native of the East Indies. It was brought to Europe by the Crusaders, and in the fifteenth and sixteenth centuries found its way into all the European colonies in the tropics. In Europe the cultivation of the sugar-cane has always been limited almost wholly to Sicily and Andalusia. In China it extends to latitude 30° N., and in North America to 32°; in the Southern Hemisphere only to latitude 22° S. The plant is a perennial with a creeping root, sending up a number of many-jointed diversely colored stems, generally 8 to 12 feet high, 1 to 2 inches thick, and filled for about two-thirds of their length with a loose, sweet, juicy pith. The leaves are ribbon-shaped, 4 to 5 feet long, with a strong midrib. The flowers are in great diffuse pyramidal panicles a yard long.

Sugar-cane requires a deep rich soil and abundant moisture during the growing season. Low alluvial soils near the sea are preferable. The land is prepared with very large plows. The plants are propagated by cuttings. For this purpose the top joints are planted in rows 5 to 7 feet apart. Usually two continuous lines of canes are planted in the row. The largest varieties, in rich, moist soils, attain a height of twenty feet; but in dry, poor soils the height is sometimes scarcely more than six feet. The plant tillers like wheat, but not to the same degree. The cane ground is kept clean by shallow cultivation. The best varieties are ready for cutting in about eight or ten months from the time of planting, but other varieties require from twelve to twenty months. When the canes are fully ripe they are cut a little above the ground, stripped of their leaves, and tied in bundles. Fresh canes, called *rattoons*, spring from the root, so that the plantation does not require to be renewed for several years; but the canes of the first crop are the largest, and a gradual decrease of size takes place. The ordinary practice on sugar estates is to renew a part of the plantation every year. The sugar content of the cane ordinarily grown has for some time averaged about 10 per cent. Sugar-cane production is usually carried on by large plantations. It is a business of great risks, but large profits. It requires a large and sure source

SUGAR-CANE.

of labor, especially at harvest. The yield of sugar varies greatly. In regions with a fertile soil, irrigation, and improved methods of culture about five tons of sugar per acre is produced. Yields of over ten tons per acre are authenticated. In Hawaii, where sugar-cane production has reached its highest perfection, yields of even fourteen tons of sugar per acre are known. This is obtained only by frequent plantings and scientific fertilization and irrigation of the crop. The leaves are sometimes used for feeding cattle. Efforts made by the Louisiana Experiment Station to make silage from sugar-cane refuse were unsuccessful, owing to the alcoholic and acetic fermentation induced by the residual sugar. The pressed residue from the mill, known as *bagasse*, is used for fuel. It is also employed as a fertilizer. See Sugar, Manufacture of.

SUGAR-CANE INSECTS. The principal enemies of the sugar-cane in the United States are the sugar-cane beetle (*Ligyrus rugiceps*) and the sugar-cane borer (*Diatræa saccharalis*). The former belongs to the family Scarabæidæ, and breeds in the ground. The adult beetles make their appearance in early spring, bore into the stubble or into the young cane, and also work into the seed cane; the top leaves wither and the stalk is finally destroyed. The borer is the larva of a crambid moth which lays its eggs upon the leaves of the young cane near the axils, and the young borer, hatching in the course of a few days, penetrates the stalk at or near the joint and tunnels, usually upward, through the soft pith. It matures in thirty days or less, and there are several generations each year. It hibernates in the larval state in the lower part of the stalk or in the tap root. Burning the tops and volunteer cane, and laying down the seed cane in trenches beneath the surface of the ground, keep this insect in check.

In Hawaii there is a weevil borer (*Sphenophorus obscurus*) which does considerable damage. Stalks of the cane are frequently riddled with the galleries of the larvæ, and the galleries are filled with macerated fibre which the larva apparently pushes behind itself. When ready to pupate the tunnel is somewhat enlarged and a cocoon is formed of coarse fibre in which transformation takes place. In Australia there is a noctuid larva which bores downward from the tips of the plants. Certain scarabæid larvæ feed upon the roots, and the young plants are destroyed by wireworms. In the West Indies a bark-boring beetle (*Xyleborus piceus*) sometimes riddles the canes by its minute burrows, the larva working into the young sprouts from the stumps of previously cut canes. In Java there are three lepidopterous borers and a mealy bug which do some damage, and in Mauritius a somewhat troublesome scale insect known as *Icerya sacchari*. Consult various volumes of *Insect Life* (Washington, 1888 to 1895); Comstock, *Report on Insects Injurious to Sugar-Cane* (ib., 1881); Morgan, "Sugar-Cane Borer," in *Bulletin 9, Louisiana Agricultural Experiment Station* (Baton Rouge, 1891).

SUGAR-HOUSE, The. A brick building on Liberty Street, New York, used by the British as a military prison during the Revolution.

SUGAR OF LEAD. The common name for acetate of lead. See Lead.

SUGARS (OF., Fr. *sucre*, from ML. *succarum*, *saccharum*, from Gk. *σάκχαρ*, *sakchar*, *σάκχαρον*, *sakʽharon*, sugar, from Ar. *sakkar*, from Pers. *shakar*, Hind. *shakkar*, from Prak. *sakkara*, sugar, from Skt. *śarkarā*, candied sugar, gravel, grit). A term applied to various substances composed of carbon, hydrogen, and oxygen (see Carbohydrates) which are more or less sweet, are readily soluble in water, are colorless and odorless, and are usually crystallizable. They are widely distributed in nature as original products of vital processes in plants. They have an unparalleled importance in the organic world. In green plants they are formed from carbon dioxide and water by the chloroplasts (see Photosynthesis), and are transferred by diffusion to all parts of the plant body to be used directly in the metabolism of the plant for the manufacture of proteid substances, or to be stored for future use, sometimes as glucose (e.g. in the onion bulb), sometimes as saccharose (e.g. in the beet), and sometimes as other widely different substances into which they have been converted. (See Storage.) If formed more rapidly than they can diffuse away, sugars may be condensed into starch in the chloroplasts themselves. At times of renewed growth, as in the germination of seeds and the sprouting of tubers and bulbs, the plant draws upon these stores of carbohydrate. If the storage has been in the form of cellulose, starch, inulin, or cane sugar, the stored food must be converted by means of enzymes into a hexose sugar before it can be utilized. The stored sugars of plant tissues form one of the most valuable sources of animal food.

Sugars found in the bodies of animals or in the excreta therefrom are believed to be derived from substances of vegetable origin. The sugars have been variously classified according to their chemical and physical properties as fermentable and non-fermentable; reducing and non-reducing; and dextro-rotary, lævo-rotary, and inactive, according to their effect on polarized light.

Fermentable and Unfermentable Sugars. These include the sugars that undergo change or decomposition under the influence of microörganisms; glucose, for example, and certain other sugars are thus changed into alcohol (q.v.) by the action of yeast. This term and method of classification have become unsatisfactory because of greatly increased knowledge of the action of the lower forms of life and enzymes on sugars and other substances. (See Fermentation; Enzyme.) Many sugars, however, that are not acted upon by one organism are readily decomposed by another, and so the subdivision of sugars into fermentable and unfermentable is of at least doubtful value. For example, milk sugar does not yield alcohol with yeast without first being hydrolyzed, but undergoes the lactic acid fermentation immediately.

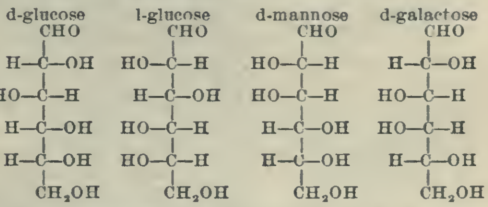
Reducing Sugars. Certain sugars possess the property of reducing compounds of copper, silver, and other easily reducible metals in alkaline solution, the reduction being generally more rapid at the boiling point of the liquid. In some cases the compounds are reduced to lower oxides, which are precipitated, as in the case of copper; in other cases the reduction is complete, the free metal being precipitated. An alkaline solution of copper (see Fehling's Solution) is the one usually employed for testing the reducing power of sugars. The amount of reduction depends upon the amount of a given sugar present; the process is therefore used for the quantitative determination of reducing sugars. Among the important reducing sugars are d-glucose (dextrose or grape sugar), d-fructose (lævulose or fruit sugar), maltose, lactose (milk sugar), and 'invert sugar' (see below). Sucrose (cane sugar), raffinose, melicitose, and stachyose are the principal non-reducing sugars known.

Optically Active Sugars. The property possessed by sugars of rotating the plane of polarized light to the right or left when passed through their solutions has long served as a basis for classification. Sugars possessing this property are said to be optically active, and those which do not are said to be inactive. Those that turn the plane of polarization to the right are called dextro-rotatory; those to the left, lævo-rotatory. The amount of rotation is proportional to the amount of the sugar in a given volume of the solution, and this is taken advantage of for the quantitative determination of sugars. A special form of the polariscope (q.v.), called a saccharimeter, is in common use for this purpose. For the polarimetric determination of sucrose (cane sugar), a weighed quantity of the sugar, syrup, or other material is dissolved in water; the solution is treated with lead acetate or other clarifying agent, diluted to 100 cubic centimeters, filtered, and placed in the observation tube of the polariscope. The observer then ascertains the percentage of sugar contained in the material under investigation by simply looking into the instrument, adjusting it to compensate for the change in the field of vision caused by the presence of the sugar solution, and by reading the percentage of sucrose directly from the scale of the instrument.

Since 1880 the sugars have formed the subject of numerous brilliant researches, notably those of H. Kiliani and Emil Fischer. In the early eighties Kiliani demonstrated that d-glucose (dextrose or grape sugar) and d-fructose (lævulose or fruit sugar) are aldehyde and ketone derivatives, respectively, of hexahydric alcohols, the former containing one aldehyde group and the latter one ketone group. (See Alcohols; Aldehydes; Ketones.) He also showed that arabinose is an aldehyde of the pentahydric alcohol, arabite, and has the formula $C_5H_{10}O_5$. The molecules of all carbohydrates had been believed to contain six carbon atoms or some multiple thereof. But sugars containing three, four, five, six, seven, eight, and nine atoms of carbon in their molecules are now known; these are designated respectively by the class names trioses, tetroses, pentoses, hexoses, heptoses, octoses, and nonoses. According as the individual members of each of these classes contain aldehyde or ketone groups (see Aldehydes; Ketones), they are designated as aldoses or ketoses; for example, aldohexoses and ketohexoses. These classes together constitute the group of carbohydrates known as monosaccharides. Their molecules contain as many atoms of oxygen as atoms of carbon, except in the case of certain of their synthetic derivatives.

There are other groups of sugars, in the molecules of which there are fewer atoms of oxygen than of carbon. When the latter are treated with acids or enzymes they are hydrolyzed, i.e. each one of their molecules combines with one or more molecules of water and simultaneously splits up into two or more monosaccharide molecules. These more complex sugars are called disaccharides when each of their molecules yields two monosaccharide molecules; trisaccharides when one molecule yields three monosaccharide molecules; and polysaccharides when one molecule yields several monosaccharide molecules on hydrolysis; for examples, see descriptions of individual sugars below.

In the course of his work, Emil Fischer prepared a number of hitherto unknown sugars by purely synthetic processes. He showed that the monosaccharides furnish excellent examples of the necessity for the chemist to consider the space relations of the atoms in the molecule. (See Stereo-Chemistry.) According to the theory of Le Bel and Van 't Hoff sixteen isomeric aldohexoses are possible, since their molecules contain each four asymmetric carbon atoms. Three of these occur in nature or are obtainable from natural carbohydrates by hydrolysis. Eight others have been produced in the laboratory. The aldopentose and ketohexose molecules each contain three asymmetric carbon atoms, therefore but eight stereo-isomers are possible in each case. No ketopentoses are known with certainty. Two aldopentoses are readily obtainable from natural sources; three or more others have been prepared in the laboratory. Only two natural ketohexoses are known; one or more others have been prepared in the laboratory. The character of the differences between the hexoses is illustrated by the following stereo-chemical formulæ:



$$\begin{array}{cccc}
\text{d-glucose} & \text{l-glucose} & \text{d-mannose} & \text{d-galactose} \\
CHO & CHO & CHO & CHO \\
| & | & | & | \\
H-C-OH & HO-C-H & HO-C-H & H-C-OH \\
| & | & | & | \\
HO-C-H & H-C-OH & HO-C-H & HO-C-H \\
| & | & | & | \\
H-C-OH & HO-C-H & H-C-OH & HO-C-H \\
| & | & | & | \\
H-C-OH & HO-C-H & H-C-OH & H-C-OH \\
| & | & | & | \\
CH_2OH & CH_2OH & CH_2OH & CH_2OH
\end{array}$$

Formic aldehyde and glycerin, both of which have been produced synthetically, are the substances from which certain sugars have been synthesized by Fischer and others. Formic aldehyde, CH_2O or H-COH, may be regarded as the simplest of the monosaccharides and be designated as monose. Bayer (1870) suggested that this substance is the first product of the reduction of carbon dioxide in the green parts of plants, and that starch and other carbohydrates are formed by its polymerization. Its formation in plants has never been satisfactorily demonstrated, but it is known readily to undergo polymerization or condensation to form paraform $(CH_2O)_n$ and trioxymethylene $(CH_2O)_3$. In 1861 Butleroff obtained by condensation of trioxymethylene a sweet, sugar-like body which he called 'methylenitan.' Loew (1885) obtained in a similar manner 'formose' from oxymethylene, and later 'methose.' The last named is more sugar-like than 'formose' in that it is fermented with yeast. Fischer regards these substances as mixtures of different hexoses, including among others d-acrose, which he also obtained from glycerose, which is a mixture of glyceraldehyde and dioxyacetone, obtained by the careful oxidation of glycerol (glycerin). From d-acrose [(d + l) fructose] Fischer prepared d-fructose, d-glucose, d-mannose, and the l- modifications, or optical antimeres, of each of these bodies.

The synthesis of each one of these bodies was accomplished by a series of complicated reactions which are fully described in text-books on chemistry. Fischer's work was greatly facilitated by the use of phenylhydrazine, which forms readily crystallizable compounds with the hexoses, called osazones. These compounds are insoluble in water and eminently suited for the separation and identification of the different sugars. By means of the cyanhydrine reaction he changed hexose sugars into heptoses, and these in turn into octoses and nonoses. The combination of monosaccharides to form disaccharides has only recently been accomplished by Fischer. Among a number of his synthetic disaccharides is one which he designates galactosidoglucose (because it is made by the union of one molecule of d-galactose with one molecule of d-glucose), and which closely resembles the natural sugar melibiose. In an article published in September, 1902, he says that if further investigations confirm his conclusion that the two sugars are identical, "melibiose is the first natural disaccharide to be produced synthetically."

The more important sugars are mentioned in the following table with brief descriptions of their success:

I.	MONOSACCHARIDES
1. Monose, CH_2O.	Formic aldehyde.
2. Biose, $C_2H_4O_2$.	Glycollic aldehyde.
3. Triose, $C_3H_6O_3$.	Glycerose, obtained by oxidation of glycerin.
4. Tetrose, $C_4H_8O_4$.	Erythrose, obtained by oxidation of erythrin, a tetrahydric alcohol found in lichens and algæ.
5. Pentoses, $C_5H_{10}O_5$. A. Aldopentoses.	l-arabinose (arabinose, arabose, pectinose, pectin-sugar) and xylose (wood-sugar), obtained alone or mixed with other sugars by hydrolysis of gums and other vegetable substances.
	d-arabinose, l-xylose, and ribose, obtained synthetically.
B. Ketopentoses.	None known with certainty.
C. Methyl pentoses, $CH_3C_5H_9O_5$.	Fucose, from seaweed; rhamnose, widely distributed in the vegetable kingdom in the form of glucosides: chinovose, obtained by the decomposition of chinovite, a constituent of cinchona bark.
6. Hexoses. $C_6H_{12}O_6$. A. Aldohexoses.	d-glucose (dextrose, grape sugar or starch sugar), see GLUCOSE; d-mannose (mannose, isomannose or seminose), obtained by the oxidation of mannite and by the hydrolysis of various vegetable materials; d-galactose (see below).
	l-glucose, l-mannose, l-galactose, d-gulose, l-gulose, d-idose, l-idose, d-talose, and l-talose, obtained synthetically.
B. Ketohexoses.	d-fructose (levulose or fruit sugar; see below); sorbinose, from mountain ash berries.
	l-fructose, obtained synthetically.
C. Hexoses of natural origin and of unknown nature.	Chondroglucose, crocose, eucalyn, hederose, indiglucin, locaose, paraglucose, phlorose, scammonose, skimminose, solanose, tewfikose (forms 5 to 6% of the milk of the Egyptian buffalo), and wine sugar.
D. Methyl hexoses, $CH_3C_6H_{11}O_6$.	a-rhamno-hexose and β-rhamnohexose, obtained synthetically.
7. Heptoses, $C_7H_{14}O_7$.	Six heptoses and a methyl derivative have been prepared synthetically.
8. Octoses, $C_8H_{16}O_8$.	Four octoses and a methyl derivative have been prepared in the laboratory.
9. Nonoses, $C_8H_{18}O_9$.	Two have been produced artificially.
II.	DISACCHARIDES
1. Derivatives of pentoses, $C_{10}H_{18}O_9$.	Di-arabinose or arabinon, obtained from arabinic acid (metapectic acid).
2. Derivatives of hexoses, $C_{12}H_{22}O_{11}$.	Sucrose (cane sugar, saccharose, saccharon, or saccharobiose), lactose (milk sugar, lactobiose, or lacton), and maltose (maltobiose, malt sugar, amylon, diglucon, ptyalose, or cerealose); see below).
	Trehalose (mycose, trehabiose) from ergot and other fungi; isomaltose from malted grain; melibiose, formed together with d-fructose by careful hydrolysis of raffinose; turanose, formed together with d-glucose by hydrolysis of melecitose; cyclamose, from cyclamen tubers; agavose, from the juice of the agava; and several produced synthetically by Fischer.
III.	TRISACCHARIDES
All are derivatives of the hexoses, $C_{18}H_{32}O_{16}$.	Raffinose (melitriose, melitose, gossypose, or cotton sugar; see below); melecitose (melecitriose), from the manna of *Pinus larix*; stachyose, from the tubers of *Stachys tuberifera;* gentianose, from the roots of *Gentiana lutea;* lactosinose (lactosin), from the roots of certain plants of the order Caryophyllaceæ; and secalose, from unripe rye.

SUCROSE, CANE SUGAR, OR SACCHAROSE. This is commercially the most important sugar. It and the products of its hydrolysis, 'invert sugar,' and the sugars that compose 'invert sugar' (d-glucose and d-fructose) are the most important sugars, considered from the point of their wide distribution in fruits and vegetables used for food by man and the lower animals. (For the commercial sources of cane sugar, see SUGAR, MANUFACTURE OF.) White granulated sugar, whether made from sugar-cane or beet roots, contains between 99 and 100 per cent. of pure sucrose or cane sugar. In many plants it is found associated with 'invert sugar,' which seems to be changed to cane sugar during the process of ripening. When cane sugar is hydrolyzed by the action of acids or enzymes, each molecule yields one molecule of d-glucose and one molecule of d-fructose, a mixture called 'invert sugar,' as explained above.

Cane sugar is readily crystallized in the form of monoclinic hemihedral tables which contain no water of crystallization. These crystals are well exemplified in loaf sugar, rock candy, and granulated sugar, the coarseness of which depends upon the size of the crystals. It dissolves in about one-half of its weight of water and is much more soluble in hot water; it is dissolved with difficulty in strong alcohol. Its specific gravity is 1.606. It melts at 160° C. (320° F.), and with care may be cooled to a colorless glass-like mass; if the temperature is somewhat higher the solidified mass is colored and constitutes the so-called 'barley sugar.' At 200° C. (392° F.) decomposition and marked coloration begin, caramel is formed, and as the heat is continued gases are evolved and finally only a black char remains. Sucrose unites with the oxides of calcium and other metals to form saccharates, which are of importance as a means of separating sugar from beet-root molasses. While cane and other sugars in dilute solutions are very prone to undergo fermentation and change, they possess considerable antiseptic power in concentrated solution, which is utilized in dried fruits, preserves, etc.

LEVULOSE, d-FRUCTOSE, OR FRUIT SUGAR. This occurs in almost all sweet fruits with d-glucose.

It is crystallized with difficulty, and melts at 95° C. (203° F.). It is readily obtained by hydrolysis of inulin, a polysaccharide which occurs in many plants. It is less soluble than d-glucose, and is as sweet as cane sugar. Levulose is used as a substitute for sugar in the food of diabetic patients. Some of the commercial forms of levulose for this purpose are called 'diabetine.'

Raffinose, Melitriose, Melitose, or Cotton Sugar. This occurs in rather large quantity in Australian manna (from varieties of Eucalyptus), in cottonseed meal, and in small quantities in sugar beets, the manufactured sugar from which sometimes contains small amounts, but the molasses much the greater proportion. It forms characteristic crystals and is strongly dextro-rotatory. When hydrolyzed by acids each molecule yields one molecule of d-glucose, one of d-fructose, and one of d-galactose.

Maltose, Maltobiose, Malt Sugar, or Amylon. This is formed, together with dextrin and dextrose, when starch is hydrolyzed with enzymes or acids. It is present in malted grain, in commercial glucose, and in the mash of beer and whisky. It is usually obtained in the form of crystalline crusts. When hydrolyzed it is converted into d-glucose.

Milk Sugar, or Lactose. This occurs in the milk of mammals. It crystallizes in white hard rhombic prisms, with one molecule of water of crystallization, which is dissipated at 140° C. (284° F.); at 205° C. (400° F.) it melts with decomposition. It dissolves in six parts of water at the ordinary temperature and in 2½ parts of hot water; is insoluble in alcohol, and has a faint, sweet taste. When hydrolyzed by the action of acids it is converted into equal parts of d-glucose and d-galactose. See Sugar, Manufacture of.

Galactose. This is of interest as one of the inversion or hydrolysis products of raffinose and milk sugar. It is also obtained by the hydrolysis of a number of polysaccharides occurring in vegetable substances and called 'galactans.'

Bibliography. Tollens, *Kurzes Handbuch der Kohlenhydrate* (Breslau, 1895); Lippmann, *Die Chemie der Zuckeraten* (Brunswick, 1895); Pavy, *Physiology of the Carbohydrates* (London, 1895).

SUG'DEN, Edward Burtenshaw. A celebrated English jurist and author. See Saint Leonards, Edward Burtenshaw Sugden, Baron.

SUGER, sụ'zhȧ', Abbé de Saint Denis (1081-1151). A French churchman, statesman, and historian. He spent a large part of his youth in the Abbey of Saint Denis, and was for a time a student with Prince Louis, afterwards Louis the Fat, with whom he always remained on terms of close friendship. In 1122 he became abbé of Saint Denis, and he carried out many reforms and greatly increased the prosperity of his charge. He was frequently engaged in affairs of State, and when Louis VII. went on the Second Crusade Suger acted as Regent in his absence and administered the affairs of the kingdom with great ability. Shortly afterwards, although he had opposed the previous one, Suger preached another crusade, but died in 1151 before it could be carried out. He wrote in Latin a *Life of Louis VI.* (c.1140), which is one of the chief sources upon the history of the period. His complete works were published at Paris in 1867. Consult Meanult, *Suger* (Paris, 1884), and Cartellieri, *Abt Suger von Saint-Denis* (Berlin, 1898).

SUGGESTION (Lat. *suggestio*, intimation, suggestion, from *suggerere*, to suggest, supply, from *sub*, under + *gerere*, to carry). A term used in four different senses in psychology. (1) In its broadest significance suggestion is a hint, a prompting, the insinuation of an idea into consciousness. An orator may suggest, e.g. impatience to his audience by a shrug of his shoulders. (2) Suggestion is used more narrowly as a synonym for association (q.v.). The idea of Spain suggests (or 'associates with') war, war suggests Cuba, Cuba suggests sugar, etc. (3) Still more specifically, suggestion implies a peculiar mode of creating belief. One may, e.g. create by suggestion the belief that a piece of metal is hot by handling it as if it were burning one. (4) Finally, suggestion indicates a means of directing the consciousness and the movements of a hypnotized subject. The operator is said to 'suggest' to his subject that he see an object which is not in reality present, or that he react to an imaginary situation. The first two definitions contemplate suggestion simply as an incentive to 'reproduction' (q.v.); the last two as a determinant of belief, under usual or 'normal' and under unusual or 'abnormal' conditions. Between the third and the fourth uses of the word no strict line of demarcation can be drawn. (See Hypnotism.) The term is most accurately employed in one of these narrower senses, as an influence upon belief. Belief (q.v.) may appear either as a mood of acquiescence (one believes, e.g. when one is told that 2 + 3 = 5), or as a conviction following upon deliberation (one believes the conclusion reached by a series of 'sound' arguments). Just how suggestion may occasion belief under unusual circumstances, as in hypnosis, psychologists are not entirely agreed, but two theories have been worked out in detail. (1) The first (Wundt's) maintains that in hypnotic suggestion there is a 'constriction' of consciousness. Few ideas enter at once; only those that are aroused directly by association. 'Foreign' ideas are barred out. The narrowing of the field of consciousness implies, according to the theory, an increased clearness and intensity in the ideas attended to. This fact is explained physiologically by hyperæsthesia of a limited cortical area and a corresponding anæsthesia in the other areas. The result is that whatever comes to mind is peculiarly vivid and forcible and stands free from contradicting ideas. This is synonymous with belief. (2) The other theory (Lipps's) sees the essence of suggestion in an unusual inhibition of experience which, if it could come before the mind, would destroy belief (e.g. a hypnotized person believes the operator's statement that he is a king or a cat, because his past experience is in abeyance: it is beyond his control: he is unable to criticise or to oppose any statement made). The theory rejects physiological explanations and substitutes 'unconscious ideas.' Both theories agree that lack of conflicting ideas is essential. There is no room in hypnotic suggestion for deliberation and choice. To this we must add a feeling element, in the mood of acquiescence.

Bibliography. Baldwin, *Story of the Mind*

(New York, 1898); Moll, *Hypnotism* (London, 1891); Wundt, *Philosophische Studien* viii. (1893); Lipps, *Zur Psychologie der Suggestion* (Leipzig, 1897).

SUHL, zōōl. A town of the Prussian Province of Saxony, Germany, on the Lauter, 12½ miles north by east of Meiningen (Map: Prussia, D 3). Important for its manufactures of firearms since the fifteenth century, Suhl has been called the 'armory of Germany.' Population, in 1900, 12,617.

SUICIDE (from Lat. *sui*, of one's self + *-cidium*, a killing, from *cædere*, to kill). The intentional taking of one's own life. Among uncivilized peoples suicide is by no means unknown, though it has generally been regarded as uncommon. It is favored by the teaching of some Oriental religions, but expressly forbidden by the Koran. Aristotle condemned suicide as unmanly, and early Greek custom accorded dishonorable burial to the perpetrator; but later practice, especially under influence of the Stoics, was much less severe. The Romans, also affected by Stoic doctrine, recognized many legitimate reasons for suicide and punished with confiscation of property only suicides committed to escape punishment for a grave crime. The Justinian code admitted seven excuses for suicide, ranging from madness to mere life-weariness. Under Christianity the spirit of law and custom was radically modified. To Saint Augustine suicide was essentially a sin, and several Church councils, from the fifth century, deprived the corpse of the ordinary rites of the Church. Mediæval law usually provided confiscation of the suicide's property, while custom decreed indignities to the corpse, such as dragging by the heels face downward, as in France, or burying at the cross-roads with a stake through the body, as in England. Later English law compelled forfeiture of lands and goods in all cases of suicide, but the requirement came to be frequently evaded through the granting of a coroner's verdict of insanity, and the law itself was abolished in 1870. A statute of 1823 made it legal to bury suicides in consecrated ground, but it was not till 1882 that religious services were expressly permitted. In France at the present time neither suicide nor attempt at suicide is punishable. In the United States suicide is not a crime, but it is unlawful, and an unintentional killing of another during an attempt at self-destruction is homicide. An attempt at suicide is a common-law misdemeanor, and in some States a felony by statute. Thus in New York, aiding a suicide is manslaughter in the first degree, aiding an attempt at suicide is felony, and the attempt itself by a sane person is felony, punishable by not over two years in State prison, or a fine of not over $1000, or by both. Suicide generally affords ground for forfeiture of a policy of life insurance (q.v.).

The statistics of suicide are by no means satisfactory, as motives always exist for the concealment of the cause of death, and published figures are likely to be too low. This trouble is partly overcome when figures are used comparatively, as in the following table, showing the average annual number of suicides per million of population in various countries during the nineteenth century:

	1831-35	1841-45	1851-55	1861-65	1871-75	1887-91	Recent
England and Wales	62.8*	64	64	66	66	81	90
Ireland	10	......	......	......	18	24	......
Prussia	96	110	130	122	134	197	193
Saxony	158†	198	248	264	299	322	305
France	64	85	100	124	150	218	236
Belgium	39	62	......	55‡	68	120	116
Italy	......	......	......	28	35	52	......
Denmark	213†	232	272	288	258	253	258
Sweden	69	66	71	76	81	119	......
Norway	97	107	107	85	73	66	......

* 1831-1840. † 1836-40. ‡ 1856-65.

The remarkable differences which appear between countries are due rather to race and national characteristics than to climate. This is well shown by suicide rates in the United States. In 1900 in the registration area persons with mothers born in France had a suicide rate (per million) of 220; Germany, 193; England and Wales, 104; Ireland, 61; Russia and Poland, 58; Italy, 51. In the registration area as a whole the rate was 103 in 1890 and 118 in 1900, being very much higher for white persons than for colored. The most notable difference of rate is that occasioned by sex, males usually constituting from four-fifths to three-quarters of the total suicides. Statistics of several States and of foreign countries indicate that the preponderance of males has been increasing during recent decades. When age is considered together with sex, it appears that while suicide in general increases with age, the ages at which women most tend to self-destruction are much under the corresponding ones for men. Thus in the United States (1900) there were out of 1000 suicides at known ages, 1.2 committed by males under 15 years, but 7.8 by females; for the age period 15 to 19 the rate was 18.8 for men, 100.5 for women; for 30 to 34 years it was 103.4 and 109.7 respectively; while for 40 to 44 the male rate was in excess, 117.3 to 90.1; and the men then continue to preponderate up to 85 years. Married people show a lower suicide rate than single, and single than widowed or divorced persons. Large cities have an unfavorable influence. The rate in Dresden is more than 500 per 1,000,000; in Paris, more than 400; in London, about 230; in Berlin, 260; in Saint Petersburg and Rome, less than 100. In 1890 the rate in Massachusetts was 84, but in Boston it was more than 120; in New York State (1890) it was 95, but 97 in Brooklyn and 150 in Manhattan (New York City).

Suicides among the young are especially prevalent in the great centres. The professional and commercial classes are more prone to suicide than are others; artisans evince higher rates than do laborers; while among soldiers and criminals the rates are extremely high. The rates for summer or late spring are always much above those for the other seasons, the maximum usually occurring between April and July, the minimum in January or December. The early part of each month and the early days of the week show a relative preponderance. Other interesting correlations appear in the methods by which suicide is accomplished. In the aggregate the order of preference in method is: Hanging, drowning, shooting, cutting or stabbing, falling from a height, and asphyxiation or poison. In cold countries drowning is naturally less favored than in the south; the use of firearms is specially prominent in Italy; of cutting or stabbing in Prussia; of poison in England. As would be expected, female suicides employ firearms less than male. In England drowning is the recorded means for more than a quarter of the women committing suicide, and poison for about a seventh; but only 15 per cent. of male suicides drown themselves, and only a twelfth use poison.

The study of the motives to suicide can be more successfully pursued by psychologists and physicians than by the statistician. Definite mental disorders usually appear as the direct cause of a third of all suicides, but a very much larger proportion of cases show evidence of mental or physical abnormality. Suicidal tendency, like insanity, has been observed to be inherited. Alcoholism is a frequent cause. Emphasis upon biological influences has led some writers to regard suicide as always being, like certain diseases, a specific tendency of the individual. But the social causes of suicide are not to be underestimated. Imitation and the desire for notoriety undoubtedly affect suicides, and though perhaps too much stress has been laid upon the influence and the hurry and strain of modern business, there can be no doubt that many contemporary conditions which stimulate suicide, especially in great cities, are, like the predisposing causes of alcoholism, largely under social control.

Consult: Morselli, *Suicide*, International Scientific Series (New York, 1882), a standard work; Legoyt, *Le suicide ancien et moderne* (Paris, 1881); Geiger, *Der Seilbstmord im klassischen Alterthum* (Augsburg, 1888); Motta, *Bibliografia del suicido* (Bellinzona, 1890); Durkheim, *Le suicide* (Paris, 1897); *Twelfth United States Census* (vol. iii.); *Registration Reports* issued by all New England States and by several other States and cities; *American Statistical Association Publications; Reports of the Registrar-General of the United Kingdom; Statistisches Jahrbuch für das Deutsche Reich* (annual); *Annuaire statistique de la France.*

SUIDÆ. The swine family. See Swine.

SU'IDAS (Lat., from Gk. Σουίδας, *Souidas*). The author of a great Greek lexicon, which was compiled probably in the middle of the tenth century. The work which is current under his name is a compilation giving the result of grammatical, lexicographical, historical, and literary studies. It is especially valuable for its articles touching the latter field, and the information which they contain is indispensable for our knowledge of the writers of antiquity. It is clear that the lexicographical portions were drawn from the lexica of Harpocration and Helladius, and certain other lexica and grammatical works which cannot be absolutely determined. He further employed excellent scholia to Aristophanes, scholia to Sophocles similar to those now found in the codex Laurentianus, Homeric scholia similar to those found in the codex Venetus B, and the older scholia to Thucydides. In his historical and theological articles it is more difficult to determine his sources, but his chief authority seems to have been the work of Constantinus Porphyrogenitus and the chronicle of Georgius Monachos. His literary articles were probably drawn in large measure from the *Onomatologos* of Hesychius Milesius, which he possessed in an abridged form. He employed also the notices of the comic poets preserved in Athenæus; but he added much from his independent reading. The work is best edited by Bernhardy (1834-53). The edition by Bekker (1854) is far inferior.

SUI JURIS, sōō'ī jōō'rĭs (Lat., of his own right). A Latin phrase employed to describe a person competent to perform legal acts. (See Civil Law; Patra Pofestas.) The meaning of the phrase has been extended in modern times to denote a person who is capable of taking care of himself.

SUIR, shōōr. A river of Ireland. Rising in County Tipperary, it forms, in part, the boundary between that county and County Waterford and then the boundary between Waterford and County Kilkenny. It unites with the Barrow to form Waterford Harbor, after a course of about 100 miles. For boats of about 55 tons it is navigable to Clonmel in Tipperary.

SUITE (Fr., succession, following), or **PARTITA.** In music, one of the oldest of cyclical forms. It had its origin in the sixteenth century, when the Stadtpfeifer began to perform several national dances in succession, which were of contrasting tempi, but all in the same key. During the seventeenth century German composers for the pianoforte applied the name partita to their *doubles* (a series of variations). (See Variation.) The form reached its culmination in the suites of J. S. Bach. The style of the suite is not so much contrapuntal as 'elegant.' The four obligatory movements are: (1) allemande, (2) courante, (3) sarabande, (4) gigue. As a rule, however, there were more movements, which were inserted after the sarabande. Such additional movements were known as *inter-mezzo* (q.v.). In modern times composers have also written suites for orchestra, which, however, but slightly resemble their prototypes. Some of the movements are not dance forms, and the principle of contrasting keys is also introduced. See Dancing; Sonata; Symphony.

SUITS AT LAW AND EQUITY. See Action; Equity.

ŚUKASAPTATI, shōō'kȧ-săp'tȧ-tē (Skt., seventy [stories] of a parrot). A collection of Sanskrit prose stories. These tales, seventy in number, are told by a parrot to the wife of a merchant who is away on his travels. She is inclined to be unfaithful to her husband, and consults the parrot regarding her plans. The bird cleverly pretends to approve of her intentions, but points out to her the dangers of detection, and induces her to promise not to meet any lover unless she can extricate herself as such and such a person did. This rouses her curiosity, and the parrot tells the story as far as the dilemma, which he asks her to solve. Unable to do this, she promises to remain at home that night on condition that the parrot will tell her the answer the following evening. In this way she is kept faithful until her husband returns. The story is very popular in India and has been translated into Persian as the *Ṭūṭīnāmah.* The Śukasaptati exists in two recensions. The shorter one was edited (Leipzig, 1893) and translated (Kiel, 1894) by Schmidt, who also edited (Munich, 1898) and translated (Stuttgart, 1899) the longer version. Consult Schmidt, *Ueber die Śukasaptati* (Halle, 1898).

SUKHĀVATĪ, so͞ok-hä′vȧ-tē′ (Skt., blissful). The 'Land of Bliss' into which those Buddhists are reborn who put their trust for salvation in Amitabha Budḍha, the Buddha of boundless light, life, and mercy, invented by the founders of the Northern or Mahayana (q.v.) School. It is situated in some far distant world in the western quarter of the universe, separated from this world by tens of millions of Buddha worlds, and is presided over by Amitabha. Here there is no difference between gods and men, and sexual distinctions are unknown. There is no more toil, no hunger, nor pain of any kind, no thirst, and neither summer nor winter, no day, no night; no heat to scorch, no cold to chill; no sin, no suffering, no distress of any kind; no torments, and no prisons for punishment. To attain to rebirth in this paradise the performance of good works in this life is not necessary. Simple trust in the mercy of Amitabha is sufficient. It may even be attained by repeating the name of Amitabha two, three, four, five, six, or more nights before death. Among the common people this doctrine of a pure land of practically unending bliss has superseded the doctrine of Nirvana (q.v.).

SULEIMAN (so͞o′lâ-män) **I.** See Solyman I.

SULEIMANIEH, su̥-lā′mȧ-nē′ye. A town of the Vilayet of Mosul, Turkey in Asia, 93 miles south of Bagdad, east of the Euphrates River. It commands several trade routes to Persia. Population, about 15,000.

SULEIMAN PASHA, so͞o′lâ-män′ pȧ-shä′ (c.1840-92). A Turkish general, born at Constantinople. He was trained at the military school in Constantinople, entered the army, and attained the rank of major in 1867, when he served in Crete. In 1873 he was a colonel and instructor in the military school, of which he later became sub-director, with the rank of general of brigade, in 1874. He took part in the deposition of Abdul Aziz, May 30, 1876, and was made general of division by Amurath V. In 1877 he was made marshal. In the early part of the Russo-Turkish War (q.v.) he fought against General Gurko, whom he defeated at Eski-Zaghra (July 31-August 1, 1877) and forced to retreat into the Balkans, failing, however, in his desperate attempts to make himself master of the Shipka Pass. From October to December he commanded the Turkish Army of the Danube and was then intrusted with the command of the Turkish forces south of the Balkans. At Philippopolis, January 15-17, 1878, he was decisively defeated. This misfortune led to a heavy sentence of imprisonment, but he was afterwards pardoned.

SULFONAL. See Sulphonal.

SULIMAN (so͞o′lẽ-män′) **MOUNTAINS.** A range of mountains in the northeastern part of Baluchistan, near the borders of the Punjab, India (Map: India, A 2). It forms part of the eastern boundary of the great Iranian Plateau, toward which it sends numerous spurs, while on the east it falls steeply into the Indus Valley. Its highest point, the Kaisargarh, has an altitude of 11,320 feet.

SULINA, so͞o-lē′nȧ. The central arm of the delta of the Danube (Map: Balkan Peninsula, G 2). Though not the largest in volume, it is the principal channel for navigation and has been made navigable for the largest vessels by means of large jetties and other engineering works conducted since 1858 by the International Danube Commission. At the mouth of the channel lies the little town of Sulina, whose harbor is a free port from which 11,411 vessels, aggregating 1,830,000 tons, cleared in 1901.

SULIOTES, so͞o′lê-ôts. A tribe of Turkish subjects of mixed Greek and Albanian blood, who derived their name from the Sụli Mountains, near Parga, in Epirus, to which they fled from the Turks in the seventeenth century. Their persistent opposition to Turkish rule brought them into constant trouble and won for them a reputation for bravery and patriotism. Overcome in 1803 by Ali Pasha of Janina, they left their mountains and fled to the islands off their native shore. In 1820 Ali Pasha invoked their aid in his fight for the independence of Albania. The forces of the Sultan were victorious and drove some of the Suliotes to their old mountain retreats, but more to the island of Cephalonia. Later they are found warring on the side of Greek independence, their most celebrated leader being Marco Bozzaris (q.v.). Many of them have migrated into Greece. Consult: Perrhaebos, *History of Suli and Parga* (London, 1823); Lüdemann, *Der Suliotenkrieg* (Leipzig, 1825).

SULLA (*Hedysarum coronarium*). A perennial leguminous fodder plant, native of Southern Italy and similar Mediterranean regions, where it has been in cultivation since about 1766. It is a leafy plant four to six feet tall, bearing numerous clusters of showy flowers. In the United States the seed is usually sown with fall wheat or oats in well-prepared soil, and after the removal of the cereal crop in the spring the sulla develops rapidly and by June is ready to cut. Sulla ranks with alfalfa as a forage crop, but does not seem as well adapted to the South as alfalfa. It is said to be preferred to alfalfa in more tropical regions, since it is better adapted to tropical conditions, but because it is susceptible to frost it is adapted to few regions of the United States.

SUL′LA, Lucius Cornelius (surnamed Felix) (b.c. 138-78). A celebrated Roman general and statesman, born at Rome of a family belonging to the clan Cornelia. In b.c. 107 he was elected quæstor, and sent to Africa with cavalry that the consul Marius (q.v.) required for prosecuting the Jugurthine war. He rapidly acquired a series of important services by inducing Bocchus, the Mauretanian King, to surrender Jugurtha (B.C. 106). In the campaigns that followed (B.C. 104-101) against the Cimbri and Teutones, Sulla's reputation continued to rise. For several years after the destruction of the barbarians Sulla lived quietly, taking no part in public affairs; but in B.C. 93 he stood for the prætorship, and won it by a liberal distribution of money among the people. Next year he was sent to Cilicia as proprætor, to replace Ariobarzanes on the throne of Cappadocia, from which he had been driven by Mithridates. In the Social War (q.v.) the successes of Sulla threw those of Marius into the shade, and the mortification of the latter was deep and bitter. In B.C. 88 Sulla was elected consul along with Q. Pompeius Rufus, and the senate conferred on him the command of the Mithridatic War. At this Marius, who desired the command for himself, precipitated a civil war. Allying himself with the tribune P. Sulpicius Rufus, a political adventurer in difficulties, Marius placed himself at the head of the new Italian party, on whom the rights of Roman citizenship had been conferred, and Sulla was compelled to flee to his camp at Nola in Campania. There, finding the soldiers full of enthusiasm, he resolved to lead them against the pseudo-government at Rome. The Marian party was overthrown and Marius fled to Africa. Sulla embarked for the East B.C. 87 and was away four years, but finally forced Mithridates to sue for peace, and returned to Italy B.C. 83. Marius was now dead, but his party was strong in numbers and again in revolt; yet before the close of B.C. 82 the Marian party in Italy was utterly crushed. In Spain, however, it held out under Sertorius (q.v.). Sulla caused himself to be appointed dictator, an office which he held until B.C. 79. Then followed the fearful period of the *proscriptions* (B.C. 81)—a virtual 'reign of terror' throughout Italy, the object of which was to extirpate the Marian party. His dictatorship was signalized by the framing of a series of laws the design of which was to restore the ancient power of the senate and the aristocracy. Sulla spent his last years at his estate at Puteoli, his death being hastened by debaucheries. Consult: Beesly, *The Gracchi, Marius, and Sulla* (New York, 1878).

SUL'LIVAN, ALEXANDER MARTIN (1830-84). An Irish nationalist, born at Bantry. In 1853 he went to Dublin to become an artist and afterwards took up journalism. As editor of the *Nation*, the exponent of constitutional agitation, he became a formidable opponent of the Fenian conspiracy. In 1874 he was returned to Parliament as a Home-Ruler from the County of Louth, and from Meath in 1880. He was called to the Irish bar in 1876, and to the English bar in the following year, whereupon he discontinued his work for the *Nation* and went to England to practice law. He published *The Story of Ireland* (1870), *New Ireland* (1877), *A Nutshell History of Ireland* (1883).

SULLIVAN, Sir ARTHUR SEYMOUR (1842-1900). A distinguished English composer. He was born in London of Irish parents. Sir George Smart accepted him as one of the children of the Chapel Royal, and during the choristership he wrote several anthems. His earliest published composition was a song "O Israel" (1855). In 1856, at the age of fourteen, Sullivan succeeded in obtaining the Mendelssohn scholarship, then recently established, and while still holding this scholarship he entered the Royal Academy of Music. In 1858 he went to Leipzig, where he studied at the Conservatory. His famous incidental music to Shakespeare's *Tempest* was his last work at the Conservatory, and was first heard in England in 1862, a few days after his arrival in the country. After holding organ appointments at Saint Michael's and at Saint Peter's he was appointed professor of the pianoforte and ballad-singing at the Crystal Palace School of Art, after which he gave a course of lectures on the theory and practice of music at the South Kensington Museum. His first great success in composition was his "Orpheus with His Lute," which was soon followed by "The Lost Chord." He was meanwhile engaged on more serious work, and in 1864 the cantata *Kenilworth* was produced. Then came the *Symphony in E* (1866), the *Overture In Memoriam* (1866), *The Prodigal Son* (1869), *Light of the World* (1873), *The Martyr of Antioch* (1880), *The Golden Legend* (1886), and the grand opera *Ivanhoe* (1891). He is held in greatest repute, however, for his light opera compositions, a form of writing into which he stumbled by the merest accident. The financial difficulties of the widow and family of a well-known artist on the staff of *Punch* caused the friends of the deceased to organize a 'benefit' for which F. C. Burnand and Sullivan promised to collaborate in a musical piece. *Box and Cox* was the result, and in seven days it was written, learned, rehearsed, and performed. The *genre* thus created became the field in which he achieved greatest success in collaboration with W. S. Gilbert. Besides those mentioned his dramatic works are: *The Contrabandista* (1867), afterwards enlarged as *The Chieftain* (1894), *Thespis* (1871), *Trial by Jury* and *The Zoo* (1875), *The Sorcerer* (1877), *H. M. S. Pinafore* (1878), *Pirates of Penzance* (1880), *Patience* (1881), *Iolanthe* (1882), *Princess Ida* (1884), *The Mikado* (1885), *Ruddigore* (1887), *The Yeomen of the Guard* (1888), *The Gondoliers* (1889), *Haddon Hall* (1892), *Utopia* (1893), *The Grand Duke* (1896), *The Beauty Stone* (1898), *The Rose of Persia* (1899), and *The Emerald Isle* (1901). In 1883 he was knighted by Queen Victoria. His music is essentially lyric in quality, and he was exceptionally fluent in melody as well as a master of dainty orchestration, in which latter respect he perhaps has never been excelled. His early training in the school of English church music left its imprint on all his sacred compositions. His anthems are distinguished by their pure melody and dignified harmony. His hymn-tunes are sung universally, and of these not the least important is his fine martial setting of "Onward, Christian Soldiers." He died in London.

SULLIVAN, FRANCIS STOUGHTON (1719-76). An Irish jurist, born at Galway. He was educated at Trinity College, Dublin, where he gained a fellowship at the very early age of nineteen. He remained at Dublin until in 1750 he was made regius professor of law in the university and in 1761 professor of feudal and English law. He was a jurist of great distinction and his one important work, *An Historical Treatise on the Feudal Law* (1772), was long held in high favor.

SULLIVAN, JAMES (1744-1808). An American jurist and politician, born in Berwick, Me.

He was admitted to the bar, and in 1770 was appointed King's attorney. In 1775 he was a member of the Massachusetts Provincial Congress, and was one of three commissioners dispatched on a secret mission to Ticonderoga. From 1776 to 1782 he was a judge of the Superior Court, and in 1784-85 a Massachusetts delegate to the Continental Congress. For many terms he was a member of the State Legislature, in 1787 was a member of the executive council, a probate judge, and from 1790 to 1807 was Attorney-General. In 1807 and 1808 he was elected Republican Governor of Massachusetts. He published *Observations on the Government of the United States* (1791), *The Altar of Baal Thrown Down* (1795), *Impartial Review of the Causes of the French Revolution* (1795). Consult the *Life* by T. C. Amory (Boston, 1859).

SULLIVAN, John (1740-95). An American soldier, prominent in the Revolutionary War. He was born at Berwick, Me., removed to Durham, N. H., and there practiced law. In June, 1775, he was appointed brigadier-general by Congress. During the siege of Boston, with General Greene, he commanded the left wing under General Lee, and on June 4, 1776, was placed in command of the army in Canada, whence, after being badly defeated at Three Rivers, he retreated with great skill to New York. On August 10th he became a major-general, and on the 27th served with distinction at the battle of Long Island (q.v.), during which he was taken prisoner. He was exchanged and served in the battles of Trenton, Princeton, Brandywine, and Germantown. In 1778 he was sent with a large force to act with D'Estaing against Newport, but the plan being abandoned, after decisively defeating the English at Butt's Hill on August 29th, he withdrew from Rhode Island. In 1779 he marched into western New York, and effectually chastised the Iroquois, defeating them and their Tory allies at Newton (Elmira) on August 29th. Resigning from active duty late in 1779, he served in Congress in 1780-81, was Attorney-General of New Hampshire from 1782 to 1786, was President of the State from 1786 to 1789, and was United States district judge from 1789 to 1795. Consult his *Life* by Peabody in Sparks, *American Biography* (series 2, vol. iii.); Amory, *The Military Services and Public Life of General John Sullivan* (Boston, 1868); and *Journals of the Military Expedition Against the Six Nations* (Auburn, N. Y., 1887).

SULLIVAN, John Lawrence (1858—). An American prize-fighter, born in Boston, Mass. In 1880 he defeated George Rooke, and two years afterwards he beat Ryan in nine rounds. In 1887 he fought a draw with Cardiff; in 1888, defeated Mitchell at Chantilly, near Paris; and in the next year, in Mississippi, in a seventy-five round fight, defeated Kilrain, winning the world's championship and a diamond belt offered by a sporting paper. In 1892 he met Corbett at New Orleans and was defeated in the twenty-first round, thereby losing the championship title. In 1896 he was defeated by Sharkey in three rounds.

SULLIVAN, Thomas Barry (1820?-91). A British tragedian, born in Birmingham. He was brought up in Cork, where he made his appearance on the stage before 1840. He joined the company of the Theatre Royal, Edinburgh, and remained there several seasons, advancing rapidly in his profession. In 1852 he appeared at the Haymarket Theatre, London, in Hamlet, the part in which he was on the whole most successful, though his Beverley in *The Gamester* was very highly praised. Consult Lawrence, *Barry Sullivan: A Biographical Sketch* (1893).

SULLIVAN, Thomas Russell (1849—). An American novelist and dramatist, born in Boston. He was educated at the Boston Latin School, passed the years 1870-73 in Europe, was then for fifteen years connected with a firm of Boston bankers as clerk and cashier, and after 1888 devoted himself to literature. He wrote *Roses of Shadow* (1885); *Day and Night Stories* (two series, 1890 and 1893); *Tom Sylvester* (1893); *Ars et Vita* (1898); *The Courage of Conviction* (1902); and several plays, of which the more noteworthy are *The Catspaw* (1881), a dramatization of *Dr. Jekyll and Mr. Hyde* (1886), and *Merely Players* (1886).

SULLIVAN'S ISLAND. An island at the entrance to Charleston Harbor, the site of Fort Moultrie (q.v.).

SUL'LIVANT, William Starling (1803-73). An American botanist, the founder of American bryology. He was born in Franklinton, Ohio, near Columbus, studied in Kentucky and in Ohio University, and in 1823 graduated at Yale. In 1840 he published a *Catalogue of Plants in the Vicinity of Columbus, Ohio,* and thereafter specialized in the cryptogamous plants. *Musci Alleghanienses* (1845) was followed in 1846 and 1849 by contributions to the *Memoirs* of the American Academy of Sciences "On the Bryology and Hepaticology of North America," and by a valuable addition to Gray's *Manual* on the mosses of the Northern United States, published separately in 1856 as *The Musci and Hepaticæ of the United States East of the Mississippi River.* In the same year, with the help of Lesquereux, he published *Musci Boreali-Americani Exsiccati. Icones Muscorum,* containing 129 valuable copper plates, is probably Sullivant's greatest work. At the time of his death he was at work on a *Manual of Mosses.*

SUL'LY, James (1842—). An English psychologist, born at Bridgewater, Somersetshire. He was educated at Independent College, Taunton, Regent's Park College, London, and at the universities of Göttingen and Berlin. Until 1892 he served as lecturer in the College of Preceptors, London, and in that year became professor of the philosophy of mind and logic in University College, London. Sully published both general treatises and special studies in psychology, the most important being: *Outlines of Psychology, with Special Reference to the Theory of Education* (1884; 2d ed. 1885); *Elements of Psychology* (1886); *The Human Mind: A Text-Book of Psychology* (1892); *Studies of Childhood* (1895); and *Essay on Laughter: Its Forms, Its Causes, Its Development, and Its Value* (1902). Sully became known as one of the most eminent of modern English psychologists; his work carries on the best traditions of the English school, but is characterized by its breadth and careful recognition of the development of psychological science on the Continent.

SULLY, sụ'lē', Maximilien de Béthune, Duke de (1560-1641). The great Minister of

Henry IV. of France. He was born at Rosny, near Mantes, the second son of François, Baron de Rosny. He belonged to a Protestant family, and was educated with the young Henry at the Court of Navarre. This was the beginning of a friendship and a loyal service that continued until Henry's death. He escaped the Massacre of Saint Bartholomew, accompanied Henry in his flight from the French Court (1576), shared in the campaigns against the Catholic League, distinguishing himself especially at Coutras (1587), and became Henry's wisest and most trusted adviser. He urged Henry's acceptance of Catholicism to save the crown. The misgovernment of the preceding years and the anarchy of the wars of religion had almost ruined France, and Sully, made Minister of Finance in 1597, and chiefly intendant in 1599, set himself thoroughly to reform the administration. He made a tour through the chief provincial districts, armed with absolute authority, personally examined the accounts, dismissed or suspended delinquents, and largely replenished the treasury with the ill-gotten wealth which he compelled them to disgorge. Little by little he brought the affairs of the country into an orderly state. From 1597 to 1609 he trebled the income of the State. His indefatigable activity was not confined to the department of finance; he practically was in supreme charge of the various other branches of the administration, promoted agriculture, encouraged export trade, and constructed roads, bridges, and causeways. He was made grand master of artillery in 1601, and in 1606 was created Duke de Sully. Sully was not popular. His single-minded service of the King made him disliked by the people for his supposed severity. The Catholics hated him for his religion; the Protestants for his invariable refusals to sacrifice the smallest jot of his master's or the country's interest for their sake. At Henry's death he was forced to resign his offices and lived in comparative retirement. Sully wrote *Mémoires des sages et royales économies d'etat, domestiques, politiques et militaires, de Henri le Grand*, a wearisome and disorderly collection of writings in the form of a narrative addressed to himself by his secretaries. It is through these volumes that we are made acquainted with the 'great design' of Henry for the federation of Europe, a design the genuineness of which has been the subject of much controversy. The edition in Michaud and Poujoulat, *Nouvelle collection des mémoires pour servir à l'histoire de France*, is from the original. Consult Lavisse, *Sully* (Paris, 1880).

SUL'LY, Thomas (1783-1872). A portrait painter of the early American school. Born at Horncastle, Lincolnshire, England; he was brought by his parents, who were actors, to Charleston, S. C., in 1792. In 1806 he removed to New York, and in 1809 he went to London, where he completed his studies begun in America under Benjamin West. Two years later he returned to America and settled in Philadelphia. Among his best known portraits are those of Commodore Decatur in the City Hall, New York; General Lafayette at Independence Hall, and George Frederick Cooke at the Pennsylvania Academy of Fine Arts, Philadelphia; Thomas Jefferson (1821) at the Military Academy, West Point; and portraits of Charles Kemble, Frances Anne Kemble, and Rembrandt Peale, James Madison, Andrew Jackson, and John Marshall, in the Corcoran Gallery, Washington. Consult his "Recollections of an Old Painter," in *Hours at Home* (1869).

SULLY-PRUDHOMME, sụ'lē' prụ'dôm', René François Armand (1839—). A French poet, born in Paris. He was educated for the law, and was a student of science and philosophy. In 1865 he published *Stances et poèmes*, which won the praise of Sainte-Beuve for their delicate elegiac sentiment. Encouraged by this success, he devoted himself wholly to poetry. In 1866 appeared *Les épreuves*, a work in which the sadness of unbelief is poignantly expressed. *Les solitudes* (1869) and a rhymed translation of the first book of Lucretius (1869) foreshadow by their depth his great philosophical poems *La justice* (1878) and *Le bonheur* (1888). These two last-mentioned poems are among the greatest efforts of French poetry since Victor Hugo and Lamartine. *Impressions de guerre* (1870) deal with some of the phases of the Franco-German War. *Les destins* (1872), *Vaines tendresses* (1875), and *Le prisme* (1886) are less philosophic and more personal. Sully-Prudhomme entered the Academy in 1881, and in 1901 received one of the Nobel prizes in recognition of the lofty qualities of his poetry. He devoted a portion of this to establishing an annual award for excellence among the younger French poets. His verses are thoughtful and often melancholy. Sensitively open to all impressions, he is singularly temperate in expression. This quality of reserve is particularly noticeable in his expression of the sadness which is his usual mood.

Consult: Brunetière, *Poésie lyrique*, vol. ii. (ib., 1894); id., *Littérature contemporaine* (2d ed., ib., 1895); Lemaître, *Les contemporains*, vols. i., iv. (ib., 1896); Gaston Paris, *Penseurs et poètes* (ib., 1897).

SULPHOCYANIC ACID, or Thiocyanic Acid, HCNS. A powerful organic acid analogous in its composition to the well-known cyanic acid (q.v.), HCNO, from which it differs in containing sulphur instead of oxygen. *Sulphocyanates*, i.e. salts of sulphocyanic acid, may be obtained by the direct action of sulphur on cyanides (i.e. salts of hydrocyanic acid). Thus, potassium sulphocyanate may be obtained by boiling a solution of potassium cyanide with sulphur. Free sulphocyanic acid may be prepared by decomposing barium sulphocyanate with sulphuric acid, and distilling the aqueous acid thus obtained over warm anhydrous chloride of calcium. The acid is thus obtained in the form of a volatile liquid with a characteristic pungent odor. Pure sulphocyanic acid may be preserved for some time if kept in the cold. At ordinary temperatures it rapidly polymerizes, forming an amorphous yellow substance. Several of the sulphocyanates are extensively used as mordants in certain dyeing processes. The principal commercial source of the salts is found in the manufacture of coal gas. The products formed during the destructive distillation of coal include ammonia, cyanogen, a certain amount of ammonium cyanide, and certain compounds of sulphur. In course of the purification of the gas, these by-products are brought into contact with moist ferric oxide for the purpose of freeing the gas from deleterious sulphur compounds. The sulphur is thus retained partly in the free state, partly as iron sulphide, and by combination with the ammonium cyanide present yields *ammonium sulphocyanate,* which may be dissolved out of the reacting mixture with water. Ammonium sulphocyanate itself may be used for the preparation of hydrazine. Usually it is transformed into the sulphocyanate of copper, from which, in turn, the useful *sulphocyanate of barium* is obtained by the action of baryta. The *sulphocyanate of aluminum,* another useful salt of sulphocyanic acid, may be obtained by the action of aluminum sulphate on the sulphocyanate of barium. Most of the sulphocyanates are soluble in water. *Sulphocyanate of mercury* may be obtained by the action of mercuric nitrate on the sulphocyanate of ammonium. It decomposes on moderate heating, the resulting mass, externally yellow, but black within, assuming a large size and often a most fantastic shape. This sulphocyanate is the principal ingredient of the well-known toy known as 'Pharaoh's serpents.' Each serpent consists of a little cone of tinfoil, filled with the salt. On lighting the cone at the apex, there begins to issue from it a thick serpent-like coil, which continues twisting and increasing in length to an extraordinary degree.

Like cyanic acid (q.v.), sulphocyanic acid furnishes a simple example of the phenomenon known as *tautomerism.* The two constitutional formulas corresponding to the acid, as deduced from a study of its two different series of derivatives, are as follows:

$$N = C - S - H \quad \text{and} \quad H - N = C = S$$

The two imaginary compounds corresponding to these formulas, but in reality represented by only one acid, are called, respectively, sulphocyanic acid and iso-sulphocyanic acid (or thiocyanic acid and iso-thiocyanic acid).

SULPHONAL $(CH_3)_2C(SO_2C_2H_5)_2$. A white crystalline compound used as a hypnotic. It is prepared by the action of acetone on mercaptan (q.v.) and the oxidation of the resulting product by permanganate of potassium. It is sparingly soluble in water and alcohol and is best administered with hot milk. It is employed as a substitute for chloral, over which it has the advantage of exercising no depressing action on the heart. It is, however, a poisonous substance and has been known to produce serious functional disturbances and eruptions on the skin. It is sometimes administered in conjunction with a similar compound, known as trional (q.v.).

SULPHOVINIC ACID. Same as Ethyl hydrogen sulphate, or ethyl sulphuric acid. $C_2H_5.H.SO_4$. See ALCOHOL.

SULPHUR (Lat. *sulphur, sulfur,* sulphur; possibly connected with Goth. *swibls,* OHG. *swebal,* Ger. *Schwefel,* AS. *swefl,* sulphur). A non-metallic element that has been known since ancient times. Owing to the fact that it burns readily, it was called *brennestone* or *brimstone,* and was regarded by the alchemists as the principle of combustibility, representing the alterability of metals by fire. It occurs in the uncombined state, though usually contaminated with clay, bitumen, and other impurities, and sometimes with traces of arsenic, selenium, tellurium, etc., usually in the vicinity of volcanoes and hot springs. Its compounds, especially those with metals (sulphides), are of common occurrence, and include *chalcopyrite* or copper-iron sulphide, *cinnabar* or mercury sulphide, *galena* or lead sulphide, *pyrite* or iron sulphide, the arsenic sulphides or *realgar* and *orpiment, sphalerite* or zinc sulphide, *stibnite* or antimony sulphide. In combination with metals and oxygen (sulphates), sulphur occurs in such minerals as *anglesite* or lead sulphate, *barite* or barium sulphate, *celestite* or strontium sulphate, *chalcanthite* or copper sulphate, *gypsum* or calcium sulphate, and *kieserite* or magnesium sulphate. Volcanic gases generally contain sulphur in the forms of sulphur dioxide and sulphureted hydrogen, and compounds containing sulphur are found in certain organic materials, such as the volatile oils of mustard and garlic, hair, wool, bile, and albuminous substances. It is generally believed that native sulphur has been formed by the action of sulphur dioxide on hydrogen disulphide. Sulphur may also be obtained by decomposing certain mineral sulphides, such as pyrite. The commercial article is usually obtained by purifying native sulphur by fusion, or by distillation, and is produced largely in Sicily, where it occurs mixed with celestite, gypsum, limestone, and marl. The ore, after being carefully hand-picked, was formerly heated in heaps from which the liquid sulphur collected in a trough at the bottom, whence it was ladled out; but as this process was very wasteful, kilns came into use, in which the sulphur ore was piled and ignited at the bottom; the heat penetrated slowly into the mass, and as the sulphur gradually melted it ran to the bottom of the kiln, where it was collected and then cast into molds. Sulphur may also be extracted from ores by using a solvent such as carbon disulphide, from which it is then separated by distillation. Crude commercial sulphur usually contains about 3 per cent. of earthy impurities, which may be removed by distillation, in which case the sulphur is first melted and then heated to the boiling-point, the vapor of sulphur then passing into a large chamber, where it condenses and falls to the floor in the form of a light yellow crystalline powder commonly known as *flowers of sulphur.* This is cast into slightly conical wooden molds, when it is known as *roll sulphur* or *brimstone,* and sometimes it is allowed to cool in the chamber, when it is obtained in large crystalline masses called *block sulphur.*

Sulphur (symbol, S; atomic weight, 32.07) occurs in several allotropic modifications. One of these is a brittle solid that crystallizes in the rhombic system, but that on heating passes into transparent yellowish-brown needles of the monoclinic system. Both of these forms are soluble in carbon disulphide. The modifications of sulphur that are insoluble in carbon disulphide include plastic, amorphous, yellow, and black sulphur. There is a variety of sulphur that is soluble in water. This is known as *colloidal sulphur* and is obtained by passing hydrogen disulphide into an aqueous solution of sulphur dioxide. Sulphur has a specific gravity of about 2.03, and melts variously from 111° to 115° C. It is a poor conductor of heat and electricity. The element itself is extensively used in the arts and manufactures, as in making gunpowder and matches, and in medicine.

Sulphur combines with oxygen to form a dioxide (SO_2) and a trioxide (SO_3), which in turn combine with water to form sulphurous and sulphuric acids (H_2SO_3 and H_2SO_4, respectively).

It also forms a sesquioxide (S_2O_3) and a heptoxide (S_2O_7); but these are unimportant. Sulphur dioxide, or sulphurous anhydride, was known to the ancients, and Homer mentions the fact that the fumes from burning sulphur were used for fumigation, while Pliny says that such fumes were employed for purifying cloth. It is readily formed by burning sulphur in the air, and also by the action of certain metals, such as copper, on sulphuric acid. It is a colorless gas with a suffocating odor and is freely soluble in water, forming sulphurous acid. The gas is used as a bleaching agent, as a disinfectant, and as an antiseptic, serving to prevent the putrefaction of meat and to stop fermentation. It is also used in the sulphuring of wine. Its compound with water, known as sulphurous acid (H_2SO_3), combines with bases to form a series of salts which are known as sulphites. *Sulphur trioxide*, or sulphuric anhydride, is formed when a mixture of sulphur dioxide and oxygen is passed over platinum sponge, or by the distillation of fuming sulphuric acid. It is a colorless mobile liquid that solidifies in the form of long transparent prismatic crystals which melt at 14.8° C. The liquid boils at 46° C. It is very acrid and chars paper, wood, and organic matter generally. When thrown into water it dissolves with a hissing sound and evolves a large amount of heat, forming sulphuric acid (q.v.). Under the name of *crystallizable sulphuric acid*, it is used in the manufacture of coal-tar colors, such as alizarin, and in the purification of ozokerite. With hydrogen and oxygen sulphur forms a series of acids including, besides those already mentioned, the following: *thiosulphuric* or *hyposulphurous acid* ($H_2S_2O_3$), which is described elsewhere; *hydrosulphurous acid* (H_2SO_2), a powerful reducing agent discovered by Schützenberger and prepared by the action of metallic zinc on acid sodium sulphite; *persulphuric acid* (HSO_4), obtained in a combined form by the electrolysis of a strong solution of acid potassium sulphate; *pyrosulphurous acid* ($H_2S_2O_5$), whose potassium salt is formed when sulphur dioxide gas is passed into a hot aqueous solution of potassium carbonate; *pyrosulphuric acid* ($H_2S_2O_7$), formed by the direct union of sulphur trioxide and sulphuric acid; *dithionic acid* ($H_2S_2O_6$), whose manganese salt is formed by the action of sulphur dioxide on manganese dioxide; *trithionic acid* ($H_2S_3O_6$), whose potassium salt is formed by the action of flowers of sulphur on a warm solution of acid potassium sulphite; *tetrathionic acid* ($H_2S_4O_6$), whose sodium salt is formed by the action of iodine on sodium hyposulphite; *pentathionic acid* ($H_2S_5O_6$), formed, along with free sulphur, by the action of sulphur dioxide on aqueous sulphureted hydrogen.

Sulphur combines with hydrogen to form a disulphide (sulphureted hydrogen, q.v.) and a persulphide, of which the former is well known. The persulphide (probably H_2S_2) is an oily yellow liquid which is prepared by pouring an aqueous solution of an alkaline polysulphide into excess of a solution of about equal parts of concentrated hydrochloric acid and water. It has the property of bleaching organic coloring matters, and reduces the oxides of gold and silver with great rapidity. With carbon sulphur combines to form a disulphide (CS_2), which is described in a special article. (See CARBON DISULPHIDE). With chlorine sulphur combines to form a monochloride (S_2Cl_2), a dichloride (SCl_2), and a tetrachloride (SCl_4), of which the most important is the monochloride. This is prepared by passing dry chlorine gas over melted sulphur and distilling off the chloride from the excess of sulphur. It is an amber-colored liquid that fumes strongly in the air, and possesses a penetrating odor. A saturated solution of sulphur in the monochloride is used in vulcanizing rubber goods.

SULPHUR, MEDICAL USES OF. Sulphur is used in medicine both internally and externally. It is prepared from crude sulphur by sublimation, washing, and precipitation. Taken by the mouth sulphur is in medicinal doses a mild laxative, producing a soft stool, which slips by strictures of the rectum, piles, and fissures with little discomfort. It is, therefore, used in these conditions. Sulphur is particularly valuable for chronic rheumatism, either taken in the form of mineral waters containing this element, or externally by means of sulphur baths. The latter are employed in various chronic skin diseases, of obstinate type, such as psoriasis, lichen, and eczema. (See BATHS and MINERAL WATERS.) Calcium sulphide is of value in all cases where pus is about to form, as when successive crops of boils appear, or in acne pustulosa.

The external uses of sulphur are mostly confined to affections of the skin and as a parasiticide. It is only active when used in the form of an ointment. For the itch (q.v.) sulphur ointment is a specific. It is also a favorite remedy for ringworm (tinea, q.v.).

SULPHURETED HYDROGEN, HYDROGEN SULPHIDE, or HYDROSULPHURIC ACID, H_2S. A gaseous acid compound of sulphur and hydrogen, known since the sixteenth century, but first carefully investigated by Scheele in 1777. It occurs uncombined in certain mineral waters and is formed in the decomposition of albuminous substances containing sulphur. It also occurs as a product of transformation of gypsum (calcium sulphate) and other metallic sulphates and is a constituent of volcanic exhalations. But whatever its origin, it does not long remain unchanged in the air, being oxidized with the greatest ease. The usual method of preparing the gas consists in causing sulphuric or preferably hydrochloric acid to act on ferrous sulphide. The following rule usually holds good: Sulphureted hydrogen is formed by the action of acids on the sulphides of those metals (e.g. iron, zinc, manganese, calcium, magnesium, sodium, potassium, etc.) which can directly decompose the acids with liberation of hydrogen. Sulphureted hydrogen is a colorless gas, somewhat heavier than air, soluble in water and more so in alcohol, the solutions reddening blue litmus paper. Mixed with 1½ volumes of oxygen and ignited, it explodes, the products of the reaction being water vapor and sulphur dioxide (SO_2). Under the influence of cold and pressure, sulphureted hydrogen condenses to a colorless mobile liquid. Sulphureted hydrogen is very poisonous, and even small proportions of it in the air are dangerous. The presence of free sulphureted hydrogen may be demonstrated by means of a strip of filter-paper soaked with a solution of lead acetate, the paper turning brown or black, owing to the formation of lead sulphide. Chlorine and iodine decompose sulphureted hydrogen, and this is why the odor of the latter is readily destroyed by bleaching powder. Sulphureted hydrogen is used in the manufacture of certain metallic sulphides, for the purification of sulphuric acid, and extensively in analytical chemistry. The sulphureted hydrogen produced in certain industrial processes is utilized by burning it and transforming the resulting sulphur dioxide either into sulphuric acid or into free sulphur.

SULPHURIC ACID, H_2SO_4. A well-known acid compound of hydrogen, sulphur, and oxygen. When pure and free from water, it is a colorless, oily liquid of specific gravity 1.84 (approximately) at 0° C. While it may readily be undercooled, it solidifies normally at 6.79° C. (44.3° F.). At about 290° C. (554° F.) it begins to boil, breaking up into sulphur trioxide and water vapor, and as some of the latter is retained by the boiling acid, the temperature rapidly rises to about 338° C. (640° F.). It is highly hygroscopic, absorbing about 30 per cent. of its weight of water. It readily chars organic matter, and is poisonous, not only on account of its powerful corrosive action, but also on account of a specific effect on the blood. Chemically it is a dibasic acid, either one or both of its hydrogen atoms being replaced by metals, with the formation, respectively, of either acid or neutral salts (sulphates). Its chemical constitution is generally assumed to be represented by the formula H — O — S — O — O — O — H. By adding to it a little water, it may be caused to form the hydrate $H_2SO_4.H_2O$, which crystallizes out when the mixture is cooled and may then be readily isolated from the mother-liquor by suction. Glass bottles containing commercial sulphuric acid often burst in winter, owing to the separation of crystals of this hydrate, whose melting-point is about 8° C. (about 46° F.), and which decomposes into sulphuric acid and water above 205° C. (about 370° F.). If pure sulphuric acid is mixed with water in the proportion of 49 parts of the former to 18 parts of the latter, another well-defined hydrate is formed, having the composition $H_2SO_4.2H_2O$.

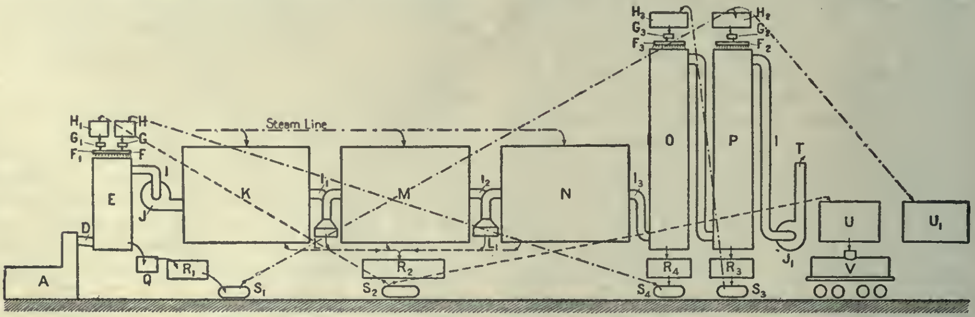


DIAGRAM SHOWING CHAMBER PROCESS FOR MAKING SULPHURIC ACID.

In the figure, A is a bench of pyrites burners, niter oven, etc. The burner gas is conducted through pipe D to the Glover tower, E, where it meets the dilute acids and oxides of nitrogen. The fan J carries the gases through the pipe I to the first chamber, K, where oxidation of the sulphur dioxide takes place in presence of water vapor supplied by the steam line shown above the chambers, thence to the second and third chambers, M and N, through the flues I_1 and I_2 and surface condensers L and L_1. The acid drained from the bottom of each chamber and the condensers is collected in the tank R_2.

The pump S_2 delivers this acid to the tank H_1, over the Glover tower, or to the storage tank U, whence it goes to the tank car V. The strong acid coming from the Glover tower is collected in cooler Q and tank R and is delivered by the pump S_1 to the tank H_2 over the second Gay-Lussac tower, P, and to the storage tank U_1. The gases from the last chamber, N, are conducted through the pipe I_3 to the first Gay-Lussac tower, O, and thence to the second Gay-Lussac tower, P, their flow being maintained by the fan J_1. The exhausted gases pass to the atmosphere at T. The nitrous vitriol from the first Gay-Lussac tower is collected in the tank R_4 and is delivered by the pump S_4 to tank H over the Glover tower. The nitrous vitriol from the second Gay-Lussac tower, containing but little N_2O_3, is collected in the tank R_3 and is delivered by the pump S_3 to the tank H_3 over the first Gay-Lussac tower. In different works this scheme varies somewhat in detail, but not in its essential points.

The term 'sulphuric acid,' however, as technically and commercially understood, seldom if ever refers to the actual monohydrate or to any of the other recognized hydrates of sulphur trioxide.

It refers either to a series of solutions of the monohydrate in water or to a series of solutions of sulphur trioxide in the monohydrate. ($H_2SO_4 + SO_3$.) The first series are known commercially as 'chamber acid'—'oil of vitriol'—'concentrated acid' or in terms of their specific gravity as indicated by a hydrometer scale, as 60° Beaume acid, 144° Twaddell acid and so forth. The second series are termed 'fuming' or Woodhausen acids and are always estimated alkali-metrically according to the percentage of free sulphur trioxide contained.

Technically, threfore, 'sulphuric acid' might be considered to be the generic name of a series of solutions of sulphur trioxide (SO_3) in water, some of which solutions are distinguished by variations of properties which occur uniformly with uniform percentage mixtures of sulphur trioxide and water and are therefore chemical hydrates of sulphur trioxide—most of which are, however, merely solutions of convenient strength for use in the arts.

The manufacture of sulphuric acid is one of the greatest chemical industries. The processes involved include the production of sulphur dioxide, the transformation of this into sulphur trioxide, and the transformation of the trioxide into sulphuric acid. Of these, the oxidation of the dioxide is the most important, the dioxide itself being readily produced by burning sulphur, mineral sulphides, or sulphureted hydrogen, with free access of air, the resulting gases, technically termed 'burner gas,' including from 5 to 8 per cent. of the dioxide (the remainder is constituted by the nitrogen and excessive oxygen of the air and by impurities). The two processes devised to effect the oxidation of the dioxide are alike catalytic in their action, in so far as the substances used, while producing the required chemical reaction, remain themselves in the end unchanged. These two processes are termed, respectively, the chamber process and the contact process.

THE CHAMBER PROCESS. In the chamber process the burner gas is mixed in large lead chambers (and with more or less auxiliary apparatus) with nitric acid, or with the products of the action of sulphuric acid on sodium nitrate, the catalytic agent being probably nitrogen trioxide, and the following reactions probably taking place:

$$2SO_2 + N_2O_3 + H_2O + O_2 = 2SO_2(OH)(NO_2);$$
$$2SO_2(OH)(NO_2) + H_2O = 2H_2SO_4 + N_2O_3.$$

The nitrogen trioxide is thus entirely reproduced. In addition to the above principal reactions there are further reactions set up in the so-called Guy-Lussac and Glover towers, in which apparatus, respectively, the catalytic agent is recovered and made available (in the form of nitric acid) for further use. The principle of the chamber process, therefore, is the production of a dilute sulphuric acid by oxidizing a burner gas containing say 5 per cent. to 8 per cent. of sulphur dioxide in presence of water vapor by the means of nitric acid in suitable apparatus in such a way that the nitric acid is practically recovered for further use. This recovery, however, is rarely complete—a certain mechanical loss being unavoidable. The strongest acid which can be produced by the chamber process will correspond to from 50 per cent. to 60 per cent. of sulphur trioxide. Stronger acids must be produced by driving off the contained water by heat or by isolating the acid by freezing. It is thus possible to produce the concentrated acid (oil of vitriol) of commerce, containing from 93.5 to 97 per cent. of pure sulphuric acid; also distilled acid, containing up to 95.5 per cent. of H_2SO_4; but the anhydrous can only be isolated by freezing.

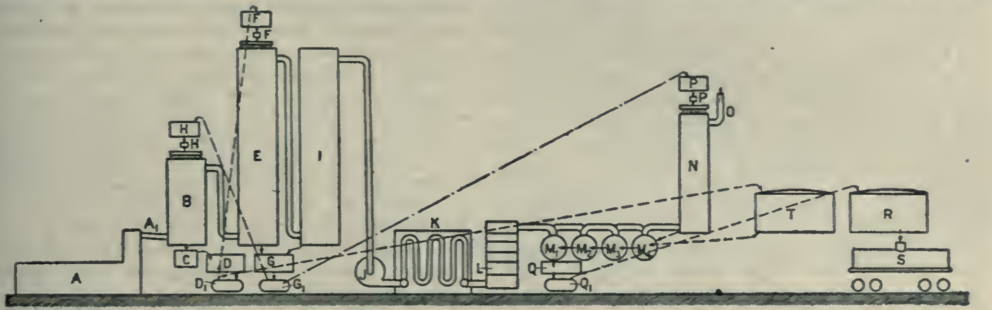


DIAGRAM SHOWING CONTACT PROCESS FOR MAKING SULPHURIC ACID.

A is a bench of pyrites burners. The burner gas passes through the flue A to the first cleaning tower, B. Weak sulphuric acid is constantly flowing down this tower, becoming concentrated by the hot burner gas and absorption of the sulphur trioxide contained in the burner gas, and finally flows out at the bottom into the cooler C at a strength of from 62° to 64° Baumé. From the cooler C, the strong acid passes to the tank D and is delivered by the pump D_1 to the storage tank T, or to the tank F over the second cleaning tower, E. A constant stream of strong sulphuric acid from the tank F is kept flowing down this tower. In this tower the burner gas coming from the top of B is further cleaned and dried by the action of the strong acid and then passes to the filter tower, I; the circulation of the gases through the train of apparatus is maintained by the fan J. Before entering the contact ovens, the mixed gases are reheated to the proper temperature for the combination of the sulphur dioxide and oxygen in the reheater, K.

The contact oven, L, consists of cast-iron rings with perforated shelves, or diaphragms, upon which is placed the contact mass.

The sulphur trioxide formed in the contact oven now passes through the absorption cylinders, M_1, M_2, M_3, M_4. These are cylindrical iron tanks connected in such a way that the gas passes from end to end, meeting the weak acid flowing in the opposite direction. Both the gas and the acid in M_1 are richest in sulphur trioxide, while in M_4 the gas and acid are weak. Sulphur trioxide is most readily absorbed by acid containing about 98% H_2SO_4. The strong acid, which is ready for the market as it comes from M_1, is collected in the tank Q and is delivered by the pump Q_1 to the storage tank, R.

The gases coming from the last absorption tank, M_4, contain still a small amount of unabsorbed sulphur trioxide. In order to recover this, the gases are passed through the tower N, which is supplied with strong acid which absorbs the last traces of sulphur trioxide. The nitrogen and oxygen remaining pass into the air through the pipe O. The tank car S receives acid for shipment from the storage tank, R.

THE CONTACT PROCESS. In the contact process the method of production is directly synthetical, and acids of any desired strength may be made in one operation. In this process the burner gas must be first rendered absolutely free from everything other than sulphur dioxide, oxygen, and inert nitrogen, the usual impurities of burner gas, such as dust, moisture, arsenic, selenium, etc., derived from the raw material used, seriously interfering with the process. After purification, the gas is passed through a substance possessing the faculty of causing sulphur dioxide to oxidize into sulphur trioxide, without apparently suffering any change whatever in its own condition. This contact must be brought about under conditions as to temperature according to the substance used. The contact substances used are finely divided platinum in various forms, such as platinized asbestos and pumice, etc., crusts formed of platinum and some soluble sulphate, ferric oxide, cupric sulphate, diatomaceous earth, etc. The transformation of sulphur dioxide into the trioxide takes place best between 200° and 450° C. (392°-842° F.). Above 450° C. the transformation grows incomplete, for at that temperature commences the dissociation of sulphur trioxide into dioxide and free oxygen—a dissociation which is complete at 900° C. The formation of sulphur trioxide having been attained, it simply remains either to condense it at the proper temperature in its crystalline condition or to absorb it in sulphuric acid or water until a solution of the required strength is obtained.

USES OF SULPHURIC ACID. The uses of sulphuric acid in the arts are extremely varied and of the highest importance. It forms the basis of manufacture of nearly all the other acids and salts. Nitric, hydrochloric, acetic, picric, phosphoric, oxalic, tartaric, citric, and stearic acids, chemical manures and fertilizers, are all prepared by the agency of sulphuric acid. It is also used in the metallurgy of copper, cobalt, nickel, silver, and platinum, as well as in the preparation of sheet iron and wire for galvanizing and tinning; in the preparation of phosphorus, bromine, iodine, potassium bichromate, ordinary ether, and various esters (q.v.), starch, glucose, sugar, and effervescent drinks; in the manufacture of parchment papers, cellulose, celluloid, high explosives, nitroglycerin, nitrobenzene, guncotton, smokeless powders, pyroxilene, etc.; in the manufacture of coal-tar colors and dyes; in dyeing, calico printing, and tanning; in refining mineral oils, tallow, benzene, and paraffin; in the preparation of the various sulphates, as those of ammonium, potassium, barium, magnesium, aluminum, iron, zinc, copper, mercury, atropine, hydroscyamine, morphine, quinidine, quinine, strychnine, and others, too numerous to mention and many of which have an extensive application in therapeutics.

HISTORY. Geber was the first to describe sulphuric acid as a spirit which can be produced from alum and which possesses solvent properties. From the year 1613 sulphuric acid was prepared by the apothecaries by burning sulphur with access of air in moist vessels. In 1666 the addition of a little saltpetre was introduced by Nicholas LeFêvre. About 1740, at Richmond, near London, England, the first sulphuric acid works on a commercial scale were founded, producing oil of vitriol 'made by the bell' in contradistinction to that distilled from copperas. The birth of the modern method of sulphuric acid making, however, dates from Roebuck's installation of lead chambers in Birmingham in 1746, and his further installation at Prestonpans, in Scotland, in partnership with Garbett. As late, however, as 1800 the Prestonpans works only yielded 111 per cent. on the sulphur burned, with a consumption of 13 per cent. of nitrate of soda (modern practice would yield 300 per cent. of the acid on sulphur burned with a consumption of less than 3 per cent. nitrate of soda). The chambers at that time were about 14 feet long, 10 feet high, and 4 feet 10 inches wide. (They are now commonly 50 feet to 100 feet long, 20 feet to 25 feet high, and 20 feet to 30 feet wide.) In 1827 Gay-Lussac introduced his towers for the recovery of nitric acid. Another important step was the introduction, in 1859, by John Glover, of his denitrating and concentrating tower at the Washington Chemical Works, near Durham, in England. This completed the rational and economical method of manufacture known as 'the chamber process.' From that time on the history of the chamber process of manufacturing sulphuric acid has been largely one of minor improvements, economics, and investigations into the chemical reactions involved in the process.

In the meantime, however, as early as 1817, the catalytic action of platinum was discovered by Sir Humphrey Davy, and this phenomenon was further investigated by Edmund Davy, Döbereiner, and others. In 1831 Peregrine Phillips, Jr., an acetic acid manufacturer, discovered and patented the application of the catalytic action of platinum to the production of sulphur trioxide. The matter remained dormant until 1848, when the Belgian Schneider claimed to have discovered in pumice stone a substance of great catalytic activity. From this time on the subject received the attention of many scientists in Europe. But it was not until the publication of the investigations of Clemens Winkler in Dingler's *Journal*, in 1875, that the foundation of a commercial contact process can be said to have been securely laid. Subsequent work by Hanisch and Schroeder, Messel and Lunge, and others, followed. Finally, about 1880, the matter was taken up by the Badische Anilin und Soda Fabrik in Germany, and this firm, after a long, costly, and obstinate struggle, brought the process to a commercial success. An output of 18,500 tons of sulphur trioxide by this firm in 1888 had been increased in 1890 to 116,000 tons. Other manufacturers also have made the contact process an established success, the different manufacturers working on slightly different methods or different contact materials. As yet, however, the only contact material of demonstrated commercial value is platinum in one or the other form or combination. In the United States the first contact plant was erected in 1899, at Mineral Point, Wis., by the New Jersey Zinc Company under the patents of Schroeder. This plant was almost immediately followed by others, all of which are in successful operation, and while this process cannot be said to have superseded the old chamber process, its advantages are such that its complete triumph is probably only a matter of time and improved methods.

BIBLIOGRAPHY. Until the publication of Georg Lunge's *Sulphuric Acid and Alkali* in 1879 (3d Eng. ed., London, 1903), the literature on this subject was confined entirely to the scientific journals and *Proceedings* of scientific societies. Consult also a lecture by Dr. Rudolf Kneitsch before the German Chemical Society, October 19, 1901, an English translation of which was published in the *Mineral Industry*, vol. x. Vols. vii., viii., ix., x. of the *Mineral Industry* also contain reports on "Progress in the Sulphuric Acid Industry."

SULPHURIC ETHER. See ETHER.

SULPHUROUS ACID (H_2SO_3). A colorless liquid containing about 6.4 per cent. of sulphurous anhydrid (SO_2) and 93.6 per cent. of water. The gas is a valuable disinfectant and has been used for this purpose from the most ancient times. The gas is employed almost universally at the present day to disinfect buildings and rooms, although formaldehyde gas is gradually superseding it. Sulphurous acid is used as a spray or lotion in diphtheria and stomatitis, and is valuable as a wash for indolent ulcers and foul sores. It is an excellent remedy for ringworm. The acid is sometimes given internally to prevent abnormal fermentation in the stomach and intestines in certain varieties of dyspepsia, but its value is problematical, and there are many other drugs suitable for this condition whose action is certain. See DISINFECTANTS; FUMIGATION.

SULPHUR SPRINGS. The county-seat of Hopkins County, Texas, 79 miles east by north of Dallas, on White Oak Creek, and on the Saint Louis Southwestern and the Missouri, Kansas and Texas railroads (Map: Texas G 3). It has cotton gins, a cotton compress, cottonseed-oil mills, and manufactories of leather, brick and tile, carriages and wagons, and lumber products. The water-works are owned by the municipality. Population, in 1890, 3038; in 1900, 3635.

SULPICIANS, sŭl-pĭsh′anz. A society of priests founded in 1641 by Jean Jacques Olier (q.v.) to educate candidates for the priesthood. It took its name from the parish of Saint-Sulpice in Paris, of which Olier was pastor. When the number of priests had increased beyond the needs of the parish, some took charge of a seminary; and this has since been their principal work. At the present time they have charge of the clerical seminaries in twenty-five dioceses of France. They came to Canada in 1642 and had a large share in the founding of the city of Montreal as a Christian colony; for a long time they did all the priestly work there, and still conduct the seminary. On the invitation of Bishop Carroll, they came to Baltimore in 1790 and took charge of the seminary founded there a year later; in 1808 they established another at Emmitsburg, the later Mount Saint Mary's College. They also have charge of the seminaries in the dioceses of New York, Boston, and San Francisco, and of the clerical students in the Catholic University at Washington.

SULPICIUS (sŭl-pĭsh′ĭ-ŭs) **SEVE′RUS** (c.363-c.410.) An ecclesiastical historian, born in Aquitaine. According to Paulinus (Ep. xxii.) he went to live at Primuliacum, a village near Toulouse, and about this time he seems to have taken monastic vows. He was a friend of Saint Martin, Bishop of Tours, whom he frequently visited, and whose life he wrote (*Vita S. Martini Turonensis*). His biography and his dialogues are of great historical value. The most important of Sulpicius's other writings is his *Historia Sacra*, composed about 403. This book was for a long time used as a text-book for history in the schools of Europe (till c.1656). There is an English version of his writings, by Alexander Roberts, in *Nicene and Post-Nicene Fathers* (vol. xi., 2d series, New York and Oxford, 1894).

SULTAN. A breed of small fowls, derived from Turkey, and kept for their beauty of plumage and docility as pets.

A SULTAN COCK.

SULTAN (Ar. *sulṭān*, emperor, empire, from *saliṭa*, to be imperious). A common title of Mohammedan princes since the time of the Ghaznivid Mahmud (997-1030). It is given, *par excellence*, to the ruler of Turkey, who takes the name *sultan khan*, 'reigning sultan,' or sultan of sultans. It is also given to the princesses of the royal house, and the Sultan's mother is called *valide sultan;* the mother of his first-born son is called *hasseki sultan*. In English a feminine form *sultana* is usually employed for women.

SULTE, sụlt, Benjamin (1841—). A French-Canadian author, born at Three Rivers, in the Province of Quebec. Taken from school at the death of his father, who perished at sea, Sulte pushed his way through various employments into journalism and into the service of the Government as translator. His most solid prose work is the *Histoire des Canadiens-Français* (8 vols., 1882-84), which was followed by *Histoire de Saint François-du-Lac* (1886) and *Pages d'histoire du Canada* (1891). Sulte is also well known for his songs in *Les Laurentiennes* (1870) and *Les chants nouveaux* (1880).

SULU, sōō-lōō′, or Joló. The capital of the island and archipelago of the same name in the Philippines, situated on the northwest coast of the island of Sulu, 580 miles almost due south of Manila, and 99 miles southwest of Zamboanga, Mindanao (Map: Philippine Islands, F 13). The old town, destroyed during the Spanish occupation of 1876-78, was the residence of the sultans from the time of the traditional first leader, Xarib, or Charib, who is reported to have come from Mecca during the latter part of the seventeenth century. The new town, laid out on the hill by the Spaniards at the time of their permanent occupation, is well constructed and fortified. The harbor is provided with a long stone pier and a lighthouse, and the town is an important shipping place. Since the protocol of 1877 between England and the German Empire and Spain, it has been a free port. The population is but a few thousand.

SULU (Sp. Joló) **ISLANDS**, or **SOOLOO ISLANDS**. The southernmost group of the Philippine Islands. It extends between the Sulu and Celebes Seas from the western extremity of Mindanao southwestward to the northeastern extremity of Borneo (Map: Philippine Islands, F 13). Its combined area, excluding the Basilan group, which properly belongs to Mindanao and forms a separate province, is estimated at 1029 square miles. The archipelago is arranged in two main parallel chains, and consists of several minor groups, each centred around a large island. Of the latter the two largest are Sulu Island in the north and Tawi-Tawi in the south, whose areas, respectively, are 380 and 187 square miles. The number of islands counted is 188. The larger islands are of volcanic formation, and consist of mountains from 1000 to 3000 feet high, with several extinct volcanoes. The mountains are generally surrounded by a coast zone of coral deposits, and most of the smaller islands are wholly of coral formation and very low, though all are built on the summits of a subterranean mountain range. The climate, being more tempered by the sea, is cooler and more equable than that of Mindanao. The soil, a mixture of volcanic and coral detritus, is extremely fertile, and the vegetation is luxuriant. The flora is more distinctly related to that of the Philippines, especially Mindanao, than to the Borneo flora; the forests produce teak and other valuable timbers, and cocoanut and nipa palms are abundant.

Considerable areas in Sulu Island are cleared and cultivated, the chief crop being rice, while coffee, cacao, corn, hemp, cotton, and indigo are also raised. The industries include weaving for domestic use, the manufacture of cordage and of knives and hatchets, and pearl and shell fishing, the last being probably the most important. Trade is almost wholly in the hands of Chinese merchants, and consists chiefly in the exportation of pearl shell to Singapore and Manila and the importation of manufactured goods. The dominant race among the inhabitants are the Moros, a tribe of Mohammedan Malays, who had invaded and conquered the islands before the arrival of the Europeans. They practice polygamy and a mild form of slavery, which the United States Government has agreed not to abolish, though it has insisted that hereafter no person shall be enslaved. The people are governed directly by local chieftains called datos, who are more or less nominally subject to the Sultan of Sulu. The latter was confirmed in his title and authority by the United States Government. The population of the archipelago is estimated at 22,630. The capital is Sulu (q.v.).

When the Sulu Archipelago was visited by Magellan in 1521 it was already occupied by the Moros, and formed, together with its possessions in North Borneo, an independent State. The Moros showed a warlike and independent spirit, and remained almost up to the present time among the most formidable pirates in the Malay Archipelago. Spain claimed sovereignty over the islands and their dependencies, but did not exercise it beyond sending occasional punitive expeditions against the pirates, and her sovereignty was disputed by England and Germany. By 1875, however, Spain had gradually gained a foothold and begun to assume actual control. In 1877 traffic was declared free in the archipelago, and Spain abandoned her claim to North-Borneo in favor of England. Finally in 1885 England and Germany formally recognized Spanish sovereignty in the islands. It had already been acknowledged by the Sultan in 1878. With the Philippine Islands the Sulu Archipelago passed into the possession of the United States in 1898. In December, 1899, a treaty was definitely concluded between the Sultan and the United States by which American sovereignty over the islands was recognized. The rights and dignities of the Sultan were acknowledged and an annual stipend was conferred upon him. The Moros were guaranteed immunity in the practice of their religion. Toward the end of 1903 hostilities broke out between the Moro chiefs and the United States forces. The latter, under the command of General Leonard Wood, inflicted a severe defeat on the enemy in the last days of November.

SULZER, zụl′tsẽr, Johann Georg (1720-79). A Swiss esthetic philosopher, born at Winterthur. Educated in Zurich, he went in 1742 to Berlin, where he entertained friendly relations with Euler and Maupertuis, became professor of mathematics at the Joachimsthaler Gymnasium (1747), then at the Ritterakademie (1763), and was elected a member of the Academy. His principal work, in which he sought to reconcile the doctrines of Wolf with the tenets of the French and English philosophers, is the *Allgemeine Theorie der schönen Künste* (1771-74; new ed., with literary additions by Blankenburg, 1792-94), supplemented by *Nachträge, oder Charakteristik der vornehmsten Dichter aller Nationen*, ed. by Dyk and Schatz (1792-1808). With Ramler he edited *Kritische Nachrichten aus dem Reiche der Gelehrsamkeit* (1750). Consult his autobiography (Berlin, 1809).

SUMACH (OF. *sumac, sumach*, Fr. *sumac, sommac*, sumach, from Ar. *summāq*, sumach, from *samaqa*, to come of good stock), *Rhus*. A genus of about 100 species of shrubs and small trees of the natural order Anacardiaceæ, distributed over almost all the world, except its coldest regions. The following species are of commercial importance: Venetian sumach (*Rhus Cotinus*), known also as wig sumach or wig tree, is a native of Southern Europe and Western Asia, and is often planted under the name smoke tree as an ornamental shrub. It has simple leaves and hairy corymbs of fruit, which have a sort of resemblance to periwigs. The wood, which dyes yellow, and, with the addition of other substances, green and brown, is known in trade as young fustic. The leaves are astringent, and are used for dyeing Turkey red. The root is also used in dyeing, and the whole plant is used for tanning in Italy. The seed resembles the almond in flavor. The very acid fruit of the elm-leaved sumach (*Rhus Coriaria*), a native of the Mediterranean region, has been used from the earliest times as a condiment. Similar to this is the Virginian sumach, or stag-horn sumach (*Rhus typhina*), a native of almost all parts of North America, with curiously crooked branches, covered, when young, with a soft velvety down. The smooth-leaved sumach (*Rhus glabra*), a similar species, also North American, has acid leaves, which are used for domestic purposes. The collection of the leaves of the sumach, especially *Rhus typhina*, for tanning is an industry in parts of the South. The varnish sumach or Japan varnish tree (*Rhus vernicifera*), a native of Japan and Nepal, yields a varnish much used in Japan for lacquer-work. The expressed oil of the seeds becomes as hard as tallow, and is used for candles. In Australia

STAGHORN SUMACH (*Rhus typhina*).

the wood of *Rhus rhodanthema* (or *Rhodasphæra rhodanthema*) is considered one of the most valuable cabinet woods. It is dark yellow with a satiny lustre, and takes an excellent polish. The leaves and bark are used in tanning. The name tanner's sumach is given to *Coriaria myrtifolia*, a European shrub of the natural order Coriariaceæ. The leaves are astringent, and are used for tanning and for dyeing black.

The popularly reputed poisonous American species are botanically confused. *Rhus Toxicodendron*, a low shrub, is believed to be common only at the South; *Rhus radicans*, the so-called poison oak or ivy, a low, trailing or climbing species, referred by some botanists to Toxicodendron, is more widely distributed. *Rhus vernix* (or *Rhus venenata*), the so-called poison alder, sumach, dogwood, or swamp sumach, has long been reputed to cause irritation of the skin in some people and to be inert in others, a reputation also pertaining to the preceding species. A saturated alcoholic solution of lead acetate is considered a specific.

SUMAROKOFF, sōō'mȧ-rô'kôf, ALEXANDER PETROVITCH (1718-77). A Russian poet. He was born in Finland, was well educated, entered the military service, became Count Rumyantseff's adjutant, and later reached a high rank. When the first permanent theatre was established at Saint Petersburg in 1756, he was made director, and also wrote plays for production at the theatre. Petty of character, quarrelsome, and overambitious, he left the capital, incensed at the insufficient recognition he had received, and began to stage his works at Moscow. After a time he got into disputes with the management of the theatre there, and in despair took to drink, dying in obscurity. Although clumsy and ineffective, his tragedies played an important part in the history of Russian morals. His comedies and satires have a great deal of genuine humor and wit. His works were published at Moscow (2d ed., 10 vols., 1787).

SUMATRA, sōō-mä'trȧ. One of the Sunda Islands, the most western, also the largest, not reckoning Borneo, of the Dutch East India Islands, separated from the Malay Peninsula by the Malacca Strait, and from Java by the Sunda Strait (Map: East India Islands, B 5). It extends in a northwest and southeast direction. Its length is 1050 miles; its breadth ranges from 90 to 240 miles. Area, 161,612 square miles.

The Bukit-Barisan mountain range, of primitive formation with a covering of eruptive rocks, lines the island along the whole western shore, and in the south and in the north diverges toward the east coast. The whole northern part of the island is in fact mountainous. The descent to the generally rocky shores on the west is comparatively short and results in numerous valleys and ports of safety. To the east, in all the central part, extend lower stretches of level and undulating country sloping eastward, where all the main rivers are found, flowing eastward, often through marshy flats at the coast. The greatest elevations in the island are in the north, the loftiest peak being 12,100 feet. Here in the vicinity of Lake Toba—the most important lake—are steppes averaging 4000 feet in elevation, and thinly wooded, but the contiguous lower plains are rich in forests and characterized by dry rice fields. In the region next south are encountered volcanoes and deep river valleys. Further south, in the large middle belt of the island, are also volcanoes on the west, rising to about 10,000 feet. Here are Lake Maninju, covering nearly 50 square miles and occupying the sunken cone of a volcano, and Lake Singkara, of equal area. Out of the latter issues the Ombilin River, coursing over a high plain of Eocene formation, and rich in coal fields. This whole fertile region in the western part is thickly populated and forms the Padang section, at present the most valuable industrial and commercial part of Sumatra. The large, more or less alluvial, and plentifully watered southern part of the island is little known. Sumatra has eight active volcanoes. The western coast with its rich soil, timber, and mines has been much more favorable to development than the eastern. The main rivers are the Musi, Jambi, Indragiri, and Kampar. They are of little importance for navigation. Around a large part of the coast extend rows and groups of islands of more or less significance and once a portion of the mainland—Banka, Linga, Rupert, Simalu, Siberut, etc. As a whole, Sumatra geologically belongs to the neighboring continental regions; sandstone, limestone, and slate formations abound.

The equator passes nearly through the centre of the island; accordingly the even temperature is constantly high, the mean annual temperature ranging from 77° to 81° F. The annual rainfall varies from approximately 90 to 185 inches. The lower sections of the island are unhealthful, the higher are pleasant and habitable. Thunderstorms and waterspouts occur frequently, and earthquakes now and then. The flora is practically that of the Malay Peninsula and Borneo, containing a few remarkable special features, such as gigantic forms of arum. A large part of the island is overgrown with trees and foliage. The mountains are rich in tall timber. Oak, camphor, and teak trees abound. Sumatra is unsurpassed for fauna, nearly all the large equatorial types being present. Buffaloes are the leading live stock. The rhinoceros, elephant, tiger, tapir, panther, deer, and many species of the ape are also largely represented. The supply of minerals is large. The island yields coal abundantly, and large tin deposits on Singkap Island on the east coast are being worked. Petroleum wells flow in the Palembang region, and there is an important output of petroleum in Langkat.

Agriculture is the occupation of the natives. All the tropical crops are or can be grown. The native princes and the Government farm out land to cultivators. The natives skillfully manufacture filigree articles in gold and silver, fabrics, and household articles. The northeast coast, around Dili, is a rich and extensive tobacco country, which produced in 1899 about 53,000,000 pounds of tobacco. The pepper trade is important. Coffee, bamboo, rubber, copra, and gums are also exported.

Sumatra is called one of the outposts of the Dutch East Indies. Its government appears to be in a somewhat transitory state, but is patterned after that of Java. The Dutch control in the interior is as yet but nominal. The various portions are known as the West Coast, the East Coast, Benkulen, Lampongs, Palembang, and

Achin, the first containing one-half the people of the island. Sumatra has a Governor (under the Governor-General of the East Indies), a President, Comptroller, etc. The 8 administrative districts are called residences. The Residency of Rhio includes several hundred islands off the east coast. A Government railway extends from Padang to the great coal mines in the adjacent interior. There is a railway from Medan to the coast, and one will operate from Achin along the northern coast. In 1900 Sumatra had 200 miles of railway. There are many good roads in various coast districts, and there is now a fair roadway from Palembang to Benkulen. Padang, Achin, Dili, Benkulen, and Palembang are the leading towns.

The population of Sumatra exceeds 3,000,000. The Europeans number about 6000, and the Chinese about 100,000. The natives of Sumatra, exclusive of the intruding Hindus, Arabs, Tamils, Indo-Chinese, and Chinese, belong to the Malayan stock, linguistically and physically, although some authorities group as 'Indonesians' such peoples as the Battaks and a few others. Among the most important and most interesting tribes are the Achinese of the extreme northwest, noted for their long struggle against the Dutch, the Battaks of the northern interior and northwest coast, and their neighbors in the Nias and Batu Islands, the Kubus, a very primitive people of the forests and marshy regions of Palembang, the so-called Menangkabau Malays of the middle of the island and other parts east and west, the Palembangs, Redjargs, Passumahs, Lampongs, and other tribes to the south, and the Abongs. The Malayan people of Sumatra exhibit many varieties of culture, from that of the forest-dwelling Kubus and other tribes of a primitive sort to those who under Hindu, and centuries later under Mohammedan influences, reached a considerable degree of culture, with religious and commercial as well as political development and expansion. The first intrusions of Hindu life and culture into Sumatra began some time before the Christian Era. Traces of Hinduism are evident in architecture, religion, and language. It was in all probability from Java that Buddhism in the sixth century made its way into Sumatra, where, however, it never obtained general vogue. The Battaks, some of whose divinities bear corrupted Indian names, possess an alphabet of Hindu origin. Hindu influences were probably at their height in the eighth century. From the thirteenth to the fifteenth century Mohammedan influences prevailed and many of the tribes were converted to Islam, and a number of sultanates were established. The Mohammedan influence upon politics, religion, and language was great. Since then the various European conquerors and intruders (Portuguese, English, Dutch) have made themselves felt, but chiefly in the coast regions. A considerable portion of the interior is still only nominally subject to the rule of the Dutch. On the whole the native population of Sumatra, as is also the case in Java, is on the increase. Mohammedanism is generally professed in the coast districts and also to a great extent in the interior.

Marco Polo visited Sumatra in 1292, and the first Portuguese in 1508. In the seventeenth century the Dutch obtained a firm foothold, having forced out the Portuguese. From 1812 to 1819 the English held the island. In 1825 Benkulen, where the English had been established for nearly a century and a half, was transferred to the Dutch. The conquest of the natives has been in progress since the discovery of the island, and has not yet been entirely completed. The Sultan of Achin, in the northwest, with whom a war has been going on since 1873, has especially proved troublesome.

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SUMBA, so͞om′bȧ, or SANDALWOOD ISLAND. One of the Sunda Islands (q.v.).

SUMBAWA, sụm-bä′wȧ. An island of the Dutch East Indies, one of the Sunda group, situated between Java and Flores. It is separated by Atlas Strait from Lombok on the west and by Sapi Strait from Komodo and Flores on the east (Map: East India Islands, E 6). Its area is given as 4300 square miles by some authorities, and as high as 5400 by others. Four mountain ranges traverse Sumbawa from west to east, the northern being volcanic, the southern containing a limestone formation. Mid-Sumbawa is a region of circular hills of lava and tufa, and the land is covered with a long silver-colored grass. The natives engage in agriculture. Sumbawa, with its four free States, is included, for the administrative purposes of the Dutch, under Residency No. XI. of Insulinde or Island India. The population is put as low as 75,000 and as high as 150,000, nearly all Mohammedan Malays. There are about 12,000 foreigners, who control the trade.

SUMERIAN LANGUAGE. The language supposed to have been spoken by the non-Semitic inhabitants of the Euphrates valley who were gradually absorbed by the invading Babylonians. This language, according to the view of a majority of Assyriologists, has been preserved in a number of inscriptions. The first successful decipherers of the cuneiform characters, Hincks, Rawlinson, and Oppert, observed that the wedge-shaped signs were employed in writing languages not akin to the Assyrian, that the inventors of this system of writing cannot have been Semites, since the signs have syllabic values and some characteristic Semitic sounds are not represented, and that one of these languages was used in Babylonia itself. Hincks thought that these languages were Aryan; Rawlinson regarded them as Scythian, meaning by this term Mongolian; Oppert considered the Babylonian non-Semitic tongue as Kasdo-Scythian. The term 'Accadian' was first used by Rawlinson in 1855, the term 'Sumerian' by Oppert in 1869. There was practical unanimity among all Assyriologists before 1874 as to the agglutinating and non-Semitic character of this language. In that year, however. Halévy began his protest against the very assumption that the Sumerian language ever existed. He first attempted to prove that the Sumerian language did not belong to the Turanian family and that the Turanian people cannot be supposed to have lived in Babylonia, and then maintained that the texts claimed to be Sumerian could be regarded as composed in an ideographic writing invented by the Assyrians in addition to the phonetic system and having the same values in pronunciation. Of the Sumerian signs in the syllabary, he found Semitic values for 114. In 1876 Halévy modified his view by admitting that the Sumerian signs could not have been pronounced like the ordinary Assyrian words. In his opinion, the so-called Sumerian was only a hieratic or priestly system of writing used as a cryptography for purposes of concealment. It was made from the other not only by the peculiar choice of ideograms, but by the apocopation of the closing vowel or syllable, changes of vowels and consonants, transpositions of syllables, and transfers of rarer meanings to common forms. Consequently it was to be regarded not only as a priestly system of writing, but as an artificial language constructed for certain occult purposes. Against this theory especially Oppert and Lenormant, Sayce, and Schrader urged many arguments, such as the impossibility of finding real Semitic values for the Sumerian signs and the improbability of an artificial language having been created as a secret means of communication between priests and then used for inscriptions in which kings recount their victories and their building enterprises. In 1880 Haupt indicated the existence of two dialects, *Emeku* and *Emesal*, of the Sumerian as shown by certain differences observed by earlier scholars without full appreciation of their significance. Even in view of this fact, explained by Halévy as due to varieties of cryptography, the difficulty of classifying the Sumerian, the apparent silence of the monuments concerning a nation speaking this language and conquered by the Babylonians, and the manifest influence of the Semitic speech on the vocabulary, led some scholars to hesitate. Meanwhile the study of the Sumerian, on the assumption that it was a real language, continued. Lehmann's investigations rendered it probable that the native name of the people speaking this language was *Shumeri* and that their home was in South Babylonia, in distinction from the *Akkadi*, who were the Semites and had their centre in North Babylonia.

The Sumerian is found in bilingual syllabaries and word-lists, bilingual hymns and prayers, bilingual inscriptions of kings, and many unilingual inscriptions. Of these the earliest show the least evidence of a Semitic influence. These are in the *Emeku* dialect. Those in the *Emesal* dialect naturally reveal more traces of the Semitic vernacular. Even within the *Emeku* dialectical differences have been observed, and the *Ememalaḥ* may represent a dialect spoken in Miluhha. (See MINÆANS.) Sumerian loan-words in the Assyrian—of which Leander has counted 217—are taken from the *Emeku* dialect. The Sumerian is made up of monosyllabic roots and shows no tendency to triliterality; it is fond of compounds, which are rarely found in the Semitic languages, and expands its nouns by many prefixes and suffixes; it has no gender. The plural is often formed by duplication, as *kur-kur*, 'lands,' *si-si*, 'horns,' and sometimes by *ini;* the genitive is sometimes expressed by the suffix *ge* or *gid;* instead of prepositions it has post-positions, such as *-shu*, 'to,' *-ta*, 'from,' *-da*, 'with;' the pronouns are either independent or pronominal suffixes, but altogether different from the Semitic; the numerals resemble the Semitic only in making the twenties, thirties, etc., in the plural while the forms are entirely different; the verb has practically the same derived stems as the Semitic and Hamitic, but has a greater variety of prefixes, infixes, and suffixes. The attempts to discover the affinities of this language have not yet been successful, but it is probably the oldest known language in the world. From the Sumerian vocabulary it is evident that the people who spoke this language had reached a comparatively high civilization. The sexagesimal system was in vogue, and the beginnings of astronomy and mathematics are with much plausibility ascribed to the race who spoke the *lishan Shumiri* or Sumerian language.

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SUMIDA-GAWA, so͞o′mē̇-dȧ-gä′wȧ. A river in the island of Hondo, Japan, rising northwest of Tokio on the border of the provinces of Musashi and Kai, and entering the Bay of Tokio, after a course of some 90 miles. It is navigable for small boats. In Tokio it is a place of popular resort. On its banks are tea-houses, temples, and the great avenue of cherry trees at Mukojima. It is crossed by numerous bridges. In July it is the scene of a great festival called 'river opening,' when the tea-houses are illuminated, a great display of fireworks is given, and the river is covered with gayly decorated boats filled with pleasure parties.

SUMMARY PROCEEDINGS (from Lat. *summa*, main thing, substance, sum, fem. sg. of *summus*, superlative assigned to *super*, above, over). Proceedings in the nature of trials which are conducted before judicial officers without juries, and in a speedy and peremptory manner. Such proceedings must be specially authorized by statute, as they are not sanctioned by the common law. The Federal Constitutional guaranty of the right to trial by jury does not extend to such civil and criminal cases as were not triable by jury at common law, thus leaving the States free to dispose of such cases by summary proceedings if they deem it expedient to do so. Most of the State constitutions also secure the right to trial by jury in all important cases. However, for the speedy administration of justice in trivial cases, both civil and criminal, the statutes of nearly all the States provide for the determination by summary proceedings of such petty misdemeanors as the violation of municipal ordinances as to fast driving, etc., disorderly conduct, and other minor offenses.

Certain proceedings for the ejectment of tenants are also known as summary proceedings in some States. See JURY; TRIAL.

SUMMER. A principal horizontal beam. The term, which is found in old English architecture, applies to a chief beam of a floor, or what is ordinarily termed a girder. When a summer is used to support a wall or other superstructure, as in the front of a building, it is known as a breast summer (q.v.). Summer is also used to denote a stone at the top of a pier or of a wall where an arch, lintel, or other work is supported.

SUMMER DUCK. The wood duck (q.v.).

SUMMER REDBIRD, or TANAGER. See TANAGER.

SUM'MERS, THOMAS OSMUND (1812-82). A clerical author of the Southern Methodist Church. He was born at Corfe Castle, Isle of Purbeck, Dorsetshire, came to America in 1830, and joined the Baltimore Conference (1835). He was missionary to the Republic of Texas (1840), and was one of the nine preachers who formed the Texas Conference. He was transferred to the Alabama Conference (1843); was secretary of the Louisville convention where the Methodist Episcopal Church South was organized; subsequently he was secretary of every General Conference of his Church until his death. He was assistant editor of the *Southern Christian Advocate* (Charleston, 1846), removing to Nashville (1855); was elected general book editor (1845), serving until his death, and editing nearly all of the publications of the denomination. He founded the *Sunday School Visitor* and edited it for four years; he edited the *Quarterly Review* nine years. He was professor of systematic theology in Vanderbilt University and dean of the theological faculty (1872-82); and was chairman of the committee which prepared a revised edition of the hymn-book of his Church. He wrote numerous works, including a commentary in six volumes on the Gospels, Acts, and Romans (1868-74); *Baptism, a Treatise* (1853); *Biographical Sketches of Eminent Ministers* (1858); *Sunday Service of the M. E. Church South* (1867); *Systematic Theology,* edited by Tigert (1888). For his life, consult Fitzgerald (Nashville, 1884).

SUMMER SCHOOL. The name applied either to institutions the sole purpose of which is the giving of instruction during the summer months, or to the summer sessions of any institutions of learning. Some universities in the United States frequently select from their regular programmes such subjects as will be suitable, and offer courses during the summer months. The successful completion of summer school courses gives credit toward the degrees of the institution at which they are taken. Other summer schools exist independently, usually at some situation favorable for summer resort. Such are the schools at Chautauqua, N. Y., at Martha's Vineyard, etc. Conditions of admission are either not required or are not severe. Certificates are given for work done, and frequently such work is allowed to count toward college degrees.

SUM'MERSON, ESTHER. The heroine of Dickens's *Bleak House*, the natural daughter of Lady Dedlock and Captain Hawdon, and ward of Mr. Jarndyce. She marries Allan Woodcourt, a surgeon.

SUMMER YELLOWBIRD. See WARBLER.

SUMMIT. A city in Union County, N. J., 12 miles west of Newark; on the Morris and Essex division of the Delaware, Lackawanna and Western Railroad (Map: New Jersey, D 2). It is attractive because of its elevation and the beauty of its scenery and is largely inhabited by New York business men. It has a Fresh Air and Convalescent Home and the Arthur Home for Orphans. There is a silk factory with several hundred hands. Population, in 1890, 3502; in 1900, 5302.

SUMMONS (OF. *semonse*, Fr. *semonce*, summons, admonition, fem. sg. of p.p. of OF. *semoner*, *somoner*, *semondre*, Fr. *semondre*, to summon, from Lat. *submonere*, to remind secretly, from *sub*, under + *monere*, to warn). A writ or process by which a defendant is notified to appear in court and answer the cause of action alleged in the plaintiff's complaint or declaration. It has superseded the *original writs* for the purpose of beginning an action in England and most of the United States. In the absence of statutory provisions to the contrary, a summons must be signed by the clerk of the court in which the action is brought, but under the codes it is usually signed by the plaintiff's attorney. For method of service, see SERVICE OF PAPERS. See also PROCEDURE; WRIT.

SUMMUM BONUM. See ETHICS.

SUM'NER, CHARLES (1811-74). An American statesman. He was born in Boston, Jan. 6, 1811; graduated at Harvard in 1830; entered the Harvard Law School the following year, and was admitted to the bar in 1834. Throughout his early years he maintained an extraordinary literary activity, writing chiefly upon legal topics, and occasionally appearing on the platform. His strength becoming overtaxed from the labor of editing an American edition of *Vesey's Reports*, he sailed for Europe in 1837, where he traveled for three years, devoting much of his time to the study of languages, literature, and history. Returning to America in 1840, he began to take an active interest in the anti-slavery movement, and in 1845 he delivered a notable Fourth of July oration at Boston, on "The True Grandeur of Nations," which Cobden pronounced "the noblest contribution ever made by any modern writer to the cause of peace," but it gave offense to the leaders of the Whig Party and led eventually to his withdrawal from that party. This oration was soon followed by others of great force, mainly on anti-slavery topics. He was a leader of the 'Conscience Whigs' of Massachusetts, who helped to form the Free-Soil Party. In 1851, through a combination of Free-Soilers and Democrats, he was elected to the United States Senate, of which body he was a member until his death. Here he waged a vigorous and uncompromising war on slavery. His first important speech was entitled "Freedom National, Slavery Sectional." This was followed in 1856 by another on "The Crime Against Kansas," in which he reflected severely upon Senator Butler of South Carolina. This arraignment led to an assault in the Senate Chamber upon Sumner by Preston Brooks (q.v.), a Southern Representative and a relative of Butler, with the result that Sumner was so injured that he was incapacitated for Senatorial service for nearly four years. The attack led, indeed, to the disease to which Sumner finally succumbed. In December, 1859, he resumed his seat, but took little part in the debates until the middle of 1860, when he delivered a speech on "The Barbarism of Slavery." From the beginning he was recognized as one of the leading men in the Republican Party. In 1861 he became chairman of the Senate Committee on Foreign Relations and made a number of able speeches on questions of foreign concern during the war, notably on the Trent Affair (q.v.).

He held the chairmanship of this important committee during ten years of a critical period. He took an active part in the debates on reconstruction measures and allied questions, ably advocating what came to be known as the 'suicide theory' of the status of the Southern States at the close of the war. (See RECONSTRUCTION.) He supported the impeachment proceedings against President Johnson and secured the enactment of a civil rights law to secure equality of treatment to negroes in hotels, theatres, etc., which was subsequently declared unconstitutional by the Supreme Court. He broke with the Grant administration, and in 1872 joined the Liberal Republican movement in advocating the election of Greeley for President. Sumner's *Works* were published in 15 volumes (Boston, 1874-83). Consult an elaborate *Memoir* by his friend E. L. Pierce (4 vols., Boston, 1877-93), and a short biography by Moorfield Story (Boston, 1900), in the "American Statesmen Series."

SUMNER, EDWIN VOSE (1797-1863). An American soldier, born in Boston, Mass. He was educated at Milton Academy, entered the United States Army, distinguished himself in the Black Hawk War, and was engaged in fighting Indians on the Western frontier. In 1838 he was placed in command of the school of cavalry practice at Carlisle Barracks, Pa. In the Mexican War, before the outbreak of which he had attained the rank of major, he participated in all the engagements of Scott's army in the advance from Vera Cruz to the City of Mexico, was wounded while leading a cavalry charge at Cerro Gordo, and for gallantry in holding in check a body of 5000 Mexican lancers at Molino del Rey was brevetted colonel. In 1857 he conducted a successful campaign against a hostile band of Cheyennes. In March, 1861, he was promoted to the rank of brigadier-general, and relieved Albert Sidney Johnston (q.v.) in command of the Department of the Pacific. In the following year he was recalled and placed in command of the First Corps of the Army of the Potomac. He distinguished himself in the Peninsular campaign, particularly in the battle of Seven Pines (q.v.); was twice wounded in the Seven Days' Battles before Richmond; was brevetted major-general in the Regular Army and was appointed major-general of volunteers; and took part in the battle of Antietam, in which he was again wounded. He commanded the right wing of Burnside's army at Fredericksburg. Relieved at his own request after the appointment of Hooker to succeed Burnside, he was assigned to the command of the Department of Missouri, and died suddenly while on his way thither.

SUMNER, INCREASE (1746-99). An American jurist, born at Roxbury, Mass. He was educated at Harvard College, where he graduated in 1767, and studied law in the office of Samuel Adams. He was admitted to the bar in 1770, and he was a member of the State Constitutional Convention of 1779. In 1782 he was elected to Congress, but at the same time was offered an associate justiceship of the Supreme Court, which he held till 1797. In 1789 he was a member of the convention which adopted the Constitution of the United States. In 1797 he was elected Governor of Massachusetts, and held that office during the remainder of his life.

SUMNER, WILLIAM GRAHAM (1840—). An American political economist and educator, born at Paterson, N. J. He graduated at Yale in 1863, studied at Göttingen and Oxford, and was tutor at Yale in 1866-69. Ordained in the Protestant Episcopal Church in 1867, for some time he was assistant at Calvary Church, New York, and rector at Morristown, N. J. After 1872 he was professor of political and social science at Yale, where he attracted public notice by his pungent and incisive advocacy of free trade in lectures, essays, and books. Among his chief publications are: *History of American Currency* (1874); *Lectures on the History of Protection in the United States* (1875); *Life of Andrew Jackson* ("American Statesmen Series") (1882); *What Social Classes Owe Each Other* (1882); *Essays in Political and Social Sciences* (1883); *Protectionism* (1885); *Robert Morris* (1891); *The Financier and Finances of the American Revolution* (1892); and *A History of Banking in the United States* (1896).

SUMO, so͞o'mō. A Central American linguistic stock. See ULUA.

SUMPTUARY LAWS (Lat. *sumptuarius*, relating to expenditure, from *sumptus*, expenditure, expense, from *sumere*, to take up, choose, apply, spend, from *sub*, under + *emere*, to take, buy). Laws to prevent extravagance in private expenditure, and indirectly to prevent immorality and crime. The purposes of sumptuary legislation may be grouped under the following heads: (1) To prevent poverty and diminish the cost of supporting the poor; (2) to increase the possible revenue of the State by diminishing private expenditure; (3) to prevent luxury when considered an evil; (4) to favor certain commercial or political interests; (5) to enforce class distinctions; (6) to prevent the consumption of commodities, as liquors and tobacco, which are considered dangerous to health and morals. Sumptuary laws were common in ancient legislation. By means of them Greece endeavored to inculcate simple habits of life among her people. Women, except prostitutes, were forbidden to wear expensive attire, as gold or embroidered apparel. The laws of Solon forbade costly banquets and funerals. At an early period in Roman history the censors, to whom was intrusted the superintendence of public and private morality, punished all persons guilty of luxurious living; but as the love of luxury grew with the increase of wealth and foreign conquest, various legislative enactments were passed with the object of restraining it. The Twelve Tables limited expenditures for funerals. Other early laws of Rome limited the expenditures of women, specified the number of guests who might be entertained at a single time, and fixed the amount which could be spent on entertainments. A later law made guests, as well as those who entertained, liable for a violation of these regulations.

Sumptuary laws found favor in England from the time of Edward III. down to the Reformation. In the reign of Edward III. one act prohibited more than two courses at a meal or more than two kinds of food at a course, except in the principal festivals of the year, when three courses were allowed. Another act prescribed the kinds of clothing the various classes might wear, except the orders of the nobility above the knights. Similar legislation prevailed in Scotland, France, Spain, and Italy.

When the mercantilistic theories of government emerged nations endeavored to control consumption by prohibiting the use of commodities produced abroad. It was held that the luxury of a people enriched other nations and impoverished their own. An English law prohibited the wearing of silk in order to encourage the manufacture of woolen goods in England. In France a law at one time prohibited the wearing of gold and silver embroidery, silks, and fine linens.

Aside from protectionism sumptuary legislation to-day comes under the head of the police regulations and is aimed to preserve the public health and morals. Under the United States Federal and State constitutions no restriction can be placed on the consumption of commodities or traffic in them, save as the public health, protection, and safety require it. The chief restrictive legislation is directed against the traffic in intoxicating drinks, and takes the form of high license requirements for the privilege of selling liquors, or in the prohibition of the right to deal in liquors altogether.

SUMTER. The county-seat of Sumter County, S. C., 43 miles east by south of Columbia, on several divisions of the Atlantic Coast Line Railroad and the Southern Railway (Map: South Carolina, D 3). It is known for its large trade in cotton. There are a cotton compress, cotton and cottonseed-oil mills, lumber mills, telephone factories, coffin and casket factories, and a manufactory of golf sticks. Population, in 1890, 3865; in 1900, 5673.

SUMTER, FORT. See FORT SUMTER.

SUM′TER, THOMAS (1734-1832). An American soldier, born in Virginia. He early removed to South Carolina; accompanied several expeditions against the Cherokee Indians; served under Braddock in 1755, and in March, 1776, became lieutenant-colonel of the Second Regiment of South Carolina Riflemen. Until the capture of Charleston (1780), he served in the interior of the State against the Loyalists and Indians; but subsequently raised a regiment in North Carolina and engaged actively in partisan warfare. On July 12, 1780, he defeated a force of mounted infantry under Captain Huck, and soon afterwards was made a brigadier-general of State troops. On August 1st he made a spirited but unsuccessful attack on Rocky Mount, and on August 6th defeated 500 regulars and Tories at Hanging Rock, but, his men dispersing, he was subsequently driven back. He then by a brilliant movement cut Cornwallis's line of communications between Charleston and Camden, capturing a supply train with its convoy; but three days later his force was almost annihilated by Tarleton at Fishing Creek. Enlisting another regiment, he defeated Major Wemys at Broad River (November 9th), and on November 20th repulsed an attack of Tarleton at Blackstock Hill, the latter losing 200 in killed and wounded, while the Americans lost 3 killed and 4 wounded. Here Sumter was severely wounded, but he returned to the army in February, 1781, and continued to render the most efficient service as a partisan commander. After the war Sumter sat in the State convention of South Carolina which ratified the Federal Constitution, was a member of Congress in 1789-93 and 1797-1801, and of the United States Senate from 1801 to 1809 and again from 1811 to 1817, and was United States Minister to Brazil in 1809-11. He was the last surviving general officer of the Revolution.

SUMY, sōō′mê. The capital of a district in the Government of Kharkov, Russia, situated 125 miles northwest of Kharkov (Map: Russia, D 4). The chief manufactures are machinery, tobacco, and liqueurs. Population, in 1898, 26,355.

SUN (AS. *sunne*, Goth., OHG. *sunnō*, *sunna*, Ger. *Sonne;* connected with AS. *sol*, Goth. *sawil*, Lat. *sol*, Gk. ἥλιος, *hēlios*, Ir. *sul*, Lith., Lett., OPruss. *sauls*, Skt. *svar*, *sūra*, Av. *hvarə*, sun). The central governing body of the solar system (q.v.), and the chief source of our light and heat. To us the sun is the most important of all the heavenly bodies, since upon it depends the possibility of life upon the earth. The sun's apparent angular diameter is 32′ 4″; diameter in miles, 866,500; density, 1.41, water being 1; mean distance from the earth, 92,800,000 miles. The sun's distance from the earth is the fundamental unit of linear measures in cosmic astronomy. The method of the determination of this distance is given under PARALLAX.

Successive generations of astronomers have been able to gather much information as to the appearance, constitution, and structure of the sun. The theory at present accepted is as follows: The visible light-giving surface, as we see it in the telescope, is called the *photosphere.* We suppose it to be a collection of luminous clouds, holding in suspension certain particles condensed out of the extremely hot gaseous material of which the innermost nucleus of the sun is probably composed. Just outside the photosphere is a thin shell of gaseous matter called the *reversing layer.* This is doubtless composed of many substances such as we find among the known chemical elements of our earth. It is observed and its very existence is demonstrated by the spectroscope. According to Kirchhoff's theory, when light coming from incandescent solids or liquids is passed through vaporized matter, the vapors absorb or cut off the light from certain definite parts of the spectrum. To each vaporized substance belongs its own series of such points in the spectrum; and these correspond exactly to the positions which would be occupied by bright lines in a spectrum derived directly from such vaporized substances themselves, if rendered incandescent. Thus the ordinary solar spectrum is crossed by certain well-known dark lines corresponding to the absorption of certain parts of the photospheric light by the absorptive effect of the reversing layer. Now if it were possible in some way to get rid of the light of the photosphere and examine directly the light of the reversing layer, we ought to see the spectrum of ordinary incandescent gases. This observation can actually be made at the time of a total solar eclipse. If we watch the solar spectrum very carefully just before the beginning of totality, when the moon's advancing edge is on the point of obscuring the sun completely, there will come a moment when nothing remains in sight but the outer or reversing layer. At that instant the dark lines in the spectrum are suddenly reversed, becoming bright like the lines in the spectrum of a gas heated to incandescence artificially in the laboratory. This remarkable observation was made by Young (q.v.) at the Spanish eclipse of 1870, and repeated photographically in 1896 by Shackleton, at the Nova Zembla eclipse.

The so-called *chromosphere* is a great layer composed of very hot gases, principally hydrogen, and surrounding the sun chiefly outside the reversing layer. It is supposed, however, that both these strata are mixed together, except that the hottest and densest gases are in the lower or reversing layer. This chromospheric layer can be seen for an instant at the beginning or end of a total solar eclipse, and it is found to consist principally of a mass of red flames. The color is due to the preponderating presence of hydrogen, and it is this color that gives rise to the name chromosphere or color-sphere. The presence of flame does not, however, indicate a process of combustion in the usual sense of the word. For instance, coal burning in an ordinary stove is really being combined chemically with the oxygen of the air, and chemical combination of that character is certainly not going on in the sun.

The most interesting features of the chromosphere are the *prominences*. These are great eruptive jets of red hydrogen flame bursting outward from the solar surface, sometimes to a distance of hundreds of thousands of miles into space. They were first seen during total solar eclipses, when the bright light of the central solar disk had been obscured by the interposed moon. Under ordinary circumstances the central solar light illuminates our terrestrial atmosphere very strongly, and enough of this light is reflected from the air itself into our telescopes to mask completely the fainter light of the prominences. But it has been found possible to study the prominences spectroscopically during full sunlight, and without waiting for a solar eclipse. This was first done visually in 1868 by Janssen, Lockyer (q.v.), and Huggins (q.v.), and photographically by Hale (q.v.) and Deslandres in 1890. The two latter astronomers working independently of each other, the former in Chicago and the latter in Paris, devised certain instruments called photographic spectro-heliographs, by means of which it is possible to take pictures of the chromosphere and prominences over the entire solar surface at once and in full sunlight. It has thus become known that the velocity of motion in these prominence eruptions may be as great as several hundred miles per second, indicating real explosions of incalculable force.

Extending far out beyond the chromosphere and prominences, and usually recognized as the sun's outermost envelope, is the *corona*. It is visible only at the time of total eclipse, when the central part of the solar disk is completely obscured. The appearance of the corona at such times is very sudden; the advancing edge of the moon slowly and gradually covers more and more of the sun's surface, until finally only a sickle-shaped filament remains. Then suddenly this too disappears, and on the instant the superb corona bursts into view, truly one of the most magnificent objects in the whole range of nature's phenomena. The inner corona, close to the solar disk, is very bright, even dazzling; farther out it fades by insensible gradations into a beautiful crown of filmy light. There are thread-like streamers, interlacing with complex involutions, and extending often many millions of miles into space above the solar surface.

Although observed visually from the most ancient times, it was not until the application of photography to astronomical observation that we have been able to fix with some approach to certainty the details of the coronal structure. See ASTRO-PHOTOGRAPHY.

Spectroscopically the corona reveals the presence of luminous gases, possibly containing in suspension particles of solid or liquid matter. No existing theory will explain quite satisfactorily its mechanical construction, so difficult is it to reconcile with gravitational law so enormous an extension outward from the sun. Possibly magnetic forces are wholly or partly responsible for its existence and equilibrium; certain it is that we still have in the corona one of the 'pending problems' of astronomy.

The chemical constitution of the sun has been studied with great care spectroscopically. The spectroscope, when suitably arranged for the purpose, enables us to compare solar light with light obtained in the laboratory from vapors of terrestrial substances raised to incandescence by artificial heating. In this way many terrestrial chemical elements have been identified in the sun; and we may consider extremely probable the hypothesis that sun and earth are composed of the same kinds of matter. This, if true, is a fact of great importance in its bearing on the origin and evolution of the solar system. (See NEBULÆ; COSMOGONY.) The most conspicuous phenomenon of the solar surface is the *sun-spots*. These are apparently great holes or depressions in the photospheric surface, usually having a dark spot in the middle, surrounded by a sort of radial grating. They vary in diameter from 500 to 60,000 miles for the central black parts, and range up to 150,000 miles for the surrounding less dusky portions. At times they are large enough to be seen with the naked eye. Their depth is very uncertain, and has been variously estimated from a few miles up to 2500. The *faculæ* are bright streaks seen in various parts of the photospheric surface, but usually near spots, and most conspicuous when approaching the edge of the solar disk. The spots usually begin as mere dots, and then grow gradually or rapidly to the enormous dimensions already stated. At times they break into several pieces, giving rise to a group or collection of several spots. They are by no means immovable upon the solar surface, but have a motion of their own, those near the sun's equator traveling farther from the poles, and those in higher solar latitudes increasing their distance from the equator. But no sun-spots are ever found farther from the solar equator than latitude 45°, and few are nearer the equator than latitude 5°. One of the most remarkable things about the spots is the fact that their frequency is periodic. Once in about eleven years they have a maximum frequency, and astronomers are able to record their occurrence in greater numbers than usual. The cause of this periodicity is unknown.

Very interesting questions are raised by a study of the sun's light and heat. The quantity of light given by the sun, as compared with a standard candle, can be measured, and the sun's 'candle power' thus made known. Experiments show that this candle power is represented by the number 1575 with twenty-four zeros attached. The quantity of solar heat is no less stupendous; it has been estimated that the heat given out each hour by the sun is equivalent to the burning of a quantity of coal sufficient to cover the entire solar surface to a depth of more than twenty feet. The source of this vast amount of light and heat has been for a long time a mystery. It cannot be a question of combustion, because in that case the sun would have been consumed long ago, even if made of solid coal. The theory at present accepted is due to Helmholtz. It assumes that the sun's bulk is slowly contracting, and that the energy thus produced is turned into heat. It has been computed that a diminution of 150 feet annually in the sun's radius would be sufficient to account for the heat developed. Such a contraction would remain invisible even in our most powerful telescopes until it had continued for at least 10,000 years, and the process would need to continue for ten million years before the sun would lose the power to give us heat enough to keep life on the earth.

The rotation of the sun on its axis occupies about 25 days, 8 hours. This period is determined by watching the spots go around with the sun; and it is somewhat uncertain, because, as we have seen, the spots are not themselves quiescent on the solar surface. The rotation axis is inclined to the ecliptic plane, like that of the earth; if continued to the celestial sphere, it would pierce it midway between the bright star Lyræ and the Pole star. And there is one very peculiar feature in the rotation due perhaps to the fact that the sun's vast bulk has not yet been completely transformed from the gaseous to the liquid or solid stage. The equatorial regions rotate faster than those in higher latitudes, showing the existence of strong rotary surface currents of different velocities. No thoroughly satisfactory explanation of this phenomenon has yet been obtained by astronomers. See ECLIPSE; PLANETS; PERTURBATIONS; ORBIT; SOLAR SYSTEM. Consult: *Astrophysical Journal* (Chicago); Kayer, *Handbuch der Spectroscopie* (Leipzig, (1902); Young, *The Sun* (New York, 1900); Lockyer, *Solar Physics* (London, 1874); Proctor, *Sun* (London, 1871).

SUN, TEMPLE OF THE. An immense temple of ancient Rome erected by Aurelian, after the taking of Palmyra, on the site of the early Pulvinar Solis on the Quirinal Hill. It was built in imitation of the Eastern sanctuaries of the sun, and stood on a platform 92 feet high, from which the temple rose to a height of 110 feet. It was approached by two staircases, the steps of which now form the approach to the Church of the Aracœli, to which they were removed in 1348. The temple was of massive proportions. The 44 pillars of its peristyle were 65 feet high and 7⅔ feet in diameter, and a single fragment of the cornice, now in the Colonna gardens, weighs 100 tons. The vaults in the substructure were utilized for the storage of wines. The last portion of the temple, which formed part of the fortifications of the Colonnas, was destroyed about 1595, and the only remains of the building are three blocks in the Villa Colonna. The material was used in the Pope's palace on the Quirinal, Santa Maria Maggiore, and other buildings.

SUN AND LION, ORDER OF THE. A Persian civil and military order of merit with five classes, founded in 1808 by Shah Feth Ali on the model of the French Legion of Honor. The decoration is a silver star, bearing a lion with a sword. See Plate of ORDERS.

SUN ANIMALCULE. See HELIOZOA.

SUNBIRD. A bird of the tropical passerine family Nectarinidæ, which may be regarded as occupying nearly the same place in the Old World as do the humming-birds in America. They are all of small size, although none are so small as the smallest humming-birds, which they rival in brilliancy of plumage. Like them, they feed partly on the nectar of flowers, which they suck by their long bill, but chiefly on the minute insects which the flowers attract; they do not, however, flutter on the wing when feeding, like humming-birds, but perch on or beside the flower into which the bill is to be inserted. The species are very numerous, and are natives of the southern parts of Asia, the Eastern Archipelago, and Africa. The resplendent metallic plumage belongs only to the male, and only to the breeding season. They have been described and depicted in a magnificently illustrated monograph by Shelley, *The Nectarinidæ* (London, 1876-80). See Plate of CREEPERS.

SUN-BITTERN (so called because of its brilliant ocellated plumage). A curious bird of South and Central America, about the size of a chicken, allied to the cranes and more closely to the kagu (q.v.), the two species of which constitute the genus Eurypyga and the family Eurypygidæ. It haunts river banks, feeds upon small fish, crustaceans, and insects, and utters a soft or plaintive, long-drawn whistle. In the mating season it executes a fantastic dance, with its wings spread about its head, showing a pattern comparable to the sun's rays. Its nest is a rude affair in a bush or on a low tree branch. The best-known species is *Eurypyga helias*, which is beautifully variegated with brown, black, and white tints. This bird is often domesticated by the Brazilians. Consult Newton, *Dictionary of Birds* (New York, 1896). See Plate of BUSTARDS.

SUN'BURY. The county-seat of Northumberland County, Pa., 54 miles north of Harrisburg, on the Susquehanna River, and on the Pennsylvania and the Philadelphia and Reading railroads (Map: Pennsylvania, E 3). There are the

Mary M. Packer Hospital, the court-house, jail, and parish house. Sunbury has silk and woolen mills, coffin works, planing mills, a foundry and machine shops, and flour mills. The government, under the charter of 1896, is vested in a burgess, chosen every three years, and a council. Sunbury was founded in 1772 on the site of an old Indian village and of Fort Augusta, built in 1756, during the French and Indian War. It was first incorporated in 1797. Population, in 1890, 5930; in 1900, 9810.

SUNDA (sŭn′då) **ISLANDS**. A name commonly applied to all the islands of the Malay Archipelago lying west of the Molucca and Banda seas, and separating the China Sea from the Indian Ocean (Map: East India Islands, B 6). They include the four large Sundas, Sumatra, Java, Borneo, and Celebes, with their dependent islands, and the Lesser Sundas, Bali, Lombok, Sumbawa, Flores, Sandalwood Island, Timor, and others extending in a chain eastward from Java. The Sunda Islands are named from the Sundanese, ethnographically a Malayan people of the western part of Java. They are shorter in stature than the Javanese proper, and somewhat more brachycephalic. They have also been less influenced by Hindu culture.

SUN DANCE. The great annual religious ceremony common to all the tribes of the Plains with the exception of the Comanche and perhaps one or two others. In purpose it is a thanksgiving and invocation to the sun god and his representatives, the buffalo. Although anticipated as a yearly tribal event, it is usually 'made' or organized on each occasion in fulfillment of a vow by some particular individual in gratitude for recovery from sickness or for some other blessing. The management of details is in charge of certain priests, together with the warrior societies. The dance usually takes place about the beginning of summer and with all its attendant ceremonies lasts more than a week, the dance proper continuing four days and nights. The entire tribe assemble for the occasion and pitch their tipis in a great circle, in the centre of which is erected the medicine lodge of leafy cottonwood saplings. The centre pole of the lodge is decorated with streamers and symbolic paints, besides which a sacred bundle, usually wrapped in a buffalo skin, is fastened near the top. The centre pole is cut down by the women with much ceremony. The dancers are stripped and painted, the paint design differing in symbolic character at each stage of the dance, and are prohibited from eating or drinking during the four days of the dance. Among the Sioux, Cheyenne, and some other tribes they formerly also subjected themselves to voluntary torture by leaning their weight upon ropes fastened to wooden skewers driven through the flesh of their breasts and shoulders. Among the Mandan this torture was carried to an almost incredible degree; the victim was lifted completely from the ground and permitted to swing from the roof pole in this condition, after which one or more fingers were chopped off as a further sacrifice. Among the Kiowa such torture was unknown.

The dancers form a half circle about the centre pole, each one looking steadfastly upon the sacred bundle at the top and constantly facing the sun in course, with their arms swinging at their sides, and holding between their teeth whistles of eagle bone with which they keep up a continual shrill whistling. At the west end of the medicine lodge is an altar of bushes and variously decorated twigs within which are the sacred buffalo skull, the sacred pipe, and other ceremonial objects. On another side are the drummers, who sing the songs of the sun dance to the accompaniment of a powerful drum. Throughout the ceremony there is a rapid succession of ceremonial performances, including addresses, feasting, giving of presents, initiation of new members into the various societies, and the piercing of the ears of the children born during the past year. At night there are games, story-telling, and more feasting, winding up with various social dances after the grand performance is at an end. The dance is still kept up among nearly all the Plains tribes, varying but little in details.

SUNDARBANS, or **SUNDERBUNDS,** so͞on′dẽr-bŭnz. A number of low islands, forming the delta of the Ganges, British India, and extending from the mouth of the Hugli to the island of Rabanabad (Map: India, E 4). Area, 7500 square miles. Only the northern part is inhabited, the southern being mainly jungle, infested by tigers, leopards, buffaloes, crocodiles, and snakes. The only town worthy of mention is Port Canning, connected with Calcutta by rail.

SUNDAY (AS. *sunnandæg*, OHG. *sunnuntag*, Ger. *Sonntag*, Sunday, from AS. *sunnan*, OHG. *sunnun*, gen. sg. of AS. *sunna*, OHG. *sunno*, Ger. *Sonne*, sun + AS. *dæg*, Ger. *Tag*, day). The first day of the week, observed by Christians almost universally as a holy day in honor of the resurrection of Christ. For some time after the foundation of the Christian Church, the converts from Judaism still observed the Jewish Sabbath to a greater or less extent, at first, it would seem, concurrently with the celebration of the first day; but before the end of the apostolic period, Sunday, known as 'the Lord's day,' had thoroughly established itself as the special day to be sanctified by rest from secular labor and by public worship. The hallowing of Sunday appears incontestably as a definite law of the Church by the beginning of the fourth century; and the Emperor Constantine confirmed the custom by a law of the State. Throughout the mediæval period the authority of the Church was so universally recognized that secular legislation in this regard was almost unnecessary. The Catholic Church then required, and still requires, abstinence from servile work on that day, and the assistance at mass of all who are not lawfully hindered. While the devout have attempted to make it in all respects a holy day, yet the mass of the people in Roman Catholic countries see no harm in spending a part of the day in social intercourse and amusements of various kinds. The tendency of Protestantism, however, has been to recur to the stricter Jewish observance, and to forbid any practice of the ordinary occupations of other days.

In the mediæval period the courts were presided over or dominated by the clergy, and Sunday early became in the legal sense a *dies non* (q.v.), on which legal proceedings could not be conducted. By the common law, however, all other business might lawfully be transacted on Sunday. The first substantial limitation of this right was imposed by the statute 5 and 6 Edw.

V., ch. 3, which provided that all secular labor should be unlawful on Sunday, except in cases of necessity. This was supplemented by the sweeping act of 29 Car. II., ch. 7, which prohibited all 'worldly business' on the 'Lord's day,' except where absolutely necessary, or for charity. These statutes have been substantially followed in practically all of the United States. The New England States were the first to regulate the observance of Sunday by a series of statutes. The Constitution of the United States prohibits the restriction of religious liberty or the enforcement of religious observances, and therefore, in law, Sunday is regarded merely as a civil day, which is a convenient one for the suspension of business, because of its observance as a holy day by a great majority of the people. These statutes are constitutional as a valid exercise of the police power. Works of necessity and great public convenience are usually excepted. Thus, a physician may carry on his practice, making lawful charges for his services; drug stores may keep open; transportation lines may handle freight and passenger traffic; milk dealers are usually permitted to deliver their product; and all persons whose business conduces to the public health are permitted to continue their activities. Where a cessation of operations would cause great financial loss, an exception is commonly made.

Where a person is traveling on Sunday in violation of law, and is injured, he is not precluded from recovering damages if he is otherwise entitled thereto. Although contracts entered into on Sunday were valid at common law, the courts of many States have interpreted their Sunday statutes as including this kind of a business transaction. A payment of a debt on Sunday is generally held to discharge the obligation. Wills executed on Sunday may be probated in most jurisdictions. In most States the legal Sunday begins at midnight on Saturday night, and continues twenty-four hours. In a few New England States Sunday ends at sunset. Many States exempt Hebrews and others who observe Saturday or some day other than Sunday as a holy day from the operation of the Sunday laws, but if such persons do not keep sacred any other day, they must suspend business on Sunday.

The need of one day in seven for rest from labor has long been recognized from an economic standpoint also. Not only has it been found that man produces more and better work by resting one day in seven, but also that he is a better physical and social being for observing such a rule. Sunday labor in the United States is, however, increasing. It has been estimated that in Massachusetts alone 50,000 persons work on Sunday. That the increase is general is shown by the growing opposition of the labor unions, and their frequent demands for shorter hours throughout the week, on the ground that they have no assurance of the Sunday respite.

SUNDAY-SCHOOLS. An agency of the Church for giving religious instruction to learners of all ages. The method of instruction is generally interlocutory and the subject of study more particularly the Bible. In its essentials the Sunday-school or Bible-school was an important part of the early Jewish educational system. About B.C. 80-70 Simon ben Shetach established a system of religious schools in connection with synagogues in Palestine, making attendance obligatory. Historians like Edersheim and Schürer confirm the general existence of such schools then and later in the time of Christ.

Bunsen says that "the Apostolic Church made the school the connecting link between herself and the world." Her catechetical instruction (cf. Luke i. 4; Acts xviii. 25) grew so steadily in acknowledged importance that church buildings were designed to provide special accommodations for the Bible-school. These early catechumenical schools included children and adults, who were taught individually, by the interlocutory method, subject matter beginning with the Old Testament story of creation and proceeding to practical Christian living. Gregory the Illuminator Christianized Armenia at the beginning of the fourth century by a compulsory system of Bible-schools for children in every city, while at that period similar schools were to be found in Mesopotamia, Cappadocia, Egypt, and elsewhere. In all these schools the Bible text was the main subject. In the Middle Ages the Bible-school idea was adhered to among the Waldenses, Albigenses, Lollards, Wiclifites, etc. A notable example of the Bible-school, apparently in many ways like our modern institution, were the schools of Charles Borromeo, Archbishop of Milan, in the middle of the sixteenth century. During the seventeenth and eighteenth centuries the direct study of the Bible gave way to the rote memorizing of set answers in catechisms not intended for such uses, and genuine Bible teaching was thus largely displaced.

It is to Robert Raikes (q.v.) that the modern revival of the Sunday-school is justly accredited, although numerous isolated Bible-schools were to be found both in England and America prior to his time and pioneer efforts were made in America independent of his example. (Consult Trumbull, *Yale Lectures on the Sunday-school*, Philadelphia, 1889.) According to contemporary testimony Raikes gathered some street boys in July, 1780, into a room in Sooty Alley, Gloucester, England, under the temporary care of a Mrs. Meredith, but soon transferred the school to the house and care of Mrs. Mary Critchley, in Southgate Street, where the first permanent Raikes school was established. The pupils were instructed not only in the Bible, but in reading, and in catechisms of the day. Later the school was held in Saint Mary de Crypt Church, then in the Crypt Grammar School, then at the Corn Exchange, and thence was transferred to the church again. The school seems to have had as many as 100 scholars at a time, the teachers receiving a shilling a day from Raikes for their work. Raikes worked quietly and experimentally for three years, and then on November 3, 1783, began to publish his idea in his newspaper, the *Gloucester Journal.* He published as early as 1785 *The Sunday Scholar's Companion.* In the extension of the Sunday-school idea Raikes accords much credit to John Nichols, of *The Gentlemen's Magazine.* The cause was notably furthered by Hannah More, John and Charles Wesley, and Whitefield, and even the Queen expressed an interest in the movement by sending for Raikes in order to hear his plan described. In 1784 Rowland Hill started a Sunday-school in London at Surrey Chapel. William Fox and Jonas Hanway were instrumental in organizing a general Sunday-School Society in 1785, of which on June 11, 1787, Raikes was elected an honorary member. In 1786 five schools were reported in or near London. In ten years from that date the society had distributed 91,915 spelling books, 24,232 Testaments, and 5360 Bibles, to 1012 Sunday-schools and 65,000 scholars. From 1788 to 1800 the society had paid more than $17,000 to teachers. Gratuitous teachers were utilized in a school in Stockport, England, toward the close of the eighteenth century, and paid teachers gradually ceased to be generally employed. Before Raikes died, in 1811, there were 400,000 children in the Sunday-schools of Great Britain alone. In Scotland, where the need was not so greatly felt, and in New England, the Sunday-school met with little favor at first, as seeming to endanger the sacredness of the Sabbath, and to relieve the home of some of its duties. The Archbishop of Canterbury summoned a council of bishops to consider means by which the movement might be stopped. Yet notwithstanding all opposition the Sunday-school idea constantly gained in favor.

On December 19, 1790, twelve Christian workers held a meeting in Philadelphia, which led to the organizing on January 11, 1791, of a Society for the Institution and Support of First Day or Sunday Schools in the city of Philadelphia, with Bishop William White as president and Matthew Carey as secretary. The Reverend Robert May, of London, gave a new impetus to Sunday-schools in Philadelphia in 1811, urging the need of a general union. On January 13, 1816, in New York City, was formed the Female Union Society for the Promotion of Sabbath-Schools, and on February 26, 1816, the New York (male) Sunday-School Union. In 1817 the Sunday and Adult School Union was formed in Philadelphia with Alexander Henry as the first president, and this developed on May 24, 1824, into the American Sunday-School Union. The records of this great agency, interdenominational and national in its scope and support, showed in 1899, on its seventy-fifth anniversary, that through its efforts 100,928 Sunday-schools had been organized, with 578,680 teachers and 4,070,346 scholars, and that the union had distributed publications amounting in value to over $9,000,000.

At an anniversary of the American Sunday-School Union in Philadelphia on May 23, 1832, fifteen States were represented. It was then decided to call a general national Sunday-school convention to meet in New York in the autumn of that year to consider 78 questions on Sunday-school work sent out to 2500 persons throughout the country. The first national convention, therefore, assembled on October 3, 1832, in Chatham Street Chapel, New York City, and chose the Hon. Theodore Frelinghuysen as president. The National Convention as an independent organization met subsequently in Philadelphia, May 22, 1833; Philadelphia, February 22-24, 1859; in Newark, N. J., April 29-30, 1869; and in Indianapolis, April 16-19, 1872, at which convention the uniform lesson system was inaugurated, after much discussion, by the appointment of the first lesson committee to select the lessons from 1873 to 1879. The united interest of Bible students in selected portions of the Bible, in the progress of the uniform lesson plan, has given rise to a literature, both permanent and periodical, that has widely popularized Bible study. The international lesson system now includes a special beginners' course of Bible study for the youngest children, and still other modifications are under discussion. Other lesson systems are in use in some schools and in a few denominations, but in the vast majority of schools the international uniform lesson system is used.

At the next convention in Baltimore, May 11-13, 1875, the convention became international in scope and name. This convention has met every three years since that time. It is composed of delegates from auxiliary State, Territorial, and provincial Sunday-school associations in North America. Its work is conducted during the triennium by an executive committee; a lesson committee, international and interdenominational in its personnel; a primary department; and a field workers' department. A World's Convention, under the auspices of the London Sunday-School Union and the International Executive Committee, was held in London, July 1-4, 1889, thus establishing an institution comprising all the countries of the world, and meeting since then in Saint Louis, Mo., September 3-5, 1893, and in London, July 11-15, 1898. In the improvement of teacher-training and Bible study what is known as the 'Chautauqua movement' has been an important factor. See CHAUTAUQUA.

The Sunday-school is the pioneer religious agency in new communities, and the conserver of neighborhood religious instruction for the entire family in every community where it exists. It is extended to frontier or sparsely settled districts in America by the various denominational mission boards, and by the American Sunday-School Union. It is stimulated to better work, and is made acquainted with the most recent methods, by means of conventions and institutes, some 18,000 of which are held in North America yearly, under the auspices of the International Convention and its auxiliary State, provincial, county, township, and district Sunday-school associations.

At the tenth intenational Sunday-school convention, held at Denver, Colo., in 1902, the following statistics were presented as to the Sunday-schools in the United States, including Hawaii and Porto Rico: Number of Sunday-schools, 139,817; officers and teachers, 1,419,807; scholars, 11,493,591; total enrollment, 13,092,703. In 1898 the corresponding figures for the entire world were: Sunday-schools, 254,698; teachers, 2,410,818; scholars, 23,227,330; total, 25,810,861.

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Teaching and Teachers (Philadelphia, 1884), the standard manual for the thorough study of the work of the teacher; Vincent, *The Modern Sunday School* (New York, 1887), a comprehensive detailed outlining of the school itself; id., *The Church School and Normal Guide* (ib., 1889), deals with the character of the institution and methods of Bible study and teacher-training; Schauffler, *Ways of Working* (New York, 1895), practical hints out of a varied experience; Foster, *A Manual of Sunday School Methods* (Philadelphia, 1899); Peters, *Practical Handbook on Sunday School Work* (Philadelphia, 1900); Oxtill, *The Organized Sunday School* (Nashville, 1901); Hamill, *The Sunday School Teacher* (Nashville, 1901); Pattison, *The Ministry of the Sunday School* (Philadelphia, 1902); Blackall, *Our Sunday School Work and How to Do It* (rev. ed., Philadelphia, 1902); Schauffler, *Pastoral Leadership of Sunday School Forces* (Nashville, 1903).

SUNDERBUNDS, sōōn′dẽr-bŭnz. A name applied to the islands forming the delta of the Ganges. See SUNDARBANS.

SUN′DERLAND. A seaport in the County of Durham, England, 14 miles northeast of Durham, at the mouth of the Wear (Map: England, E 2). It is one of the great coal-shipping ports of the world. Shipbuilding is an important industry. Machinery, glass, earthenware, ropes and chains, anchors, and other iron wares are extensively manufactured, and fishing is carried on to a considerable extent. In the vicinity are rich coal mines, of which the Pemberton, 2286 feet deep, is said to be the deepest in existence. On both sides of the river are extensive wet docks, much of the area of which has been reclaimed from the sea. The harbor, defended by batteries, is formed by two great piers, one 650 yards and the other 590 yards in length. Sunderland is a well-built town with broad streets. There are a fine town hall, an assembly hall, handsome club houses, a large infirmary, and a spacious workmen's hall. The public park contains 70 acres. The town came under the Municipal Corporations Act in 1835. The borough was extended in 1867 and again in 1895; it includes the townships of Bishopwearmouth, Monkwearmouth, and Monkwearmouth Shore. The Monkwearmouth portion of the town dates from a monastery of the seventh century, in which the Venerable Bede spent most of his life. Population, in 1891, 131,686; in 1901, 146,565.

SUNDERLAND, CHARLES SPENCER, third Earl of (1674-1722). An English statesman. He was the second son of the second Earl of Sunderland, and became Lord Spencer on the death of his elder brother in 1688. In 1700 he married Lady Anne Churchill, second daughter of the Earl of Marlborough. In 1702, on the death of his father, Spencer succeeded to the title. Through the influence of Marlborough, Sunderland obtained several important posts, and became a member of the famous Whig Junta, which for a time controlled the whole Government. In 1720 Sunderland brought about the establishment of the notorious South Sea Company (q.v.). When the crash came it was found that Sunderland had received a bribe of £50,000 from the company, and though he was acquitted by a party vote, he had to resign his offices. He retained, however, considerable influence until his death. Sunderland seems to have been a disagreeable and treacherous politician. He was a collector of rare books, and a patron of Addison and other men of letters.

SUNDERLAND, JABEZ THOMAS (1842—). A Unitarian minister, born at Howarth, in Yorkshire, England. He was educated at Madison (now Colgate) University, Hamilton, N. Y., University of Chicago, and Union Baptist Theological Seminary of Chicago. From 1886 to 1895 he edited the *Unitarian Monthly.* He visited India in 1895-96. He is author of *A Rational Faith* (1878); *What is the Bible?* (1878); *The Liberal Christian Ministry* (1889); *Home Travel in Bible Lands* (1894); *The Bible: Its Origin, Growth, and Character, and Place Among the Sacred Books of the World* (1893); *The Spark in the Clod: A Study in Evolution* (1902).

SUNDERLAND, ROBERT SPENCER, second Earl of (1640-1702). An English statesman. He was the only son of Henry Spencer, who was raised to the peerage in 1643. After some diplomatic service abroad he was made a member of Temple's reformed Privy Council of thirty members, and was one of the smaller inner Cabinet with which King Charles II. habitually conferred. Sunderland at first supported the Duke of York and then labored for the Exclusion Bill, which was to exclude the Duke from the succession. Thereby he lost the favor of Charles and his position in the Privy Council (1680). In 1682 he was restored to royal favor through the influence of the Duchess of Portland, mistress of Charles II., and the French Ambassador Barillon, and unscrupulously advocated the disgraceful French connection. He remained in office until the accession of James II., when his influence in the Ministry became greater than ever. Although there is reason to believe he gave some encouragement to Monmouth in his rebellion, he managed, with consummate art, to obtain the entire confidence of James, and in 1685 became Lord President and principal Secretary of State. In 1687 he privately conformed to the Roman Catholic Church, and afterwards openly professed his conversion. Yet we find him about this time in correspondence with the Prince of Orange, afterwards William III. With profligate but masterly dexterity he contrived to deceive both his master and Barillon, and to keep them in ignorance of the events that were passing in Holland. When the Prince arrived in England, Sunderland and his wife went to Amsterdam, whence he wrote to the new monarch, claiming his favor and protection on the ground that he had all along been in his interest. In 1691 he was allowed to return to England, and in 1697 was made Lord Chamberlain. Popular indignation, however, compelled him to resign within a few months. He spent the rest of his days at Althorpe, where he died September 28, 1702.

SUNDEW (so called from the dew-like drops exuded, especially in the sunlight), *Drosera.* A beautiful and interesting genus of about seventy-five species of plants of the natural order Droseraceæ, several species of which are natives of American bogs, etc. A common species is the round-leaved sundew (*Dorsera rotundifolia*). Its leaves all spring from the root, and spread out in a rosette, from the centre of which springs the flower-stem or scape with a raceme of flowers all on one side. The leaves of this and the other species are fringed and beset in all parts with hairs, which bear at their extremity viscid glands, which fold up when irritated, imprisoning insects and digesting them through the action of enzymes secreted by the plant. Consult Darwin, *Insectivorous Plants* (1875).

SUNDEW (*Drosera rotundifolia*).

SUN-DIAL. See DIAL.

SUN-DOGS. See HALO.

SUNDSVALL, sụns′vȧl. A seaport in the Län of Wester Norrland, Sweden, 28 miles south by west of Hernösand, on the Gulf of Bothnia (Map: Sweden, G 5). It is known for its extensive lumber interests, and is engaged in shipbuilding and the manufacture of iron and steel. Population, in 1901, 15,087.

SUNFISH. The name of a variety of fishes; also given by sailors to jellyfish. (1) In the United States a group of numerous and familiar fishes of streams and ponds, related to the bass, and forming several genera of the family Centrarchidæ (q.v.). All are of small size, six to ten inches long, oval in shape, and much compressed. All are excellent eating. They are brightly colored, especially in the breeding season, and may be known by the black flap to the posterior edge of the gill-cover. Their feeding and breeding habits are similar to those of the fresh-water bass (q.v.). See Plate of DARTERS AND SUNFISH; and consult Jordan and Everman, *Fishes of North and Middle America* (Washington, 1900), and the authorities there cited.

(2) One of the strange oceanic fishes of the family Molidæ, related to the Diodontidæ; especially *Mola mola*, which seems to be composed of a huge head with small fins attached. (See Plate of ROCKFISH, SUNFISH, ETC.) They reach a weight of 300 to 1500 pounds, are scaleless, dull in color, clumsy, and often lie inert like a huge gray blanket on the surface of the sea sunning themselves and bending with the movements of the waves. The young are more fishlike, and were long considered entirely separate. They are of no use as food. There are about six species, one of which (*Ranzania truncata*) is called 'king of the mackerels.' Consult Dean, *Fishes Living and Fossil* (New York, 1895).

(3) The threadfish (*Alectis ciliaris*).

SUNFLOWER (probably so called from its yellow radiate disk), *Helianthus.* A genus of large herbs of the order Compositæ, containing numerous, mostly perennial species, all natives of America. The common sunflower (*Helianthus annuus*), an annual, one of the most important species, is a native of the tropics, where it sometimes attains a height of 20 feet and produces flower heads from 1 to 2 feet in diameter. In temperate climates it grows from 5 to 8 feet high. This species has become widely distributed throughout the United States as a weed, especially in the West and the Southwest. It was introduced into Europe about the middle of the sixteenth century. In Egypt, India, and Southern Europe, especially in Russia, the plant is grown for its seeds, which are eaten like nuts, and their oil, which is used for culinary purposes. The oil is also used in the manufacture of varnishes on account of its drying properties, which, however, are inferior to those of linseed oil. It is also used in soap-making and other manufactures. Sunflowers are cultivated somewhat in the United States and Canada for ornament, for forage, and for seed. On light, well-drained, well-tilled, and fertile soil a yield of from 30 to 50 bushels of seed per acre may be obtained. The preparation of the soil and its subsequent cultivation is similar to that for corn, but the distance between plants in the row should be from 12 to 16 inches. From 10 to 15 pounds of seed is required per acre. The heads are harvested shortly before they are thoroughly ripe to prevent loss of seed. Before storing they are carefully dried to prevent molding. The seeds are threshed out with flails.

AVERAGE COMPOSITION OF SUNFLOWER PRODUCTS.

	Water	Protein	Fat	Nitrogen-free extract	Crude fibre	Ash
	per cent.	*per cent.*	*per cent.*	*per cent.*	*per cent.*	*per cent.*
Whole plant	85.2	1.7	1.0	6.2	4.0	1.9
Heads	86.1	1.9	1.5	5.6	3.8	1.1
Seed	8.6	16.3	21.2	21.4	29.9	2.6
Sunflower seed cake	10.8	32.8	9.1	27.1	13.5	6.7

The whole plant and the seeds have been used to a limited extent as a feeding stuff, especially mixed with horse beans and corn fodder for making silage. The seed is frequently fed to poultry. The oil cake is fed especially in Northern Europe to fatten animals.

Sunflower stalks are useful as fuel when other materials are not abundant.

SUNG, sōōng. One of the seven great Chinese dynasties. It was founded in 960 by Chao Kw'ang-yin, a descendant of a family of officials of the T'ang dynasty (618-907), who had risen to high military command. With the Empire rent with disorder, and the hordes of the Liao Tatars threating on the north, the army concluded to raise their general, Chao, to the throne. He at once proceeded to repel the Liao and unify the Empire by reducing the petty States. He introduced many reforms, and for sixteen years ruled with great wisdom and ability. The Liao, however, continued to encroach on Chinese territory, and in 1126, during the reign of the ninth Emperor, established their authority over all of North China, styling their dynasty the *Kin* or 'Golden.' The Sung fled south to Hang-chow (q.v.), which continued to be the capital of the diminished empire of the Southern Sung. Nine emperors ruled here until 1279, when Kublai Khan and his Mongols overthrew both the Kin and the Sung, and established the Yuen dynasty in 1280. Notwithstanding the harassments and encroachments of invading armies, the Sung period was one of great prosperity and advance in civilization and culture.

SUNGA'RIA, or **DZUNGARIA.** A name vaguely applied to a region of undefined extent in Central Asia (Map: Asia, H 4). It belongs to the Chinese Empire, and the name is generally restricted to the region lying north of the Tarim Basin in East Turkestan, between the Tian-Shan and Altai Mountains, and west of Mongolia. It is chiefly of historical significance, deriving its name from the Sungarians, a Mongolian people who attained their greatest power about the middle of the seventeenth century, when their kingdom embraced the territory between the Kuen-lun and the Altai Mountains, extending westward to Lake Balkash. About 1670 the ruler of Sungaria entered into conflict with the Chinese, who completely overran the country. The Chinese were driven out in 1710 and for a short time the rulers of Sungaria were masters of Tibet. In 1759 the Chinese, after long campaigns, destroyed the reestablished Sungarian kingdom and made the country a part of their empire, peopling it in large measure with colonists from China.

SUNKEN BELL, THE (Ger. *Die Versunkene Glocke*). A poetic play in blank verse by Gerhart Hauptmann (1896). It is a fairy-drama, the chief human character of which is Heinrich, a master bell-founder who has completed his crowning work, a bell which is to be hung in a church on a mountain inhabited by sprites. Through their hostility the wagon bearing the bell is overthrown and the latter is sunk in a mountain brook. Heinrich is injured and is nursed by the chief personage of the drama, Rautendelein, half child, half fairy, whose love changes Heinrich's standards and brings about the death of his wife.

SUNN. A plant (*Crotalaria juncea*) grown in India and some other warm climates for its fibre. See HEMP, SUNN; CROTALARIA, and illustrations on Plate of CRANBERRY, ETC.

SUN'NA (Ar. *sunnah*, custom, legal usage, tradition, from *sanna*, to establish a usage or law). In the original meaning among Moslems, the sayings and the example of Mohammed and his community, provided they are in accordance with the Koran, the meaning of which, however, is itself explained by the Sunna. As embracing traditional law, Sunna is divided into three parts: (1) what Mohammed did; (2) what he enjoined; and (3) what was done in his presence and not forbidden by him. The term is therefore (though incorrectly) used for the collections of moral and legal traditions known as *Hadith* (q.v.) traced to the Prophet, which supplement the Koran, somewhat like the Mishna (q.v.), which supplements the laws of the Pentateuch. The Sunna not only comprises religious doctrines and practice, but also civil and criminal laws, and the usages of common life, the way to eat and to drink, to dress, and the like. For the credibility and canonicity of a tradition, it was originally necessary that it should have been *heard* by one truthful witness; but this law was much relaxed in later times. By the beginning of the ninth century a large number of individual collections known as *Musnads* had been produced by different theologians, but the first who sifted them critically, and without regard to any special theological system, was Buchari (810-887). His collection contains 7275 single traditions, 4000 of which, however, occur twice in the work. Muslim, a younger contemporary (817-873), supplemented Buchari with another collection, containing 12,000 traditions, again including 4000 repetitions. Besides these, there are 'canonical' collections by Abu Daud (817-888), by Tirmidhi (830-914), a pupil of Buchari, and by Abu Maja (824-886), besides others that also enjoyed some measure of authority. The Sunna, as we have it in these collections, contains, broadly speaking, more truth than it is generally supposed to contain, and, critically used, is, besides the Koran, the most authentic source of a knowledge of Islam. A selection from the different collections (both canonical and otherwise), called *Mishkat Al Masabih*, has been translated into English by Matthews (Calcutta, 1809). The Arabic text of Buchari has been published by Krehl, *Le recueil des traditions musulmanes* (Leyden, 1862-68), and fragments of this work in German translation were embodied by Hammer-Purgstall in his *Fundgruben des Orients* (Vienna, 1810-19). Goldziher has a valuable treatise on the Hadith literature in his *Mohammedanische Studien*, vol. ii., pp. 1-274 (Halle, 1890).

SUNNITES, sŭn′īts (from Ar. *sunnah*, custom, legal usage, tradition, from *sanna*, to establish a usage or law). The orthodox sect in Islam; politically it may be described as the Centre, in contrast to extreme theories concerning the headship of the Church. The term arose in distinction to several tendencies which early asserted themselves, but especially differentiates that section which denies the claim of the Shiites (q.v.) for the peculiar authority of Ali, as the sole legitimate successor of Mohammed. (See MOHAMMEDAN SECTS.) These Shiites fast developed their peculiar theological and constitutional theories, and so drove their opponents to an understanding of their own position; as they were content with tradition and with things as they were, they called themselves Sunnites, or Traditionalists. The differences rapidly developed into those of a political and ethnic character, the Shiites being found in the lands which were opposed to the Ommiads (q.v.), as Arabia, where independence was characteristic, and in Persia, which only by force of arms had submitted to Islam. But the decision between the two parties was by no means immediately reached. The fall of the Ommiads was brought about by Persian Shiite influences (750), although the new Abbaside dynasty which was installed soon threw in its lot with the Sunnites. In general the geographic centre of the Arab power, Mesopotamia and Syria, remained in the control of this party. But the Shiites maintained the contest. The latter as liberalists and theosophists possessed a strong following, especially among the cultured, and they often enjoyed immunity under free-thinking caliphs. The Empire was honeycombed with Shiite secret societies like the Assassins (q.v.), and Shiite dynasties arose in Egypt and at Bagdad. (See SHIITES.) But by 1100 Sunnism was master in Southwestern Asia. This party was able to maintain itself during the Mongol invasions, and with the favor of the Ottoman Turks it remains as the predominant body in Islam. At the present time orthodoxy outnumbers all its opponents by ten to one, and commands not only the whole Turkish Empire, but the millions of Moslems in Africa, India, China, Malaysia and the Philippines, non-Turkish Arabia, and Northern Africa (Morocco being practically Sunnite).

Within this conservative and orthodox body, apart from outer foes, there early developed all kinds of theological strife. Rationalistic and liberal parties developed, which opposed, one after another, the original principles of Islam, such as its views of God, and of heaven and hell, its doctrines of predestination and of the literal authority of the Koran. On the other hand, the crass views of the fanatical mob opposed anything like philosophy, even though orthodox. Traditionalism was not fitted to meet the dialectic methods of its opponents, who had learned from the ancient schools of culture, and was ignorant of the use of philosophy in self-defense. But the champion of orthodoxy arose in Al-Ashari (born 882). A member originally of the Mutazilite sect, which had gone to the extreme of rationalizing upon the faith and the Koran (see MOHAMMEDAN SECTS), he was led to the consciousness of this inconsistency, and openly abjured that heresy, henceforth devoting himself to the formulation of a scholastic philosophy in support of orthodoxy. This school encountered for long the opposition of the liberals and the ignorant, but about 1050 Ashari's triumph became evident. His philosophy was continued and popularized by Al-Gazali (q.v.), who established the pietistic principle of Sufiism, which may be compared to the Christian emotional principle of faith. Since Ashari and Gazali no commanding theologian has arisen and no further philosophic advance has been made in Islam.

With reference to the head of Islam, Sunnism still as ever lacks a definite principle. Since 1658 the Ottoman Sultan has claimed the caliphate, although he possesses but fictions of the traditional requirements, and he holds his power by force and through the agreement of the Faithful. Hence Sunnism is not bound to the dynasty at Constantinople, and many of its thoughtful minds would regard the fall of the Ottoman power in the light of redemption for the Church. Contrary, therefore, to the original theocratic constitution of Mohammed there has arisen a division between the spiritual and the political forces. Political power is wielded by the Sultan, but the spiritual rule is in the hands of the Ulema (q.v.) of Constantinople, a close corporation of lawyer-theologians. Its chief, the Sheik-ul-Islam, is appointed by the Sultan, but only out of that body, and he possesses large independent powers which the Sultan dare not invade. He is the chief spiritual person in orthodox Islam.

Within the Sunnite body exist four different schools of law, those respectively of the Hanbalites, the Hanifites, the Shafiites, and the Malikites (so named after their respective founders). The first code is confined to the Wahhabites (q.v.); the second to Upper Egypt and North Africa; the third prevails in Lower Egypt, Southern India, and Malaysia; the fourth is followed by the Turks and by the Moslems of Central and Northern Asia. These schools arose in the second and third centuries of the Hejira and represent so many different compositions between tradition and progressive law. They are at peace with one another now, and divide orthodox Islam among themselves, each people being allowed to live by its law, and each lawyer electing his choice. But in the Ottoman Empire there exists the contrast between this canon law and the secular law. The latter proceeds from the authority of the Sultan or is the ancient secular law of the land; the other, the law of the Church, is confined mostly to domestic matters, and it is one of the grievances of the orthodox that the legal authority of the Church is thus put into abeyance by the secular arm. Here again the analogy may be drawn with the dispute which has prevailed in European Christendom between the canon and the civil law. Therefore, both in its past history and in its present condition, Sunnism is by no means to be regarded as a homogeneous body or practice. For literature, see MOHAMMEDANISM; MOHAMMEDAN SECTS.

SUNNYSIDE. A gabled stone house on the Hudson River near Irvington, three miles south of Tarrytown, noted as the home of Washington Irving, and described in Irving's sketch entitled *Wolfert's Roost*, the former name of the mansion. The house, in which the author's study has been preserved in its original condition, is overgrown with ivy from Abbotsford.

SUNSTONE, or HELIOLITE. A variety of aventurine, oligoclase, or feldspar, which when polished yields internal yellowish or reddish reflections emanating from crystals or flakes of iron oxide that are contained in the mass. The finest specimens, which show a brilliant play of colors, are found in Norway, although gem varieties occur in the United States at Crown Point, N. Y., and Media, Pa.

SUNSTROKE. See HEAT-STROKE.

SUN-WORSHIP. See NATURE-WORSHIP.

SUO'VETAURIL'IA (Lat., sacrifice of a boar, a sheep, and a bull, from *sus*, boar + *ovis*, sheep + *taurus*, bull). A Roman sacrifice, which was offered to Mars, in the lustrum, or purification of the people on the Campus Martius at the Census, the Ambarvalia in May, the Amburbium in February, and other similar lustrations. It derived its name from the three animals of which it consisted, a boar, a ram, and a bullock. In all cases the animals were led three times around the gathering or territory to be purified, and then sacrificed.

SUPAN, so͞o′pän, ALEXANDER (1847—). An Austrian geographer, born at Innichen, Tyrol. Having studied at the universities of Gratz, Vienna, Halle, and Leipzig, and taught at Laibach, he qualified as privat-docent at Czernowitz, Bukowina, and was made professor in 1880, but removed to Gotha in 1884 to assume the redaction of *Petermanns Mitteilungen.* The publication of its geographical literary reports, since 1885, is due to his initiative. He wrote: *Lehrbuch der Geographie für oesterreichische Mittelschulen* (1874; 10th ed. 1901); *Grundzüge der physischen Erdkunde* (3d ed., 1903); *Geographie von Oesterreich-Ungarn* (1889); *Deutsche Schulgeographie* (6th ed. 1903); and numerous contributions to the *Mitteilungen.*

SUPEREROGATION, WORKS OF (Lat. *supererogatio,* payment in addition, from *supererogare,* to pay in addition, from *super,* above + *erogare,* to expend, especially after asking consent, from *e,* out + *rogare,* to ask). A class of good works which, in the Roman Catholic system, are described as not absolutely required of each individual as conditions to his eternal salvation. Roman Catholics found this definition on the distinction between what they believe to be commanded and what they hold to be only counseled. (See EVANGELICAL COUNSELS.) For works of supererogation, as for all supernaturally good works, they hold that the assistance of God's grace is indispensably necessary; and they do not ascribe to them any merit, except that which arises from God's own free and gratuitous promise. A further consequence of this doctrine is that God may accept the superabundant works of one in atonement for the defective service of another; and hence, in the Catholic theory of indulgences (q.v.), along with what they regard as the infinite and inexhaustible treasure of the merits of Christ, they also regard, although in a degree infinitely inferior, the superabundant merits of the saints as forming part of that 'treasure of the Church' which is applied in the form of indulgences.

The idea of such works is rejected by Protestants generally, and the Anglican Articles declare that they "cannot be taught without arrogancy and impiety."

SUPERFICIES (Lat., surface). At civil law, the hereditary and alienable right to maintain and use a building on land belonging to another. Unless a term be fixed in the contract, the right is perpetual. The owner of the land is technically owner of the building (*superficies solo cedit*); but practically the owner has no right except to an annual ground-rent (*solarium*). Even when the ground-rent has not been paid for several years, the right of the superficiary is not forfeited unless this be expressed in the contract. In the absence of such express agreement, the owner of the land can only attach and sell the superficiary right.

Historically, *superficies* was first established at Rome in public or municipal land. It was originally lease (*locatio conductio*), but it soon became a different thing, because the superficiary was recognized as having possessory right (see POSSESSION) and actions *in rem.*—advantages which the Roman lessee did not enjoy. In the later development of the Roman law superficiary right could be established on private land and also in a special story or floor of a building.

Superficies is analogous to *emphyteusis* (q.v.), but the rights of the superficiary are greater than those of the emphyteutist.

Mediæval jurists regarded superficies and emphyteusis as cases of divided ownership, analogous to the feudal tenures. The landlord had *dominium directum,* the tenant *dominium utile.* Some of the modern legislations recognize divided ownership in a different sense: the landlord is said to own the land, the superficiary the house or floor. See DOMINIUM; EMPHYTEUSIS; PROPERTY.

SU′PERFŒTA′TION (from Lat. *superfœtare,* to conceive anew when already pregnant, from *super,* above, over + *fœtare,* to breed, from *fœtus,* offspring; connected with Gk. *φύειν, phyein,* to generate, Skt. *thū,* to become, and ultimately with Eng. *be*), and SUPERFECUNDATION. The circumstance of two distinct conceptions occurring in the same woman at an interval of weeks or months, so that two fœtuses of different ages, and possibly the offspring of different fathers, may coexist in the uterus. True superfœtation takes place when a second ovule has been impregnated while the uterus already contains an ovum which has arrived at a considerable degree of development. By *superfecundation* is meant the impregnation, at or near the same period of time, of two separate ovules before the decidua lining of the uterus has been formed, which is believed by many to interpose an insuperable obstacle to subsequent impregnation. The possibility of this occurrence has been proved on numerous occasions by the birth of twins bearing the stamp of fathers of different races, i.e. white and black. The question of superfœtation has given rise to much discussion owing to its medico-legal importance. Against the possibility of this occurrence it is urged that ovulation is suspended when impregnation has taken place; that the decidua (afterbirth) so completely fills the uterine cavity that the passage of spermatozoa is impossible, and that their ascent is prevented by the plug of mucus filling the cervix. It is now believed that none of these obstacles is insuperable.

The medico-legal aspect of the question may be summed up as follows: A woman may be unjustly suspected of conjugal infidelity when, delivery of a mature or premature child having taken place, she is (without having meanwhile seen her husband, or submitted to coitus), in the course of one, two, or three months, delivered of another child, either mature or premature. Cases of this kind may be explained, as indicated above, by twin pregnancy with expulsion of the fœtuses at an interval of several weeks or months; by the existence of bilobed uterus, the two cavities expelling their contents at different times; or by true superfœtation. When the children are of different race or color the fidelity of the female may be justly questioned. See Bonner, in *Edinburgh Medical Journal* (1864-65); Witthaus and Becker, *Medical Jurisprudence* (New York, 1894); Playfair, *Midwifery* (Philadelphia, 1893).

SUPE′RIOR. A port of entry and the county-seat of Douglas County, Wis., adjacent to Duluth, Minn.; at the mouth of the Saint Louis and Nemadji rivers, on three bays, inlets of Lake Superior, and on the Northern Pacific, the Eastern Minnesota, the Saint Paul and Duluth, the Duluth, South Shore and Atlantic, the Great Northern, and the Chicago, Saint Paul, Minneapolis and Omaha railroads (Map: Wisconsin, A 2). It is connected with Duluth by two railroad bridges and by ferry. The city is finely situated. It is the seat of a State Normal School, and among other features are a public library, with more than 13,000 volumes, and Saint Mary's Hospital. An excellent harbor, which has been enlarged and improved through national, State, and city appropriations, and good transportation facilities have contributed to Superior's commercial importance. In the year ending June 30, 1901, the total foreign trade was valued at $7,353,553, including exports to the amount of $6,946,547. Wheat, corn, flour, lard and other meat products, iron and steel, cement, and lumber compose the principal shipments. The various industries in the census year 1900 had an invested capital of $5,882,562, and a production valued at $7,527,703. There are lumber mills, foundries and machine shops, breweries, flour mills, boiler shops, iron works, manufactories of chairs and windmills, and shipbuilding interests.

The government is vested in a mayor, elected biennially, and a unicameral council; and in administrative officials, the majority of whom are appointed by the mayor, subject to the confirmation of the council. For maintenance and operation, the city spends annually about $409,000, the chief items being: schools, $120,000; fire department, $25,000; interest on debt, $23,000; and streets, $19,000. Population, in 1890, 11,983; in 1900, 31,091.

On the site of Superior Radisson and Groseilliers are supposed to have made their headquarters in 1661. Here in 1680 the famous explorer Du L'Hut established a trading post. Superior was first laid out in 1855, and in 1885 the city was considerably enlarged, a company headed by Gen. J. H. Hammond having laid out an addition west of the original town. In 1881 the Northern Pacific Railroad Company built a branch hither.

SUPERIOR, LAKE. The largest and most northerly of the Great Lakes of North America, and the largest body of fresh water in the world (Map: America, North, K 5). It is situated a little to the northeast of the centre of the continent, and is bounded on the north and east by the Canadian Province of Ontario, and on the south by the State of Michigan and a part of Minnesota, the latter State forming also the western boundary. Its shape is nearly a crescent, the horns extending southwest and southeast, while the large Keweenaw Peninsula reaches nearly to the centre of the lake from the middle of the southern coast. Lake Superior has a coast line of 1500 miles; its extreme length from east to west is 412 miles; its extreme breadth is 167 miles. Area, 31,200 square miles. Its mean elevation above sea level is 602 feet, and it lies 20 feet above the level of Lake Huron, into which it discharges through the Saint Mary's River (q.v.). It receives a large number of streams, but they are all short, the basin of the lake being closely hemmed in by the watersheds of the Mississippi and of Hudson Bay. The principal stream entering it is the Saint Louis River, which falls into the extreme western end of the lake, and is considered as the farthest headstream of the Saint Lawrence.

The shores of Lake Superior, except in the southeast, where there are long lines of sand dunes, are generally bold and rocky. On the Michigan shore are the celebrated sandstone cliffs known as Pictured Rocks, which are streaked by the red and yellow deposits of ferruginous waters. In many places, especially along the Canadian shore, there are precipitous cliffs of basalt rising directly from the water to a sheer height of from 300 to over 1000 feet, such as Thunder Cape on the northwest shore. The north shore is also cut up into deep bays surrounded by high cliffs, and forming good harbors, and it is lined with a number of high, rocky islands with precipitous sides and capped by eruptive material. In the greater part of the lake, however, the islands are few, the largest being Isle Royal, 45 miles long and 8 miles wide, belonging to Michigan. In general the country surrounding the lake is covered with pine forests.

Lake Superior is deeper than any of the other Great Lakes, its maximum depth being 1008 feet, so that the bottom lies 400 feet below sea level. The water is very clear, and so fresh as to be almost chemically pure. It is cold throughout the year to within a few feet of the surface, and in the deeper portions maintains a nearly uniform temperature of 39°. The lake never freezes except in the shallow water along the shores. The level of the lake is subject to several sets of periodic changes, partly owing to changes in rainfall and evaporation and partly to the winds; a long continued storm will sometimes raise the leeward level seven feet above the normal. Violent storms occasionally sweep over the lake, when the waves may attain an amplitude of 15 or 18 feet.

The basin of Lake Superior is remarkable as being unrelated to those of the other Great Lakes. While the latter are river valleys scooped out of the softer strata of the ancient coastal plain lying northwest of the Appalachian Plateau and skirting the Archæan continent, Lake Superior lies almost wholly within the Archæan region. The most recent investigators are of the opinion that this basin is a primitive depression in the earth's crust antedating the Huronian period. The numerous intrusions of eruptive rocks which encircle the lake are arranged roughly in concentric circles, the most recent being found nearest the lake, and it has been suggested that the depression is an ancient and deep-seated centre of volcanic activity. The formation of the lakes themselves, however, is due to the obstruction of the valleys during the Glacial Period. The country surrounding the lake is rich in minerals, and large veins of copper and iron ore traverse its bottom from the southern shore. Consult Agassiz, *Lake Superior: Its Physical Character, Vegetation, and Animals* (Boston, 1850). For commerce and navigation on the lake, see GREAT LAKES.

SUPERPHOSPHATE. An orthophosphate in which only a portion of the hydrogen of the orthophosphoric acid has been replaced by a basic radical. The most important superphosphate, agriculturally. that of lime, monocalcium phosphate ($CaO.2H_2O.P_2O_5$). is prepared by treating tricalcium phosphate ($[CaO]_3.P_2O_5$) in the form of mineral phosphate, bone ash, bone black, etc., with sulphuric acid. It is also called acid phosphate. See MANURES AND MANURING.

SUPERPOSITION. See CONGRUENCE.

SUPERSEDEAS (Lat., that you set aside). A common-law writ containing an order for a stay or suspension of legal proceedings. Under the common-law practice it is issued in a great variety of cases for the above purpose, and is sometimes used as a substitute for the common-law writ of *audita querela* (q.v.). Probably it is issued most frequently to stay execution, pending an appeal from a judgment. The person applying for the writ is required to give a bond, to secure the other party against loss by reason of the delay. Several writs are said to operate as a *supersedeas* by implication, as in effect they operate as a stay, viz.: habeas corpus, certiorari, and writ of error. The practice of granting a *stay* by an order of the court has superseded the above practice in many jurisdictions.

SUPERSTITION (Lat. *superstitio*, excessive religious belief, superstition, possibly originally a standing over a thing in amazement or awe, from *superstare*, to stand above or over, from *super*, above, over + *stare*, to stand). A term loosely used to include all false faith or belief, its distinguishing characteristic being its irrational estimate of something imperfectly understood. Since the answer to the question of truth or falsity varies with place and time, it follows that the accepted belief of one time or people may be superstition to another. Most of the popular superstitions of the present are survivals of earlier science or religion. At a time when there existed no system of recorded observations of natural phenomena conclusions were of necessity drawn from external characteristics, and objects and events were supposed to exercise influences corresponding to the impression produced upon the senses or imagination. This manner of interpretation, or sympathetic magic (see MAGIC), is responsible for a great mass of superstitions. It is a characteristic of popular credulity that such notions, once prevalent, do not yield to contrary experience. If observation shows the principle to be inaccurate, reasons are always at hand to explain the error, or at the most it is only necessary to introduce additional complexity into the rule. Hence the power of the ancestral habits, which we find arbitrary and call superstitious. With all savage peoples, such beliefs have an immense effect on action; the daily method of nutrition, attire, the chase, agriculture, and warfare are determined by an infinity of regulations which are religiously handed down from generation to generation. In some cases it is possible to discover the principle of expediency which gave birth to the requirement; thus, the discovery of the ill effect of in and in breeding causes to be established a religious necessity, limiting the relations of the sexes according to certain complicated and ingenious rules, of which the prohibited degrees are the modern ecclesiastical survival. But in multitudes of other cases no good reason can be offered for demands and abstentions which originally depend on inferences which it is impossible to reconstruct.

A considerable number of superstitions are connected with the heavenly bodies. From remote times the observation of the stars and their movements has been considered important, but it has been with the night, especially, that ancient religious ceremonies are associated. The most distinctive differences between the nights were formed by alterations in the growth of the lunar crescent; according to universal processes of thought, it was supposed that the time when the planet increases and becomes dominant the principle of growth must prevail, and on the other hand, that her wane must be a season of general decay. Hence it has been everywhere inferred that all operations designed to promote increase ought to be performed at the time of the new moon, and that then potatoes should be planted, hair cut, and so on. But if it is desired to cause shrinking, the work should be done when the moon is at the full according to the maxims of traditional agriculture, and at this time should be cut alders, spruce, and other undergrowth, because the roots will in this case wither without sprouting.

Not less important in popular usage is the part played by the course of the sun. As he moves in a particular direction, so it has been thought that in order to produce beneficial results, mankind should proceed in a corresponding manner; in worship it was thought necessary to adopt a processional movement in the sunwise direction. Even in the ordinary movements of daily life this order was followed, and traces of it survive to the present day. Thus in order to make good bread or butter, it is essential that the motion should be in the same uniform direction, for reversal of the direction in which the kneading or churning is performed will undo the work accomplished, and insure a failure. From household maxims still preserved, it appears that the hand must be moved in a sunwise circuit. As the route taken by the sun is holy, so the opposite path will be evil, and has been adopted in practices of witchcraft and magic, and in Roman worship the gods below were adored with this reverse circuit.

Among periods of human life, the terror which attaches to death has made it the centre of a vast body of superstitious habits. A great number of actions and experiences are still popularly regarded as signs of approaching departure. The principle on which the phenomena are interpreted is that of association of ideas. Thus ringing in the ears is a sign of dissolution, because the Church has usually rung a 'death-bell' over the departed; carrying a spade through the house has like significance, because a spade is used to dig graves; a blue flame in the candle is ominous, for the lowering of the light forecasts the decline of the life; a flower blooming out of season foreshows a decease; and so on indefinitely. In like manner, the unusual also is a fruitful source of superstition; if every child were born with a caul (that is, a membrane encompassing the head) it is doubtful if this would have been taken as an especial sign of good luck.

A considerable number of superstitions relate to times of the year, and revert to the practices of old religion. Thus Hallowe'en, or the evening before All Saints' Day, is attended with observances which seem to have been dependent on its original character as a feast of the dead, when departed spirits were invited to partake in the fruits of the harvest, and were conceived as present at the sacrifice and merry-making. On this night it is usual to perform divinations, now reduced to mere jests, in which an unmarried person is expected to discover his or her companion for life. These practices must be regarded as the remainder of serious necromancy, in which the returning spirits were asked to reveal the future.

While the majority of superstitions are remains of antiquity, their invention has not altogether ceased in historical times. Of this we have examples in the prejudice against the number thirteen, and in objection to Friday as unlucky, since in Christian thought the day of the Crucifixion and the number involving the addition of Judas were of necessity regarded as ill-omened. The superstition of the evil eye, that is, the belief that certain individuals have the power to injure by a look, is still widespread in Eastern countries, where the belief yet lingers that the demoniac (q.v.) is divinely inspired. Nature worship (q.v.) lingers in such superstitions as those connected with the moon, the belief in its mysterious power to work good or ill, its influence on the weather, and the like. The belief in ghosts (q.v.) reflects the earlier ancestor worship. The common notion about the good luck brought by a horseshoe has been traced back to phallicism (q.v.).

The following list, prepared by Bolton (*The Counting-out Rhymes of Children*, London, 1888), gives the technical names for different forms of divination and the method followed in each:

Aëromancy	by appearances in the air.
Alectoromancy, or Alectryomancy	by a fowl picking up grains of wheat.
Aleuromancy	by wheat.
Alphitomancy	by barley flour.
Amniomancy	by the amnion.
Anagrammatism	by anagrams of a person's names.
Anthropomancy	by human entrails.
Anthroposcopy	by man's features.
Arithmancy	by the use of numbers.
Astragalomancy, or Astragiromancy	by little sticks, bones, tablets, or dice.
Astrology	by the heavenly bodies.
Austromancy	by winds.
Axinomancy	by the axe or hatchet.
Belomancy	by arrows.
Bibliomancy	by the Bible.
Bletonism	by subterranean springs.
Botanomancy	by herbs.
Cartomancy	by playing cards.
Capnomancy	by smoke from an altar.
Catoptromancy	by mirrors.
Ceromancy	by dropping melted wax into water.
Cephalomancy	by an ass's head.
Chalcomancy	by vessels of brass.
Chaomancy	by appearances in the air.
Chartomancy	by writings on paper.
Chiromancy	by the hand.
Cledonismancy	by certain lucky or unlucky words.
Cleromancy	by dice.
Clidomancy	by keys.
Coscinomancy	by sieves.
Crithomancy	by dough of cakes.
Cromniomancy	by onions.
Crystallomancy	by a magic lens.
Dactylomancy	by suspended rings.
Demonomancy	by evil spirits.
Daphnomancy	by the laurel.
Extispicium	by entrails of a victim.
Gastromancy	by ventriloquism, or by a vial of water.
Geloscopy	by the manner of laughing.
Geomancy	by geometrical figures.
Gyromancy	by walking in a circle.
Haruspicy	by sacrificial appearances.
Halomancy	by common salt.
Hieromancy	by the entrails of animals.
Hydromancy	by water.
Hydatoscopy	by rain water.
Ichthyomancy	by the entrails of fishes.
Idolomancy	by idols and images.
Judeomancy	by a Jewish art.
Keraunoscopy	by thunder.
Lampadomancy	by lamps.
Lecanomancy	by a basin of water.
Libanomancy	by incense.
Lithomancy	by precious stones, or pebbles.
Logarithmancy	by logarithms.
Lychnomancy	by lamps.
Margaritomancy	by pearls.
Macharomancy	by knives and by swords.
Meteoromancy	by meteors.
Metoposcopy	by men's features.
Molybdomancy	by melted lead.
Myomancy	by mice.
Necromancy	by the black art.
Oinomancy	by wine of libations.
Omphalomancy	by the navel of an infant.
Oneiromancy	by dreams.
Onomancy	by letters forming the name of a person.
Onyomancy, or Onychomancy	by the finger nails reflecting the sun's rays.
Oōscopy	by eggs.
Ophiomancy	by serpents.
Ornithomancy	by birds.
Palmistry	by the hands.
Palpitatio	by the pulsation of some member.
Pegomancy	by springs of water.
Pessomancy	by pebbles.
Physiognomy	by man's features.
Podomancy	by the feet.
Psephomancy	by pebbles drawn from a heap.
Psychomancy	by ghosts.
Pyromancy	by sacrificial fire.
Pyroscopy	by examining fire.
Rhabdomancy	by wands.
Rhapsodomancy	by poetical passages.
Salisatio	by the pulsation of some member.
Sciomancy	by shadows or manes.
Sideromancy	by straws on a red-hot iron.
Sortilege	by drawing lots.
Spatilomancy	by skin, bones, etc.
Stereomancy	by the elements.
Sternomancy	by marks on the breast.
Stichomancy	by poetical passages.
Tephramancy	by writing in ashes.
Theomancy	by oracles.
Theriomancy	by wild beasts.
Tyromancy	by cheese.

See also FOLKLORE; MAN, SCIENCE OF; MAGIC; MYTHOLOGY; RELIGION, COMPARATIVE.

SUPERTONIC. In music, the note which, in the diatonic scale, is next above the tonic or keynote, and forms with it the interval of the second, as, for example, D in the key of C major.

SUPERVISOR (ML. *supervisor*, overseer, from Lat. *supervidere*, to overlook, oversee, from *super*, above, over + *videre*, to see). A popularly elected officer of a township or other local district in the United States. The name first appeared in New York in 1691. This officer is still the chief administrator of the town organization in New York, while all the supervisors of the county assembled in a board meeting constitute the chief county authority. The New York supervisor system exists in several Western States. In Michigan and Illinois, as in New York, there is a single supervisor for each township, while in Wisconsin and Minnesota there are three for each township. In some States the supervisor is not a member of the county board and his duties vary, as, for example, in Michigan, where he is also tax assessor, and in Illinois, treasurer. See UNITED STATES, section on *Local Government*.

SUPPÉ, sōō-pā′, FRANZ VON (1820-95). An Austrian composer of light opera, born at Spalato, Dalmatia. He studied at the Vienna Conservatory under Sechter and Seyfried. He was kapellmeister successively at the Josephstädter Theater, the Theater an der Wien, and from 1865 until the end of his career at the Leopoldstädter Theater. He was a prolific composer, the most important of his works being the operettas *Flotte Bursche* (1863), *Die schöne Galathea* (1865), *Leichte Kavallerie* (1866), *Banditenstreiche* (1867), *Fatinitza* (Vienna, 1876), *Boccaccio* (1879), *Das Modell* (posth., 1895). He also composed considerable instrumental and sacred music. He was one of the most popular of the world's light opera composers, and a musician of no little genius.

SUPPLE JACK (*Berchemia volubilis*). An American twining shrub of the natural order Rhamnaceæ, which is found as far north as the Dismal Swamp in Virginia. It has oval leaves, small flowers, and violet-colored berries, and ascends to the top of the highest trees. The name is also given in the West Indies and tropical America to Serjania lucida and Serjania trachygona, shrubs of similar habit which belong to the natural order Sapindaceæ. The stems are used for walking-sticks.

SUPPLEMENTARY PROCEEDINGS. Certain proceedings under codes and practice acts designed to discover property of a judgment debtor and apply it to the satisfaction of the judgment. The order directs the debtor to appear and submit to an examination under oath as to his property. Most acts provide for the appointment of a receiver where property is found. Consult *New York Code of Civil Procedure.* See EXECUTION.

SUPPLIANTS, THE (Lat. *Supplices*, Gk. Ἱκέτιδες, *Hiketides*). (1) The earliest of the extant plays of Æschylus, of uncertain date. With but slight plot or dramatic action, it pictures the arrival of the fifty daughters of Danaus on the shore near Argos, their prayer to the King of Argos for protection, the appearance of the ship bearing the fifty sons of Ægyptus, and their repulse by the King.

(2) A tragedy by Euripides, produced about B.C. 420. Theseus and the Athenians, entreated by the mothers of the dead chiefs, after defeating the Thebans, oblige them to surrender the bodies of the slain Polynices and his allies, to whom they had refused burial. The funeral of the chiefs, the burning of Evadne on the pyre of her husband, Capaneus, and the patriotic and political references provide the interest lacking in the simple plot.

SUPPORTERS (from *support*, OF., Fr. *supporter*, from Lat. *supportare*, *subportare*, to support, from *sub*, under + *portare*, to carry). In heraldry, figures placed on each side of an armorial shield. See HERALDRY.

SUPPOSITORY (Lat. *suppositorium*, from *supponere*, *subponere*, to put beneath, from *sub*, under + *ponere*, to put, place). A solid medicated compound intended to be introduced into the rectum, vagina, or urethra, either for the purpose of causing an evacuation of the bowels, or for its specific effect on inflamed mucous membrane. Suppositories are made in several shapes —conical, cylindrical, or spherical—and in sizes adapted to the orifice they are intended to enter. In consistency they are such that they remain solid at ordinary temperatures, but melt slowly at the temperature of the body. The basis of most suppositories is cocoa butter. With this are incorporated one or several ingredients, such as carbolic acid, tannic acid, belladonna, morphine, opium, cocaine, and lead.

SUPPURATION (Lat. *suppuratio*, *subpuratio*, from *suppurare*, *subpurare*, to form pus, from *sub*, under + *pus*, white viscous matter from a sore). A morbid process which takes place in animal tissues, resulting in the formation of pus. It is a frequent termination of inflammatory processes and is due to invasion of the inflamed tissues and their exudates by pyogenic organisms. (See PUS; INFLAMMATION.) White blood cells escape into the neighboring tissue after passing through the walls of the blood vessels, and become pus cells. If they escape to the surface and there is an open wound, the wound is said to suppurate. If they are confined to a circumscribed area below the surface, the collection of pus cells and broken down tissue is called an abscess (q.v.).

SUPRALAPSARIAN. See INFRALAPSARIAN.

SUPRARENAL (from Lat. *supra*, above + *renalis*, relating to the kidneys, from *renes*, kidneys) **CAPSULES** AND THEIR DISEASES. The suprarenal capsules are two small, flattened, glandular bodies of a yellowish color and crescentic shape, situated, as their name implies, immediately in front of the upper end of each kidney. In weight they vary from one to two drams. They belong to the class of ductless glands, and on making a perpendicular section each gland is seen (like the kidney) to consist of cortical and medullary substance. The blood-vessels and nerves of the glands are exceedingly numerous. The capsules are also called the suprarenal bodies or the adrenals.

The suprarenal bodies are subject to inflammation, to atrophy, and to invasion by malignant processes, but all of these occurrences are extremely rare. The only morbid process that occurs with any frequency is tuberculosis. This process is the causative factor in the production of Addison's disease (q.v.), a rather rare and usually fatal affection characterized by anæmia, general languor, feebleness of the heart's action, irritability of the stomach, and bronzing of the skin.

The dried and prepared suprarenal substance of animals constitutes a powerful and valuable astringent and hæmastatic. See ORGANOTHERAPY.

SUPREMACY, ROYAL (OF. *suprematie*, Fr. *suprématie*, from OF. *supreme*, Fr. *suprême*, supreme, from Lat. *supremus*, highest, superlative of *superus*, high, from *super*, Gk. ὑπέρ, *hyper*, Skt. *upari*, Goth. *ufar*, OHG. *ubar*, *uber*, *ubiri*, AS, *ofer*, Eng. *over*). A phrase specifically applied to the relation of the sovereign of England to the established Church of that country. During the Reformation the supremacy of the Pope was abolished in England, and the act passed in 1534 declared the King to be the "only supreme head on earth of the Church of England." The Government at the same time issued an explanation of this language to the effect that it was intended to recognize in the sovereign the authority of a governor without spiritual jurisdiction, and not to "take any power from the successors of the Apostles that was given them by God." Under Queen Mary this Act of Supremacy was repealed in 1554, but this repeal was itself repealed by Queen Elizabeth in 1559, who, however, did not make use of the words 'supreme head.' In her injunctions she explained the supremacy of the Crown to be "that which is and was of ancient time due to the Imperial Crown of this realm, that is, under God to have the sovereignty and rule over all manner of persons born within those her realms of what estate either ecclesiastical or temporal soever they may be so as no other foreign power shall or ought to have any superiority over them." The governing and visitorial power of the sovereign, under the safeguard of an organized court of justice, has since been continuously recognized by the Church of England. By successive statutes an oath as to royal supremacy was appointed to be taken by the holders of public offices along with the oaths of allegiance and abjuration. A royal supremacy similar in character is a prerogative of the Czar of All the Russias, also of the Protestant princes of Germany, and of the sovereigns of Holland, Denmark, Norway, and Sweden.

SUPREME COURT. See COURT.

SUPREME COURT OF THE UNITED STATES, THE. The Supreme Court of the United States is the head of the national judiciary. In our system of government there are three coördinate departments—executive, legislative, and judicial. The latter is the last named in the national Constitution, was the last brought into being, but is by no means the least important. The existence of the Supreme Court is authorized by the Constitution. Section 1 of Article III. provides that "the judicial power of the United States shall be vested in one supreme court, and in such inferior courts as the Congress may from time to time ordain and establish." The Supreme Court is thus a constitutional court, while the other courts of the United States are statutory. Though the Constitution provides for a Supreme Court, it leaves its organization and membership for Congressional supervision. The first act in respect thereto was passed at the first session of the United States Congress, approved by Washington on September 24, 1789, and directed that the court should consist of a Chief Justice and five associate justices, any four of whom should make a quorum. This act not only made provision for the Supreme Court, but created the inferior courts of the United States and organized its entire judicial system. It was drafted by Oliver Ellsworth, afterwards a Chief Justice of the United States. It has remained in its main features unchanged, and one of Ellsworth's admirers has declared that the Federal judicial system, "the whole edifice, organization, jurisdiction, and process, was built by him as it now stands."

The Constitution in Section 2 of Article III. declares that "the judicial power shall extend to all cases, in law and equity, arising under this Constitution, the laws of the United States, and treaties made, or which shall be made, under their authority; to all cases affecting ambassadors, other public ministers, and consuls; to all cases of admiralty and maritime jurisdictions; to controversies to which the United States shall be a party; to controversies between two or more States; between one State and citizens of another State; between citizens of different States; between citizens of the same State claiming lands under grants of different States, and between a State, or the citizens thereof, and foreign States, citizens or subjects." And also that "in all cases affecting ambassadors, other public ministers, and consuls, and those in which a State shall be a party, the Supreme Court shall have original jurisdiction. In all other cases before mentioned, the Supreme Court shall have appellate jurisdiction, both as to law and fact, with such exceptions and under such regulations as the Congress shall make." The original jurisdiction, being conferred by the Constitution, cannot be taken away by Congress, although that body may prescribe the procedure by which that jurisdiction is to be exercised; but in respect to the appellate jurisdiction both the procedure and its extent are matters of Congressional determination, and Congress has from time to time made changes in each.

The appellate jurisdiction may be separated into two divisions: one over State courts; the other over the inferior Federal courts. With respect to the former it reviews the final judgment rendered in any case by the highest court of the State to which the case under State practice can be carried, and this irrespective of the amount in controversy. With respect to the latter, up to 1891 it had, speaking generally, jurisdiction to review the proceedings in any case which had passed to final judgment in such inferior courts, with a limitation in some classes of cases to a certain amount in controversy. By the act of that year (1891) courts of appeal were established, one in each circuit, and were given final jurisdiction in certain cases, such as revenue, admiralty, patent cases, etc. But the Supreme Court may still by certiorari, if it sees fit, bring any of these cases from a court of appeals before it for review. This act did away with the limitation as to the amount in controversy requisite for review by the Supreme Court. In addition the Supreme Court is given power to issue writs of prohibition and all other writs which may be necessary for the exercise of its jurisdiction and agreeable to the principles and usages of law. So that it may be said that the Supreme Court has complete supervision and control over all the inferior courts of the United States.

The full significance of the Supreme Court as a factor in the new government was not at first appreciated by all; yet there were some who realized its great importance, like Washington, who, with prophetic visions of what the future was to disclose, wrote, in a letter inclosing the commission of James Wilson, one of the first associate justices: "Considering the judicial system as the chief pillar upon which our national government must rest, I have thought it my duty to nominate for the high offices in that department such men as I conceived would give dignity and lustre to our national character." Early there arose two parties in this country—one believing that the new government was but a continuance of the old confederacy, in effect a league of States, the States remaining the dominant powers, and the national Government serving only as a limited agency for the transaction of a few matters of general importance; the other that a new nation was created, supreme in control, possessing all the power of a nation, the States being simply parts of the one new nation. By the one party, the provisions of the Constitution were strictly construed; no power was vested in the national Government, except that which was expressly named. The other believed that the Constitution was to be so construed as to give vigor and efficiency to the new nation. Upon the solution of this question turned the future of the Republic. It was finally answered and settled by the Supreme Court, which has always spoken for the nationality of the United States. A brief reference to some of the leading cases may indicate its action, and the effect thereof on our history. In Chisholm, executor, *v.* Georgia, 2 Dall. 419, decided February 18, 1793, the court (considering those provisions of the Constitution which extend the judicial power of the United States to controversies "between a State and citizens of another State," and give to the Supreme Court original jurisdiction of controversies to which a State is a party) held that an action might be maintained against a State by a citizen of another State. The national idea was not yet strong, and the proposition that a sovereign State could at the instance of an individual and without its consent be brought to the bar of a court and compelled to defend an action against it startled many. As a consequence the Eleventh Amendment was adopted, which in effect forbids an action in the Federal courts against a State by an individual.

John Marshall became Chief Justice in January, 1801, and remained in office for thirty-four years. He is often aptly called 'the great Chief Justice.' During his long term many questions of vital interest were considered and determined by the court. It was a great constructive period, and by those decisions which declared the relative powers of the nation and the State was disclosed the full significance of the Constitution as an instrument expressing the creating of a new nation and not a mere article of confederation between separate States. Not merely were these relative powers declared, but the peculiar work and value of the Supreme Court as the tribunal to determine the extent of such relative powers and to pass in judgment upon acts of State and nation were also made apparent. In Marbury *v.* Madison, I. Cranch, 137, decided February 24, 1803, it was held that an act of Congress repugnant to the Constitution was void. True, this was not the first case in which such a judicial opinion had been announced, but Chief Justice Marshall presented the argument so fully and forcibly that since then the question has been at rest, and it is now undoubted that a legislative act repugnant to the Constitution is a nullity. Again, in M'Culloch *v.* Maryland, 4 Wheat. 316, the question was presented of the power of Congress to charter a national bank. The Constitution gives in terms no such power, or indeed any power to create corporations, and the advocates of a strict construction contended that in the absence of an express grant of such power Congress could not create a corporation for any purpose. The court, upon the authority of that clause which, following the clauses making express grants to Congress, empowers that body to "make all laws which shall be necessary and proper for carrying into execution the foregoing powers," held that, as a bank was a proper and convenient agency for carrying on the fiscal affairs of a government, there was power in Congress to create a banking corporation; that the word 'necessary' was not to be construed in a strict and narrow sense, but—viewing the Constitution as an organic instrument by which a government was established and which from the very necessities of the case used general terms in giving to that government the power essential for its being—to be taken broadly and liberally, and said in a phrase which has become axiomatic in constitutional law: "Let the end be legitimate, let it be within the scope of the Constitution, and all means which are appropriate, which are plainly adapted to that end, which are not prohibited, but consistent with the letter and spirit of the Constitution, are constitutional."

This decision laid the foundation of what is known as the doctrine of implied powers, the significance of which may be better appreciated when we recall the fact that under a grant of power stated in these few words "to establish post-offices and post roads" the great postal system of the United States has been built up. At the same term was decided the case of the Trustees of Dartmouth College *v.* Woodward, 4 Wheat. 518, in which it was held that the charter of a private corporation granted by a State created a contract whose obligations the State could not impair, because of that provision of the Federal Constitution which forbids a State to pass any law "impairing the obligation of contracts." (See DARTMOUTH COLLEGE CASE.) It is true the full effect of that decision has been avoided by constitutional enactments in the several States, reserving the power of repeal, alteration, and amendment of all corporate grants. Yet, notwithstanding these limitations, that decision stands as the great bulwark of the sanctity of contract rights created by the States.

Martin *v.* Hunter, I. Wheat. 304, and Cohens *v.* Virginia, 6 Wheat. 264, the latter decided at the February term, 1821, settled the power of the Supreme Court to review, and if necessary set aside, the proceedings of a State court in a case in which a Federal right was asserted by the defeated party. Thus it is that all rights which are claimed under the Constitution of the United States may finally be adjudicated by the Supreme Court of the United States, and a unity is thereby established which pervades the nation in respect to such rights. Again, in Gibbons *v.* Ogden, 9 Wheat. 1, decided in 1824, the supreme power of the Federal Government over the navigable waters of the United States was affirmed. In that case Robert Fulton, the inventor of the steamboat, and his associate, Robert R. Livingston, obtained from the State of New York the grant of an exclusive right to navigate with steamboats the waters within the jurisdiction of that State. Gibbons claimed a right under national authority to navigate with his steamboats the same waters, and hence the litigation. The Constitution having granted to Congress the power to "regulate commerce with foreign nations and among the several States," it was held that that power could not be infringed upon by any action of a State and that a State could not interfere with such commerce even when carried upon waters wholly within its own territory. Upon that decision rests that freedom of commerce between the States which, perhaps more than any other thing, has wrought into the minds of the people the great thought of a single controlling nationality. In this connection the case of 'The Genesee Chief,' 12 How. 443, decided in 1851, may be noticed. In that case it was held that the English rule that the jurisdiction of admiralty ended with tide waters was inapplicable, and that in this country such jurisdiction, which by the Constitution is vested in the United States courts, extends to all the navigable waters of the Republic. Thus the control of the Great Lakes and all the navigable rivers of the United States, whether within or without the limits of a State, is vested in the national Government. In Osborn *v.* United States Bank, 9 Wheat. 738, it was held that a State had no power to tax one of the branches of the United States Bank; that the bank was one of the agencies and instrumentalities of the national Government, and as such was removed from the sphere of State taxation. From that decision has sprung the settled rule exempting all the agencies and instrumentalities of the national Government from State taxation except so far as permitted by Congress. This is seen in respect to United States bonds, national banks, etc. Conversely, though at a later date, in The Collector *v.* Day, 11 Wall. 113, decided December, 1870, it was held that Congress could not impose an income tax on the salaries paid to State officials. By these two decisions neither State nor nation can impair the efficiency of the necessary governmental action of the other.

Chief Justice Marshall was succeeded by Chief Justice Taney. As he and a majority of his associates had belonged to the 'strict construction school,' many prophesied a complete reversal of prior rulings, but the court still affirmed the nationality of the United States. Thus in Pennsylvania *v.* Wheeling and Belmont Bridge Company, decided in 1849, 9 How. 647, and 1851, 13 How. 518, the jurisdiction of the Supreme Court was affirmed over a case brought by a State to restrain the obstruction of a navigable river within the limits of other States. In Ableman *v.* Booth, decided in 1858, 21 How. 506, a prisoner in custody of the United States authorities was held not to be subject to discharge by State process. And in the famous 'Dred Scott Case,' decided in 1856, 19 How. 393, the nationality of the United States was asserted, though in a way not satisfactory to the friends of human freedom, in that it decided that the recognition by the Constitution of slave property carried with it the protection of that property in all the territories of the nation.

When the Civil War ended and Chief Justice Taney had been succeeded by Chief Justice Chase a new series of cases arose. Naturally bitter feelings were excited by the war, and stringent laws were passed by Congress and by some of the States against those who had participated in the rebellion. Test oaths were prescribed which prevented ministers and lawyers who had taken part with the South from pursuing their respective professions, but in Cummings *v.* Missouri, and *ex parte* Garland, decided in 1866, 4 Wall. 277 and 333, such test oaths were adjudged invalid as *ex post facto* acts. At the same time in *ex parte* Milligan, 4 Wall. 2, it was held that a military tribunal, sitting in Indiana, a State in which there had been no rebellion, had no jurisdiction to punish a citizen, in no way connected with the army, for an offense against the Government. In Texas *v.* White, 7 Wall. 700, decided in 1868, it was held that States in rebellion did not lose their existence or identity, and in the opinion Chief Justice Chase made the memorable declaration that this was "an indestructible union composed of indestructible States." Soon after the war the Fourteenth Amendment to the Federal Constitution was adopted, which prohibited the States from depriving any person of life, liberty, or property without due process of law, and from denying to any one the equal protection of the law. It was claimed by many that this operated to prevent the grant by a State of any special privileges, but in the Slaughter House Cases, 16 Wall. 36 (1872), a charter given by the State of Louisiana, which secured to the corporation a monopoly of the butchering business within certain limits of New Orleans, was held to be valid, and thus the right of each State to determine for itself, in the grant of privileges, that which was best for its citizens, was sustained. In 1890 came Leisy *v.* Hardin, 135 U. S., 100, in which it was held that the grant by the Federal Constitution to Congress of the power to regulate commerce between the States invalidated the legislation of one State which sought to prevent a citizen of another from selling and shipping liquors into it. In 1895, in the Income Tax Cases, 82 U. S., 429, it was held that the constitutional provision requiring direct taxes to be apportioned among the States according to their population rendered invalid a tax which was not so apportioned on incomes derived from real estate and as the direct product of personal property. And only recently were decided the Insular Cases, 128 U. S., 1, cases arising out of the conquest of Porto Rico and the Philippines, in which was considered the power of Congress to govern territories acquired by war or treaty, and in which was affirmed to the largest extent the national power of the Republic. This list might be greatly increased, but enough have been cited to show the general character of the cases considered and determined by that court in upholding the idea of nationality. It has always strongly upheld the powers given by the Constitution to the nation, and at the same time protected the States in the powers reserved by that instrument to them.

At first the amount of business in the Supreme Court was small; now it is large. In 1801, the first year of Chief Justice Marshall's term, only ten cases were filed; from 1875 to 1880 there were 1953, or an average of more than 391 a year. While the act of 1891 diminished the number of cases that could come to the court, yet during the year 1900 401 cases were filed, and during the year 1901 383.

As heretofore stated, the court at first consisted of six members; it never has had at any time over ten, and now has but nine. The following is a list of the Chief Justices and also of the associate justices, as well as the States from which they were appointed: Chief Justices—John Jay, New York; John Rutledge, South Carolina; Oliver Ellsworth, Connecticut; John Marshall, Virginia; Roger B. Taney, Maryland; Salmon P. Chase, Ohio; Morris R. Waite, Ohio; Melville W. Fuller, Illinois. Associate Justices—William Cushing, Massachusetts; James Wilson, Pennsylvania; John Blair, Virginia; James Iredell, North Carolina; Thomas Johnson, Maryland; William Patterson, New Jersey; Samuel Chase, Maryland; Bushrod Washington, Virginia; Alfred Moore, North Carolina; William Johnson, South Carolina; Brockholst Livingston, New York; Thomas Todd, Kentucky; Joseph Story, Massachusetts; Gabriel Duval, Maryland; Smith Thompson, New York; Robert Trimble, Kentucky; John McLean, Ohio; Henry Baldwin, Pennsylvania; James M. Wayne, Georgia; Philip P. Barbour, Virginia; John Catron, Tennessee; John McKinley, Alabama; Peter V. Daniel, Virginia; Samuel Nelson, New York; Levi Woodbury, New Hampshire; Robert C. Grier, Pennsylvania; Benjamin R. Curtis, Massachusetts; John A. Campbell, Alabama; Nathan Clifford, Maine; Noah H. Swayne, Ohio; Samuel F. Miller, Iowa; David Davis, Illinois; Stephen J. Field, California; William Strong, Pennsylvania; Joseph P. Bradley, New Jersey; Ward Hunt, New York; John M. Harlan, Kentucky; William B. Woods, Georgia; Stanley Matthews, Ohio; Horace Gray, Massachusetts; Samuel Blatchford, New York; Lucius Q. C. Lamar, Mississippi; David J. Brewer, Kansas; Henry B. Brown, Michigan; George Shiras, Jr., Pennsylvania; Howell E. Jackson, Tennessee; Edward D. White, Louisiana; Rufus W. Peckham, New York; Joseph McKenna, California; Oliver W. Holmes, Massachusetts; William R. Day, Ohio. They hold office for life, and yet up to 1903 the average term of office of the Chief Justices had been 13 5-12 years, and of the associates 15 9-12 years.

That the work of the court has not only developed a national idea, but also has done much to give stability to republican institutions, is now conceded by all. See CONSTITUTION OF THE UNITED STATES; COURT; FEDERAL GOVERNMENT. Consult Curtis, *Jurisdiction of the United States Courts.*

SURABAYA, sōō′rȧ-bä′yȧ. The most populous residency in Java. Area, 2091 square miles. The soil is fertile and produces an abundance of rice, coffee, sugar-cane, indigo, and tobacco. Capital, Surabaya. Population, in 1897, 2,217,120.

SURABAYA, or **SOERABAYA**. The largest city in Java, and the capital of the Residency of Surabaya, situated in the eastern part of the north coast, at the mouth of the Kediri River, two days by rail from Batavia; latitude 7°12′ S., longitude 112°34′ E. (Map: East India Islands, D 6). It has regular steam communication with the other cities in the island and archipelago. It has a good harbor and strong fortifications and is the military and naval headquarters of the Dutch East Indies. The houses are generally separated by gardens. Simpang, the suburb, contains the home of the resident and a large hospital. The shipbuilding industry is important. The trade in rice, coffee, cotton, sugar, tobacco, and cocoanuts is very extensive. Population, in 1897, 142,980, of whom 6988 were Europeans, 121,075 natives, and 12,133 Chinese.

SURAKARTA, sōō′rȧ-kär′tȧ. A residency in the central part of Java, between Samarang and Surabaya. Area, 2404 square miles. The residency is one of the so-called independent States, and is governed by a native 'emperor,' who is subsidized by the Dutch and wholly under their control. Capital, Surakarta. Population, in 1897, 1,226,368.

SURAKARTA, or **SOERAKARTA**. The capital of the residency of Surakarta, Java, on the left bank of the Solo River and on the railway between Samarang and Surabaya (Map: East India Islands, D 6). It is the residence of the native prince, whose palace is directly opposite the great fort called Vastenburg in the middle of the city. Population, in 1897, 86,074.

SURAT, sōō-rät′. The capital of a district of the same name, Bombay, British India, 150 miles by rail north of Bombay and about 15 miles from its port, Swalli, at the mouth of the Tapti, in the Gulf of Cambay (Map: India, B 4). The town is surrounded on the landward side by a brick wall. It has numerous mosques and several Hindu and Parsi temples and the palace of the former Nawab of Surat. The Tapti, owing to a sand-bar, affords entry only to small vessels, and the commerce of Surat, which from the sixteenth century to the eighteenth century was very extensive, has been steadily diverted to Bombay. Surat is a place of military importance, with a castle dating from 1540, centrally situated on the river front, and a cantonment, the residence of a British military commandant and other dignitaries. Surat rose into importance as the spot whence the Mohammedans of Hindustan embarked on their pilgrimage to Mecca. In 1612 the English East India Company established a factory here, which for some time was their principal trading station in India. In 1759 the castle was made over to the English and in 1800 they assumed the administration of the town. Population, in 1901, 118,364.

SUR′BITON. A town in Surrey, England, on the Thames, one mile south of Kingston, with which its industries are identified. Surbiton common witnessed the last stand of the Royalists in the Civil War. Population, in 1891, 12,178; in 1901, 15,019.

SURDS. See IRRATIONAL NUMBERS.

SURESNES, sụ′rân′. A town of the Department of Seine, France, at the foot of Mont Valérien, on the left bank of the Seine, seven and a half miles west of Paris (Map: France, B 6). In 1593 a conference was held here which resulted in the adoption of Catholicism by Henry IV. Population, in 1901, 11,225.

SURETTE, sōō-rĕt′, THOMAS WHITNEY (1862 —). An American organist and composer. He was born in Concord, Mass., and studied music under Arthur Foote and J. K. Paine. In 1883 he became organist in his native town, and in 1894-96 was organist and choirmaster of Christ Church, Baltimore. In 1896 he became interested in the University Extension movement, and devoted most of his time to lecturing under its auspices on musical subjects. He also lectured on music at the University of the State of New York, Albany; at Oxford University, England; and at Mill Hill Abbey, London. As a composer he became known by his operetta *Priscilla* (1899), which has been frequently performed. In the same year he produced in Pittsburg a romantic opera named *Cascabel*, and also set Keats's *Eve of Saint Agnes* as a dramatic ballad.

SURETYSHIP (from *surety*, from OF. *surete*, *seurte*, Fr. *sûreté*, from Lat. *securitas*, freedom from care, from *securus*, free from care, from *se-*, apart + *cura*, care, anxiety). The engagement by which one person becomes legally bound to another for the liability of a third. It therefore involves three parties: the creditor, the principal debtor, and the surety. The distinction between this term and another which is often used interchangeably with it has been pointed out under GUARANTY (q.v.), and need not be repeated here.

It is generally held that surety agreements are subject to the ordinary rule of interpretation that a written contract is to be construed strongly against the party executing it. This will always be enforced when it appears that the language was chosen by the signer, whether he enters into the contract for his own benefit or for the benefit of a third person. Another important rule is that such contracts shall be interpreted so as to give effect to all of their provisions if possible.

After the contract is made it is the duty of the creditor not to enter into any binding engagement with the principal, modifying that contract, without the assent of the surety. The law favors the surety and protects him with much jealousy. Accordingly, if the creditor varies the terms of the original contract or changes securities put into his hands by the principal debtor, or discharges a co-surety, or gives time to the principal debtor, or negligently causes a loss to the surety, the latter will be discharged unless he has assented to this conduct of the creditor. If, however, the principal debtor or a co-surety is discharged from liability by operation of law, as by a discharge in bankruptcy, the surety still remains bound.

The rights of the surety may be considered under three heads. First: Against the principal debtor. As soon as the debt becomes due, the surety is entitled to call on him for exoneration. This relief is obtainable in a court having equitable powers, it being unreasonable that the surety should have such a cloud hanging over him. If the surety has been compelled by the creditor to pay the debt he is entitled to call on the principal for reimbursement; for the money paid by him was paid for the principal's use. Second: Against the creditor. As soon as the debt becomes due the surety may compel the creditor to sue the principal and collect the debt from him. In some of our States the surety is discharged from liability if the creditor does not sue the principal upon the surety's request. One who is surety for the honesty or good conduct of an employee is entitled to have the employee discharged from service for serious defaults or breaches of duty, or to be freed from his suretyship. Another and very important right of the surety is to have the benefit of all securities which the creditor holds against the principal. This is known as the right of subrogation (q.v.). Third: Against co-sureties. It often happens that one surety is compelled by the creditor to pay the whole debt, and that the debtor is worthless. In such a case the unlucky surety is entitled to call upon his co-sureties for contribution (q.v.). (See SUBROGATION.) Consult authorities cited under GUARANTY.

SURFACE (OF., Fr. *surface*, from Lat. *superficies*, upper side, surface, from *super*, above + *facies*, form, figure, face). The boundary between two portions of space. As a point in a plane is determined in general by two intersecting lines, so a point in space is in general determined by three intersecting surfaces. These surfaces may be plane, quadric, or of higher order according as their equations are of the first, second, or higher degree in the linear coördinates of the system. Thus in Cartesian coördinates (see COÖRDINATES) the general equation of the first degree in x, y, z, or $ax + by + cz + d = 0$, is represented by a *plane*. The general equation of the second degree in x, y, z, or $ax^2 + by^2 + cz^2 + 2fyz + 2gzx + 2hxy + 2kx + 2my + 2nz + d = 0$, is represented by a conicoid, or surface of the second order, also called a *quadric* surface. By a suitable transformation of coördinates the general equation of the second degree may be transformed into one or the other of the forms (1) $Ax^2 + By^2 + Cz^2 = D$ or (2) $Ax^2 + By^2 = Cz$. Surfaces having the symmetric equation (1) are symmetric with respect to the origin as a centre and are called *central* quadrics. Non-central quadrics are included in equation (2). If $A = B = C$, equation (1) takes the form $x^2 + y^2 + z^2 = K$ $(= r^2)$, the equation of the sphere (q.v.). The general equation (1) represents either an ellipsoid (q.v.) or an hyperboloid. If $D = 0$, and A, B, C are not all positive, equation (1) represents a conical surface whose vertex is at the origin. Equation (2) is represented by the surface of a paraboloid (q.v.).

A surface through every point of which a straight line may be drawn so as to lie entirely in the surface is called a *ruled* surface. Any one of these lines which lies on the surface is called a generating line of the surface. The cylinder, cone, hyperboloid of one sheet, conoid (q.v.), and the hyperbolic paraboloid (see PARABOLOID) are ruled surfaces. There are two distinct classes of ruled surfaces, those on which the consecutive generators intersect and those on which they do not. The former are called *developable* and the latter *skew surfaces*.

If the degree of the equation $f(x, y, z) = 0$ is higher than the second, the surface representing it will be of an order higher than the second. In discussing the properties of such surfaces, especially the nature of the surface in the vicinity of any given point, the equation of the tangent plane at that point is necessary. This plane is the locus of all tangent lines through the given point, and will meet the surface of the nth order in a curve of the nth degree, since each straight line meets this curve in n points. The point of contact of the plane with the surface will be a singular point on the curve. (See CURVE.) The section of any surface by a plane parallel and indefinitely near to the tangent plane at any point is a conic and is called the *indicatrix* at the point. Thus points of a surface are called elliptic, parabolic, or hyperbolic, according as the indicatrix is an ellipse, parabola, or hyperbola. If every straight line through a point (x', y', z') of a surface meets the surface in two coincident points, the point (x', y', z') is called a *singular* point. If the tangent lines at any point form a cone the point is called a *conical* point; if they form two planes the point is called a *nodal* point. Similar to the envelope of a family of curves, the envelope of a family of surfaces is the locus of the ultimate intersections of a series of surfaces produced by varying one or more parameters (q.v.) of an equation. The curve in which any surface is met by the consecutive surface is called the *characteristic* of the envelope. Every characteristic will meet the next in one or more points, and the locus of these is called the *edge of regression* or cuspidal edge of the envelope. The conditions for convexity and concavity, different orders of contact, and various other properties are best obtained from works on analytic geometry.

Consult: Monge, *Application de l'analyse a là géométrie* (Paris, 1795); Dupin, *Développements de géométrie* (ib., 1813); Plücker, *Neue Geometrie des Raumes gegründet auf die Betrachtung der geraden Linie als Raumelement* (Leipzig, 1868); Salmon, *Analytic Geometry of Three Dimensions* (4th ed., Dublin, 1882); Smith, *An Elementary Treatise on Solid Geometry* (3d ed., New York, 1891); Gauss, "Allgemeine Flächentheorie," in Ostwald's *Klassiker der exakten Wissenschaften* (Leipzig, 1900); Knoblauch, *Einleitung in die allgemeine Theorie der krummen Flächen* (ib., 1888). For a brief sketch of the history of the subject, consult Smith, "History of Modern Mathematics," in Merriman and Woodward's *Higher Mathematics* (New York, 1896).

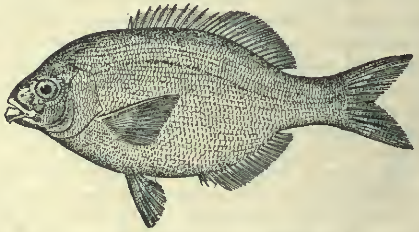
SURFACE, Joseph. A sentimental, plausible hypocrite in Sheridan's *School for Scandal,* Charles's elder brother, who pursued Maria for her fortune.

SURFACE TENSION. See Capillarity.

SURF-BIRD. A remarkable plover-like bird (*Aphriza virgata*) widely distributed on the coasts and islands of the Pacific Ocean, and common along the entire west coast of North America. It is about nine and a half inches long, dark ashy brown above, white beneath, everywhere more or less spotted, streaked, or barred with black. The feet are like those of a sandpiper, but the bill is plover-like, short and thick. The wings are very long and acute, reaching beyond the end of the tail when folded. It is clearly related to the turnstone (q.v.).

SURF DUCK, or Surf Scoter. See Scoter.

SURF-FISH. A fish of the suborder Halconoti and family Embiotocidæ, related to the percoids. Many species occur on the Pacific Coast of the United States, where they inhabit bays and the surf on sandy beaches. They are small, oval-oblong, compressed, and often very handsome, with stripes, spots, and effusions of various colors. Their flesh is not very highly regarded. The fact of greatest interest connected with them is that they are viviparous. One of the largest and most useful of the family is the 'alfiona' (*Rhacochilus toxotes*).



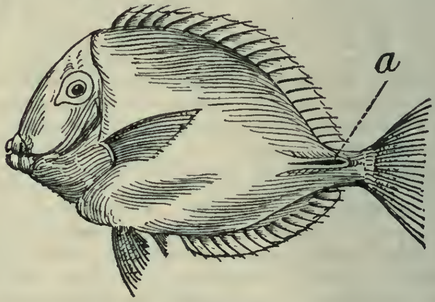
A SURF-FISH, THE ALFIONA.

SURF SMELT. A small, firm-fleshed, and fat smelt (*Hypomesus pretiosus*) of the coast of California and northward, valued as food. It spawns in the surf, and is netted in great quantities. See Plate of Whitefish, Smelts, etc.

SURGEON, Military and Naval. Appointments to the medical corps of the United States army or navy are made by the President of the United States upon recommendation of candidates by the surgeons-general of the army and navy, and after satisfactorily passing the examinations of the respective medical examining boards. Candidates for the army medical service must be between the ages of twenty-two and twenty-nine years; for the navy, between the ages of twenty-one and thirty. A candidate for either service must be a graduate of a regular medical school. Appointees are admitted to the service of the army and navy as assistant surgeons, with the rank of first lieutenant in the army and lieutenant (junior grade) in the navy. A surgeon in the army has the rank of major, and is required to have been an assistant surgeon at least five years. A surgeon in the navy has the rank of lieutenant and must have been an assistant surgeon for two years. Prior to regular assignment, United States army surgeons go through a five months' course at the Army Medical Museum, Washington, D. C.

The Royal Army Medical Corps of Great Britain differs from the United States in that it is a distinct branch of the service; the surgeons and enlisted men use the same distinguishing titles of rank as the combatant arms, and the officers prefix the word surgeon before the rank. They are under their own headquarters organization, and are rarely, even indirectly, subject to the authority of commanding officers of other branches. Members of the corps are armed and trained for military as well as medical emergencies. The Sanitary Corps of Germany and France are on similar lines to the United States, differing principally in the details due to general army organization. See Surgery, Military; Army Organization; Hospital; Hospital Corps.

SURGEON-FISH (so called from the lancet-shaped spine), or Sea-Surgeon. One of a family (Teuthididæ) of tropical Oriental fishes, of which about 80 species are recognized, and which feed upon seaweeds. Those best known are of the genus Teuthis, called 'barberos,' 'lancet-fishes,' 'tangs,' and so on, and characterized by the possession of a long, sharp, lancet-like spine on each side of the caudal peduncle. The spine is movable and shuts into a groove along the side of the tail.



SURGEON-FISH.
a, position of the lancet and its sheath.

SURGERY (OF. *cirurgerie, cirurgie, sirurgie,* Fr. *chirurgie,* surgery, from OF. *cirurgien, serurgien,* Fr. *chirurgien,* surgeon, from Lat. *chirurgus,* from Gk. χειρουργός, *cheirourgos,* surgeon, handicraftsman, from χείρ, *cheir,* hand + ἔργον, *ergon,* work). In contradistinction to medicine surgery embraces a consideration of those disease conditions that are treated chiefly by mechanical methods rather than by the administration of drugs. This classification is naturally arbitrary; and now that the dangers of surgical operations have so materially diminished, diseases formerly looked upon as hopeless or as suitable for medical treatment only are included among the surgical affections. It is incorrect, however, to assume that surgery consists entirely or even in great part in the elaboration of methods of treatment; the pathological processes so treated demand and receive their proper degree of investigation and study.

Up to the time of Hunter (1728-93) surgery, and indeed medicine, were based in their practice almost entirely upon tradition and dogma. Hunter, by his labors in the direction of anatomy and physiology, lifted medicine from the obscurity of philosophical doctrine to the firm foundation of facts and imparted an impulse that is still felt and is still in evidence in the methods of research employed to-day in the fields of comparative pathology and experimental medicine which promise most for the advancement of the medical and allied sciences. With Hunter's death, however, ended the active prosecution of original investigation; and although the high position of English surgery at that time was preserved by the clinical and other work of Hunter's successors, notable among whom are Charles Bell, Astley Cooper, Abernethy, and Jenner, the laboratory methods employed by him were largely abandoned and have only within relatively few years been revived. From Hunter's period to the introduction of anæsthesia there is no remarkable fact in the development of surgery. During this time the efforts of surgeons seem to have been directed chiefly to the perfection of the bedside methods and the influence of the profession in America began to make itself felt. Ephraim McDowell, a native of Kentucky and trained under Bell in Scotland, in 1809 first successfully opened the abdominal cavity and removed an ovarian cyst, thus establishing forever one of the most beneficial of operations. A little later Valentine Mott of New York successfully applied ligatures to some of the largest arteries, for the relief of aneurism, and demonstrated the curability of this disease in positions in which it had previously been invariably fatal. The introduction of general anæsthesia (q.v.) in 1846 by Warren in the Massachusetts General Hospital marks the greatest stride in the progress of surgery up to that time. This property of ether was discovered independently by Long of Georgia and Morton of Boston, but it remained for Warren to popularize it by making use of it publicly, repeatedly and with success. A year later Simpson of Edinburgh introduced chloroform. The propulsion to the practice of surgery given by the employment of general anæsthesia during operations can hardly be exaggerated. Before that time operative treatment of disease was limited in its application to lesions correctible by coarse methods and in briefest time. Human beings, surgeons and patients, could not endure the pain of protracted operations, nor could sufficient freedom from struggling be secured to make refined dissections possible. Under the influence of anæsthesia quiet was obtained and the necessity for great speed was greatly diminished, so that new operations were soon planned, new regions invaded, and detailed procedures devised and new and better results achieved. Even after the introduction of anæsthesia, however, operations and all open injuries continued to be looked upon with dread, for they were almost invariably followed by one or the other of the infectious wound diseases, and deaths from septicæmia, pyæmia, tetanus, hospital gangrene, etc., were so common that the mortality after even trifling operations was not small.

Pasteur then began the series of observations and experiments that finally enabled him to indicate the causes first of fermentation and then of wound diseases, and to identify some of the agents as members of the class of beings known collectively as bacteria. Lister seized these facts and applied them in surgery. His notion was that the infectious wound diseases were due to the deposit upon the raw surface exposed in open injuries of the bacteria floating in the air, and he therefore aimed at the sterilization of the air in the neighborhood of wounds during the course of operations, and at the exclusion of air from wounds during healing. The first was attempted by saturating the air in contact with wound surfaces with the vapor of carbolic acid, and from time to time flooding wounds with solutions of the same substance or of corrosive sublimate; the second object was accomplished by covering wounds during repair with dressings impregnated with the same antiseptics.

The effect was apparent at once in the results of operations, in lowered mortality, and in recoveries with fewer complications. This plan of treatment, properly called antiseptic, was found, however, to possess serious dangers to both surgeon and patient in the risk of poisoning by the powerful germicides necessarily employed, and the idea began to develop that it was more logical to prevent the inoculation of wounds by bacteria from any source than to attempt their destruction after they had gained entrance. Meanwhile the rapid growth of the science of bacteriology had reached a development that led to the identification of the bacteria causing the common wound diseases and had made surgeons familiar with their distribution, the modes of growth within and outside of the body, and the means of destroying them. The adoption of methods of conducting operations and treating wounds whose purpose was absolutely to prevent the inoculation of denuded surfaces and tissues by bacteria followed naturally, and now has become universal; and the methods have become so perfect that wound diseases due to bacteria are rare except after accidental injuries, and some of the most serious of them have virtually ceased to exist. Few men of the present generation of surgeons have seen hospital gangrene, for example, a disease which has been the cause of thousands of deaths.

The possibilities suggested by the relative freedom from danger with which operations were carried out were quickly appreciated by the medical profession, and the cure of disease by operative measures was soon extended to regions in which, previously, operations had been undertaken with the greatest misgiving, or not at all. In consequence, to-day the surgeon opens the cranial and spinal cavities, the thorax, the abdomen, and the joints with perfect confidence that no ill will result from the operation itself; and the benefits that have thus been secured in the relief of lesions of the viscera contained in these cavities cannot be adequately estimated. While the attention of the surgeons during the last two or three decades has been in great part directed toward the perfection of operative technique, progress in other lines has also gone on, and during this period the knowledge of the pathology of many surgical affections has been greatly widened, with corresponding refinements in their treatment.

Not the least important factor in the great progress which has been made in surgery and in medicine also is the method by which the subject is now taught, and the candidate for the degree of doctor in medicine is now qualified to undertake the management of the cases he may be called upon to treat. Up to twenty years ago the instruction to medical students consisted very largely of didactic lectures on the various branches of medicine, supplemented by clinics at which various diseases were demonstrated and their treatment indicated or carried out by the professors. The student but rarely came into contact with the patient. With the better appreciation of the value of laboratory methods of instruction in the natural sciences which were originally adopted by Hunter and revived and insisted upon by Huxley, they began to be utilized in medical schools, and were gradually elaborated until at present in almost every department the student gains his information and experience in that way. The result is that didactic lectures have been greatly diminished in numbers. During the first year of instruction the medical student is introduced in this way to normal human anatomy and physiology; in the laboratories he studies the gross and minute structure of the body and the functions of the tissues of which it is composed. During the second year he is taught by the same means the general process of deviation from the normal that constitutes disease. During the third year he studies specific instances of deviations from the normal and learns to identify them as particular diseases. At this time he is brought into contact with patients suffering with the diseases with which he has more or less familiarized himself in the laboratory and concerning whose causation and pathology he is fully informed, but whose symptoms and treatments he has yet to learn. The laboratory method is still pursued, but the dispensary and the hospital have now become for the student his laboratory, and it is in them during his fourth year that he spends the major part of his time. Thus up to the point of gaining experience in performing operations the student is as well instructed as he can well be. This field is well covered by the performance of operations upon the cadaver where practically all of the major and minor operations can be as well practiced as upon the living; and for special purposes operations can be carried out upon the dog.

As time has progressed and the treatment of diseases peculiar to particular regions has become more refined, special divisions of surgery have naturally arisen; and this specialization has contributed in no small degree to the rapidity of the development of surgery. There are now the well-recognized departments of ophthalmology, treating of diseases of the eye; otology, treating of diseases of the ear; rhinology and laryngology, treating of diseases of the nose, throat, and larynx; gynecology, treating of diseases of the female; genito-urinary surgery, treating of the diseases of the male; dermatology, treating of diseases of the skin; orthopædic surgery, treating of deformities growing out of diseases of the bones and joints. In the case of all of these specialties the feature that makes them departments of surgery is the fact that the diseases peculiar to each are treated by mechanical means, either by the application of fixed apparatus to be continually worn through long periods or by bloody or non-bloody procedures whose duration is brief.

Operations. The purpose in view in designing operations is very variable and scarcely admits of formulation with any accuracy. They may be planned in case of injuries to close superficial or deep-seated wounds, to stop bleeding, to facilitate the adjustment of broken bones or the reduction of dislocated joints, to remove foreign bodies, or to make disinfection and drainage easier. In inflammations operations may be required to evacuate pus, to establish drainage, or to remove inflammatory tissue. In case of tumors, operations are done for their removal. In deformities, operations may be required to restore the normal contour of the region. In the contemplation of a typical operation to be performed under average circumstances several factors necessarily come up for consideration in detail: (1) The operating room, instruments, dressings. (2) Preparation of the patient. (3) Preparation of the surgeons. (4) The operation. (5) After-treatment.

(1) *The Operating Room.*—This should be of good size, well lighted, and of a temperature of between 70° and 80° F. All furniture, carpets, and hangings should be removed, the walls and ceiling rubbed over with moist bread crumbs, and the floor scrubbed. The operating table should be made especially for the purpose. On each side of the table and at its head there should be one or two small tables, those on the operator's side for the instrument trays, those on the assistant's side for the sponges, towels, dressings, etc., and that at the head for the anæsthetics, stimulants, etc. On each side of the table there should be a large basin in which the hands of the operator and his assistant may be rinsed from time to time. The *instruments* vary with the character of the operation to be performed. They should be made entirely of metal to withstand the heating necessary for sterilization and as smooth as possible to avoid lodgment for bacteria. They are sterilized immediately before use by boiling for fifteen minutes in a 1 per cent. solution of sodium carbonate, and are then transferred to trays themselves sterilized by thorough washing in 0.2 per cent. solution of bichloride of mercury and lined by sterile towels. The *suture and ligature materials* are also sterilized, silk by being exposed to steam at about 250° F. for one hour, catgut by boiling in absolute alcohol under pressure for one hour. *Dressings* composed of absorbent material (usually cheese-cloth and cotton) and the pledgets of gauze with which the wound is kept free from blood during the progress of the operation are sterilized by being exposed to steam at 250° for one hour. The *basins, trays, and other receptacles* used during operations are sterilized by prolonged submersion in strong (0.2 per cent.) solutions of corrosive sublimate. The *solutions* used are 0.1 per cent. bichloride of mercury for the hands and towels; for douching wounds 0.6 per cent. solutions of sodium chloride are employed, sterilized by being boiled in cotton-plugged flasks for one hour on two occasions.

(2) *Preparation of the Patient.*—Twenty-four hours before operation the skin at the site

chosen for incision and for a wide area around it is thoroughly scrubbed and shaven and then covered by a soap poultice. Immediately before the operation the skin is again scrubbed, wiped off with spirits of turpentine, ether, and a 0.1 per cent. solution of corrosive sublimate in alcohol. If local anæesthesia is sufficient it is secured by the injection into the skin and subcutaneous tissues of dilute solutions of cocaine. If general anæsthesia is necessary, ether, chloroform, or nitrous oxide may be used, the choice depending upon the duration of the operation and upon the presence or absence of certain physical changes in the heart, blood-vessels, lungs, and kidneys. In any case the necessary restoratives must be at hand.

(3) *The Surgeons' Preparations.*—The surgeons' preparations consist in sterilization of their hands and forearms and in the assumption of gowns designed to prevent dust from settling from the clothing upon the wound, instruments, etc. Such gowns are of coarse cotton or linen, and extend from the neck to the feet; the sleeves only reach the elbow. They are sterilized by steam before using. The hands and forearms of all persons likely to handle the wound, instruments, dressings, etc., are thoroughly disinfected and the hands covered by thin rubber gloves previously sterilized by boiling.

(4) *The Operation.*—In addition to the procedures necessary to fulfill the purpose of the operation, the most painstaking care is exercised to exclude all bacteria from wounds, in aseptic operations; and to kill or remove the bacteria present, and to avoid the introduction of more bacteria, in antiseptic operations. Therefore, besides the elaborate preparations just described during the progress of an aseptic operation, much attention must be paid to cleanliness. (a) No substance—finger, instrument, sponge, or dressing—is allowed to come into contact with the wound unless previously sterilized. (b) Instruments, sponges, and the surgeons' and assistants' hands are rinsed in sterile solutions from time to time. (c) If, for any reason, hands or instruments become soiled, they must be resterilized before again coming into contact with the wound. (d) No antiseptic fluids are to be used in the wound. If any flushing at all is necessary, sterile salt solution only is allowable. For antiseptic operations, the same preparations are made, but here it is often advisable to use antiseptic rather than simple sterile solutions. Otherwise the precautions are the same.

The first step in so-called bloody operations is the division of the integument. This is done by cutting implements, as knives and scissors, or, sometimes, by the actual cautery, or the écraseur. Subsequent steps are accomplished in a variety of ways: To expose deep-seated tissues, retractors are used. To facilitate dissection, various forms of forceps are used. To puncture cavities, hollow needles and trocars are used. To scrape out tissue, sharp spoons are used. To divide bones, saws, chisels, and strong cutting forceps are used. The division of tissue involves more or less bleeding. To prevent bleeding, in operations upon the extremities digital or instrumental compression of the afferent arteries is practiced, or the afferent artery may be ligated as a preliminary step. During the progress of the operation the 'bleeding points'—ends of the vessels—are seized by clamps, and then ligated with catgut. General oozing is controlled by packing the wound with dry gauze, or by flushing it with very hot salt solution, or by touching the surface with the actual cautery, or by elevating the part. At the end of the operation it remains to treat the wound so as to secure healing in the shortest possible time, and with a minimum scar, i.e. to secure union by first intention. For this purpose every obstacle to such union is removed. (a) Bleeding is absolutely stopped. (b) Foreign bodies, including bacteria, are removed. (c) The walls of the wound are brought into close contact and no 'dead spaces' allowed to remain. (d) Drainage is provided for, i.e. vents established for the escape of wound secretions. (e) The wound is protected from possible bacterial invasion, and the wounded tissues supported and immobilized by dressings.

(5) *After-Treatment.*—After the dressing has been applied, the patient is moved to his bed and allowed to recover from the anæsthetic. Morphine is often given to diminish vomiting and to mitigate anticipated pain. General symptoms, as shock or acute anæmia, are treated if they exist. No food or drink is given by the mouth until the nausea and vomiting caused by the anæsthetic have ceased. Then small but increasing quantities of milk or beef-juice are given until the desired diet is taken. If there is retention of urine, the bladder is emptied with the catheter. The bowels are to be moved by the second or third day after operation. Drains are removed in two to five days. Sutures are removed in five to seven days. If suppuration, due of course to bacteria, develops, the particular inflammation excited is to be treated as indicated by its characteristics.

From what has just been outlined it is obvious enough that all of the conditions looking toward the successful issue of a serious operation can be secured only in hospitals of first-class equipment; and it is to be noted that this fact is becoming so generally known that hospitals of the first class are being established and operated not only in the larger cities of this country, but also in the smaller ones and even in villages. Institutions of this kind are of benefit to the communities in which they exist and by which they are supported in many ways. They furnish at a nominal cost, or very often without charge, care for the sick poor that could be supplied in no other way; and the well-to-do may find in them facilities for the treatment of disease and particularly for the conduct of operations that cannot be secured even in their own homes. For the community at large they are also of the greatest value, since they afford for the medical men who serve in the hospitals a field which amplifies their experience indefinitely. Again, in the larger cities where medicine is taught as before outlined the hospitals may be regarded as parts of the laboratory system. The wards are the places in which the student finally gains his practical experience in the recognition of particular disease forms and the treatment of them.

SURGERY, Military. The best civil have proved the best military surgeons, as is shown by the great names in surgical history, Ambroise Paré, Larrey, Pirogoff, Von Bergman, Von Esmarch, Billroth, and Lister. Not until the discovery of asepsis and antisepsis was the true foundation laid for the modern treatment of gunshot wounds. This discovery so radically changed all former methods of treatment as to lead to the now thoroughly established maxim formulated by Senn in the recent war between the United States and Spain, "The fate of the wounded rests in the hands of the one who applies the first dressing." The lesson has only recently been learned that bullet wounds must never be touched on the field—much less explored by probing or otherwise—before the first aid (antiseptic) dressing is applied. Operative interference is justifiable on the battlefield only in cases of extreme urgency, where extensive hemorrhage exists, or where the wound is in the region of the throat and suffocation is imminent. As a rule gunshot wounds are bloodless. Primary hemorrhage, unless resulting from the very rare accident of cutting some large vessel, is usually absent altogether, or can readily be controlled by a compress or first aid bandage. Especially in wounds of the abdomen the law of non-interference applies with double force. In the Spanish-American War 50 per cent. of all the cases of abdominal wounds unoperated upon recovered, while all operated upon died. In the Russo-Turkish War, that great apostle of conservatism in military surgery, Von Bergman, by the use of occlusive dressings, immobilization of the limb, and antiseptic precautions, saved thirteen out of fourteen cases of severe gunshot wounds of the knee-joint complicated with extensive comminution of the bone, while of similar cases treated by the old method of exploration without antiseptic precaution 95 per cent. died.

Observations during the recent Spanish-American War and the Boer War have led to the following deductions: (1) Small-calibre bullet wounds are usually aseptic and heal promptly. (2) Jagged and extensive wounds, poisoned by such missiles, are due to the detachment of the jacket, the introduction into the bullet of foreign particles (such as cloth, buttons, etc.), lateral impingement of the bullet, or ricochet. (3) Owing to the small diameter of the bullet and its great velocity, the orifices at entrance and exit are minute, and it is almost impossible to distinguish one from the other. (4) The cardinal principle has been established that manipulation of such wounds and probing on the field (except in the rarest instances) is surgical malpractice.

To Esmarch is really due the latest conception of the axiom *'laissez aller,'* and his first aid package is a memorial to his practical grasp of the principles of wound infection. The first aid package has been modified by Senn, of Chicago, who emphasizes his conclusions as follows: (1) First aid packages are indispensable on the battlefield in modern warfare. (2) The first aid dressing must be sufficiently compact and light to be carried in the skirt of the uniform, or on the inner surface of the cartridge or sword belt, to be of no inconvenience to the soldier or in conflict with military regulations. (3) The Esmarch triangular bandage is of great value in the school of instruction, but as a component part of the first aid package it is inferior to the gauze bandage. (4) The first aid package must contain in a waxed aseptic envelope an antiseptic powder, such as boro-salicylic powder; two strips of aseptic lintine, each 2½ × 4 inches; a triangular piece of gauze, the diagonal half of a square yard; sterilized pins wrapped in tin foil, and between this package and the outside impermeable cover, two strips of adhesive plaster an inch wide and eight inches long. (5) The first aid dressing must be applied as soon as possible after the receipt of the injury, a part of the field service which can be safely intrusted to competent hospital corps men. (6) The first aid dressing, if employed on the firing line, should be applied without removal of the clothing over the injured part, and fastened to the surface of the skin with strips of rubber adhesive plaster, the bandage being applied over and not under the clothing. (7) The first aid dressing must be dry and should remain so by dispensing with an impermeable cover of any kind over it, so as not to interfere with free evaporation of the wound secretion. (8) The first aid dressing should not be disturbed unnecessarily, but any defects should be corrected at the first dressing station.

Suppurating wounds from small-calibre bullets, having high velocity, heal with comparative promptness. Wounds from such bullets are necessarily more humane and less painful than those from the older missiles; but the relative percentage of deaths to wounded is but slightly reduced. Unless unusual complications call for immediate surgical interference, the injured should be removed as rapidly as possible to a well-equipped base or general hospital for treatment. Penetrating abdominal and thoracic wounds give a vastly larger pencentage of recoveries where non-interference has been observed. Laparotomy, except under the most favorable conditions, such as hold in well-equipped hospitals, is attended with great peril. The Röntgen ray has been of utility in indicating where surgical interference is justified and in many cases has averted infection which would result from probing or similar surgical procedures. It has also thrown light on the pathology of wounds involving the solid structures, and shown that the severest lesions of bones will progress toward recovery, provided the wound is sterile. It proved an invaluable aid in the Spanish-American War, in the Boer War, and in the Philippines, where it was used in general hospitals at the base of operations and on hospital ships; but it is not a practical apparatus near the firing line, where its use in the detection of bullets could only prove an incentive to premature operations. The modern jacketed bullet is practically aseptic; there is never urgency for its removal except where aseptic technique is possible, otherwise infection of the wound is an inevitable consequence. The Röntgen ray was also of especial scientific value in gunshot fractures by showing the character of the bone lesions, the form of the fracture, and the amount of bone comminution by small-calibre bullets, fragments of shells or other missiles, conditions that could not have been otherwise determined in the living body, thus also proving an important factor in developing the principle of conservatism in surgery of war.

It is to Pasteur and Lister that military surgery owes its greatest debt. They have simplified its labors and taught the great lesson of non-interference. The soldier who falls on the battlefield from the effect of a ball passing through any but a vital part of his anatomy and who has a 'first-aid' dressing promptly applied and is then transported to a general hospital where the Röntgen ray and the principles of asepsis and antisepsis can be utilized, has a far greater chance of recovery than when his wounds are treated on the field. By following these conservative methods in the Spanish-American War the percentage of recoveries was 95.1 per cent., while 4.9 per cent. died, a ratio never before attained in the history of warfare.

The medical corps of different armies vary little in their personnel. There is one surgeon-general; a chief surgeon to each separate army corps, division, brigade, and general hospital; a surgeon and two assistants to each regiment; and a single surgeon with each battery or separate detachment. These are all commissioned officers. The hospital corps comprises the hospital stewards and their assistants, privates often selected to serve as pharmacists, orderlies, nurses, cooks, litter-bearers, and ambulance-drivers, and should equal four per cent. of the fighting force of the army. In addition to a canteen, the United States Hospital Corps men carry a corps pouch and an orderly pouch. The corps pouch contains aromatic spirits of ammonia, first dressing packets, wire gauze for splints, gauze bandages, rubber bandages, surgical plaster, scissors, pins, forceps, and knife. The orderly pouch contains chloroform, antiseptic tablets, pocket case, ligatures, hypodermic syringe, etc. Medical and surgical chests used on the march or at the front should contain, as stated by Surgeon-General Forward, United States Army, "surgical material mainly, and very little medicine, which may be for the most part in tablet form. The principal articles are splints and modern wound dressings, including plaster rollers, and rubber plaster for rapid fixation of splints; a light complete operating set, tin trays, basins, and cups in nests; chloroform and inhaler; rubber tubing, needle, and canula; and pure sodic chlorid for transfusion; mercuric bichlorid, tricresol, iodoform, soda, and green soap; rubber bandage and rubber gloves; hypodermic syringe and full sets of tablets; purgative pills, quinine, and a few other medicines; concentrated food and stimulants; small case of 'tools in the handle,' and a lantern. The dressings consist mostly of bichlorid and iodoform gauze, absorbent cotton, and gauze bandages. They should be in small parcels, compressed, and wrapped in strong waterproof paper, to save waste and contamination, and for convenience in transportation, handling, and distribution."

The same general directions, relative to (1) the operating room, covering, instruments, and dressings; (2) preparation of the patient; (3) preparation of the surgeons; (4) the operation; and (5) after-treatment, that apply in general surgery (as stated in the article SURGERY) apply also to military surgery at the base hospitals, and successful results will follow in exact proportion as these details are carried out. It is not therefore to any special training in surgical technique that the military surgeon will owe his triumphs. History has shown that more campaigns have been decided by disease than by the sword. Statistics of wars for the past hundred years, while varying in some particulars, have concurred to establish the fact that for every soldier killed in battle there are five wounded who recover. The introduction of modern weapons with the compound metal-jacketed small-calibre balls of high velocity and great range, has shown no perceptible change in the proportion of these figures, viz. one killed to five wounded. It is also an established fact that for every man killed in action or who dies from the results of wounds, at least five die of disease that is almost invariably of a preventable character. In the American Civil War (1861-64) 100,000 were killed, and over 400,000 died from disease. These proportions were higher in the war of the Crimea and also in the Mexican War; and in the Spanish-American War, although actual hostilities only lasted for a period of six weeks, the proportion of losses by disease was even higher still.

When these appalling figures are properly recognized, and the advantages of extreme conservation on the field is appreciated, the true field of the military surgeon will be found. He must possess executive ability and a certain amount of military training, so that in time of action he can quickly organize his assistants and hospital corps, seeing that the wounded are brought promptly from the firing line to the first dressing station. This should be located at the nearest protected spot to the firing line. Here the wounded man can receive such immediate attention by the surgeon or an assistant as is imperatively demanded; dressings if out of place can be readjusted; in case of fractures or joint injuries the limb can be immobilized in splints, and the soldier can rest until transported by ambulance or otherwise to the field hospital, which should be located well in the rear. Here the case can receive thorough attention, and later be transported to a general or base hospital, a hospital ship, or a civil hospital, as is deemed most advisable. The problem of rapid transportation of the wounded is one that should engage much attention. Splendid results in the development of this feature were attained in the war with Spain, by the hospital ships and fast railway train in charge of the surgeons of the American Army, and many valuable lives were saved in consequence.

But it is at times when the army is not in action that the responsibilities of the military surgeon are greatest. In order to prevent the invasion of that deadlier foe, whose fatalities in every year are never less than five times greater than those killed in battle, he must prove himself a keen sanitary engineer in the selection of camp sites, of camp drainage, of the location of latrines; in the inspection of all water supplies, the quality of food and its cooking, and of the soldier's clothing and his personal cleanliness. He must be an epidemiologist and a bacteriologist, as well as a student of dietetics and metabolism. Terrible epidemics of typhoid fever, cholera, dysentery, and diarrhœa have resulted from flies carrying disease germs from unsavory places to the mess-hall, or through the drinking of polluted water. The parasite of malaria and of yellow fever is transmitted through the medium of the mosquito, that of tuberculosis through the sputum. (See INSECTS, PROPAGATION OF DISEASE BY). The iron-clad ration of the soldier has at times led to starvation or scurvy, or has proved an excitant to intestinal disease. With all these problems the military surgeon must be prepared to wrestle, especially when he is with newly recruited troops, unaccustomed to the rigorous discipline of army life, or when stationed in tropical climes. The normal condition of the soldier is health; disease and premature death are to a large extent unnecessary. "They are to be overcome, however, not by the abrogation of the intellectual faculty, but by its exercise."

SURGICAL ASSOCIATION, American. A society founded in 1880 for the primary purpose of cultivating and improving the science and art of surgery. The active membership is limited to 125 fellows; the honorary membership to 25 fellows. An applicant to be eligible for fellowship must be thirty years old, a graduate of five years' standing from a recognized medical college, and have an established reputation as a practitioner, author, or investigator. The meetings of the association are held annually. Every third year the association joins with the constituent associations of the Congress of American Physicians and Surgeons in a meeting held in Washington, D. C. An annual volume of *Transactions* is published containing the papers presented at each meeting.

SURICATE. The meerkat (q.v.).

SURIGAO, so͞o'rē-gä'ō. A province of Mindanao, Philippine Islands, occupying the northeastern portion of the island, and bounded on the west and south by the provinces of Misamis and Dávao (Map: Philippine Islands, K 11). Area, 13,201 square miles. The greater part is covered with forests, and the river forms almost the only means of communication, most of the towns being situated on its banks. Cotton, hemp, rice, sugar, and tobacco are raised, and betelnuts and cocoanuts are exported. Population, estimated in 1901, at 85,125, largely Visayans. Capital, Surigao (q.v.).

SURIGAO, Strait of. The strait connecting the Sulu Sea with the Pacific Ocean, extending between the island of Mindanao on the south and the islands of Negros, Cebu, Bohol, Leyte, and Samar on the north (Map: Philippine Islands, K 10).

SURINAM, so͞o'rē-näm'. A river of Dutch Guiana. It rises in the south central part of the country, and flows northward, emptying into the Atlantic Ocean through an estuary three miles wide, on whose shore lies the town of Paramaribo. Length, 400 miles. It is navigable 40 miles for the largest vessels, and 100 miles for ships drawing 10 feet. Near its mouth it is joined by the Cottica River, a navigable channel running 100 miles parallel with the coast and connecting with the mouth of the Maroni.

SURINAM, A Dutch colony in South America. See Guiana.

SURINAM TOAD. See Pipa.

SURMULLET (OF., Fr. *surmulet*, from *sur*, *sor*, *saur*, reddish + *mulet*, diminutive of *mulle*, from Lat. *mullus*, red mullet). One of certain species of mullets found for the most part in the tropical seas. The striped red surmullet (*Mullus surmuletus*), attaining a weight of six to eight pounds, is sometimes abundant on the coasts of Europe. A very similar species (*Mullus auratus*), about eight inches long, occurs along our Atlantic coast, particularly toward the south. See Plate of Mullets and Allies.

SURNAME (OF., Fr. *surnom*, from ML. *supernomen*, surname, additional name, from Lat. *super*, above, over + *nomen*, name). In modern usage, the family name, as distinguished from the given or individual name. Many are based on personal peculiarities, as William Rufus, John Lackland, and are consequently originally mere epithets. Another class is patronymic, indicating of whom the person bearing the name is a son. Here belong the numerous names like Johnson, Thompson, Williamson. This form of surname prevailed especially in Scandinavian countries, and survived in Denmark until the middle of the nineteenth century, when it was replaced by the system of family names. A third class is given by the occupation or place of residence. Surnames were not generally used as family names until the thirteenth century. See Cognomen.

SURPLICE (OF., Fr. *surplis*, from ML. *superpelliceum*, surplice, from Lat. *super*, above, over + ML. *pellicia*, fur garment, *pelisse*, from Lat. *pelliceus*, made of skin, from *pellis*, skin). A linen vestment worn in the Roman Catholic Church by all ecclesiastics in choir except the officiants of the mass, and by the clergy of the Anglican communion; also, in both churches, by laymen and boys who sing in the choir or assist at the altar. The shape of the vestment in mediæval days was long and flowing; the modern tendency has been to reduce its size so that it usually comes little below the waist. The Italian name *cotta* is frequently applied to the modern vestment.

SURRENDER. In law, the giving up or abandonment of an estate for life or years in real property to the person next entitled to the remainder or reversion, with intent to merge the lesser estate in the greater. This differs from *renunciation* (q.v.) which is practically the refusal to receive an estate to which one is legally entitled. A valid surrender can only be made by an adult person of sound mind. Under the Statute of Frauds in most States, a surrender *in fact*, that is, by agreement, can only be made in writing. Thus, the mere cancellation or destruction of the instrument creating the estate will not operate *ipso facto* as a surrender. However, a surrender may take place by operation of law. Thus, where the landlord accepts another person as tenant; where the landlord takes possession of the premises to his own use; or where the tenant accepts a new lease for the same premises, these acts will be construed as a surrender by operation of law. The legal effect of a surrender is to terminate the relation of landlord and tenant, and to discharge the latter from liability for future rent, though not for rent already accrued. See Landlord and Tenant, and authorities there referred to.

SUR'REY. A southeastern inland county of England, bounded on the north by Middlesex, and on the east by Kent (Map: England, F 5). Area, 758 square miles; population, in 1891, 1,731,343; in 1901, 2,008,923. The surface is hilly and diversified, with a northern slope toward the Thames. The principal streams are the Mole and Wey, tributaries of the Thames. The northern half of the county along the valley of the Thames is fertile and largely cultivated, hops, wheat, and the ordinary crops being raised; market gardening constitutes a lucrative industry. In the west and southwest the land is to a great extent covered with heath. The numerous manufactures include silk, cloth, leather, paper, pottery, and beer. Lambeth, Southwark, and other portions of southern metropolitan London are in the county, which is a favorite suburban residential section of London business men.

SURREY, Henry Howard, Earl of (c.1517-47). An English soldier and poet, son of

Lord Thomas Howard, affirmed third Duke of Norfolk. His youth was spent in France, and at the Court of Henry VIII., and he received a careful classical education. He was made a knight of the Garter in 1541, and in 1543 joined the English army in France, where by his gallantry and feats of arms he gained the title of field marshal. He captured Boulogne, was made its Governor, and gained other victories, but was recalled to England after some slight reverses at Saint-Etienne. His influence at Court was no longer so powerful as in the life of his youthful friend and companion the Duke of Richmond, Henry's natural son, and charges of treasonable ambition in aspiring to the royal succession were constantly urged against Surrey and his father by the Hertford faction. In 1546 the two were arrested; Norfolk was sent to the Tower, and Surrey, on the most trivial charge, was beheaded in 1547. Though not primarily a man of letters, his work in that field left a more abiding impression than his exploits as a soldier. He wrote many amatory verses and elegies in the Italian manner, but his chief service to English literature lay in the insight with which he enriched its poetry by the introduction of the verse forms which had already received a higher development in Italy. His translation of two books of the *Æneid* gave the language its most powerful and characteristic poetic form, blank verse; and the sonnet which Shakespeare used, consisting of three quatrains and a couplet, was also introduced by Surrey. The peculiar excellence of his work was in the insight with which he not only adopted but also adapted these forms, making them harmonize with the genius of the English language. The best known edition of his verse and that of Wyatt, including a memoir, is by Nott (London, 1815-16; new ed. 1871); there is also the Arber reprint of *Tottel's Miscellany*, in which the work of both of them first appeared. Consult also an essay in Hales, *Folia Literaria* (London, 1893).

SURROGATE (Lat. *surrogatus*, *subrogatus*, p.p. of *subrogare*, *surrogare*, to substitute, from *sub*, under + *rogare*, to ask). A judicial officer having jurisdiction over the probate of wills, the administration and settlement of decedents' estates, and in some States the power to appoint and supervise guardians of infants and other legally incompetent persons. As the derivation of the name indicates, a surrogate was formerly the substitute or representative of another official. Originally in England the ecclesiastical courts had jurisdiction of all the matters above mentioned, and as their business increased it became necessary for the bishops to delegate some one to act in their places. These substitutes were at first ecclesiastical, and at a later period lawyers, and were known as surrogates. In 1857 the probate jurisdiction of the surrogates was transferred to the Court of Probate and Divorce.

Prior to the Revolution the Governors of the various American colonies were accustomed to appoint surrogates to represent them in matters of probate and administration of estates. In New York and several other States to-day the surrogate of a county is an independent judicial officer. The jurisdiction of a surrogate is usually confined to the probate of wills, the administration of the estates of persons dying intestate, and the appointment of guardians for infants and other incompetent persons. Incidentally they must hear contests of wills, and controversies over the descent and distribution of property of decedents. They exercise a close supervision over the conduct of guardians' affairs, and the latter may apply to them for advice in case of doubt on any matter pertaining to their trusts. Proceedings before a surrogate are conducted with practically the same formality as in other courts. An appeal from the decisions of surrogates will lie to appellate courts. Surrogates correspond to probate judges and judges of widows' and orphans' courts in some States. See COURTS; PROBATE COURT; and consult the authorities there referred to.

SURTEES, sûr'tēz, ROBERT (1779-1834). An English antiquary, born at Durham. He graduated B.A. from Christ Church, Oxford, in 1800; then studied law at the Middle Temple. On the death of his father (1802) he gave up the law and settled on the family estate at Mainsforth, a small village in the County of Durham, where he lived in retirement. Surtees devoted his life to his *History of Durham* (vol. i. 1816; vol. ii. 1820; vol. iii. 1823; vol. iv., ed. by James Raine, 1840). This is a careful and exhaustive work, and is written in a readable style. Surtees was also an adept at composing ballads which were playfully palmed off as ancient. Scott himself was deceived by *The Death of Featherstonehaugh*, which was inserted in the *Minstrelsy of the Scottish Border*. As a memorial, the Surtees Society was established in 1834 at Durham for publishing unedited manuscripts bearing on the history of the northern counties of England from the earliest period to the Restoration. Consult the *Life of Surtees*, by G. Taylor (Surtees Society, Durham, 1852).

SURVEY. See SURVEYING; GEODESY; COAST AND GEODETIC SURVEY, UNITED STATES; GEOLOGICAL SURVEY, UNITED STATES.

SURVEYING (from *survey*, from AF. *surveer*, *survoir*, from Lat. *supervidere*, to overlook, oversee, from *super*, above + *videre*, to see). The art of ascertaining by measurement the shape and size of any portion of the earth's surface, and representing the same on a reduced scale on maps in a conventional manner. Surveying is supposed to have originated in Egypt, where property boundaries were annually obliterated by the inundations of the Nile. In Rome surveying was considered one of the liberal arts, and the measurement of lands was intrusted to public officers (*agrimensores*) who enjoyed certain privileges; and it is probable that the system of measurement practiced by them was similar to the cruder methods of plane surveying practiced at the present time. The higher development of surveying method is of comparatively recent date.

Surveys are broadly separated into two classes, determined by the extent of the area surveyed. Most surveys comprise the measurement of comparatively small areas in which all practical refinements are met if we consider the areas absolute planes, neglecting the curvature of the earth's surface. The methods of measuring such areas is usually denominated plane surveying. Certain surveys of modern times, however, include areas so large that it is necessary to take into account the curvature of the earth's surface, and the methods of measuring such areas are termed geodetic surveying or geodesy (q.v.).

Briefly summarized, plane surveying includes land surveying, topographic surveying, and hydrographic surveying (see HYDROGRAPHY), mining surveying, railway surveying, and city surveying. Geological surveying is a development of topographical surveying in which the outcrops of the earth's rock formation are located and denoted on topographical maps. Geodetic surveying is a class by itself, as is also photographic surveying (q.v.).

PLANE SURVEYING.

LAND SURVEYING. As at present practiced all surveys of land, properly so called, are made: (1) to establish certain monuments, corners, lines, and boundaries, so as to lay out and divide land; or (2) to identify and locate such monuments, lines, and boundaries after they have been established, as in all resurveys for location and area. In all cases of land surveying the boundaries and dividing lines are the traces of vertical planes on the surface of the ground, and the area is the area of the horizontal plane included between the bounding vertical planes. In other words, the area sought is not the real surface, but the horizontal projection of that surface. In laying out land, the work consists in running the bounding and dividing lines over all the irregularities of the surface, determining their bearings and horizontal distances and leaving temporary and permanent marks. The bearing of a line is the horizontal angle it makes with a meridian plane through one extremity, and it is determined by means of a surveyor's compass. The length of the line is usually determined by measurement with a surveyor's chain. (See ENGINEERING INSTRUMENTS.) The marks by which the line is physically denoted are various, such as stones, stakes, holes, mounds, or trees, specially marked and described. These marks, whatever their character, are called monuments, and should be of distinctive and permanent character.

The true meridian of a place may be obtained by astronomical observations and the deviation of the magnetic meridian determined. This deviation is called the declination, or variation, of the magnetic needle. The compass is usually provided with a vernier-scale (see VERNIER) for turning off the variation so that the needle may indicate the true meridian if desired. An instrument called the solar compass, invented by Burt (1836), determines the true meridian by a single observation, the sun being on the observer's meridian. This instrument has been adopted by the United States Government for use in surveying the public domain. The declination varies from year to year and is an essential element to be recorded in the field-notes so as to enable the surveyor at any future time to retrace the original survey.

The system of laying out the United States public lands furnishes a good example of the methods of laying out land on a large scale. This system probably was devised by Gen. Rufus Putnam, of Revolutionary War fame, and was first used in laying out the eastern portion of the State of Ohio in 1786-87. The reference lines employed in these public land surveys are in each case a principal meridian and a base line, the meridian running, of course, north and south, and the base line running east and west. From the principal meridian and its accompanying base line guide meridians are run north and south from the base line 24 miles apart, and standard parallels are run east and west from the principal meridian 24 miles apart. These lines are run with great care, the solar compass being employed. Every mile is marked by a monument and is called a 'section corner,' and every sixth mile has a different mark and is called a 'township corner.' From each township corner on any standard parallel, auxiliary meridians are run north to the next standard parallel. Since these meridians converge somewhat toward the principal meridian, they will not be quite six miles apart when they reach the next standard parallel, and, therefore, to run the next series of auxiliary meridians north, the start is made not at the points where the first series terminate, but at the six-mile points previously marked off. Where the auxiliary meridians have been lined out, the land is divided into a series of strips running north and south, and six miles wide. These are called 'ranges.' The next step is to cut these ranges transversely by running east and west lines at six-mile intervals. The land is thus divided into squares measuring six miles on each side. These squares are called 'townships,' and each contains 36 square miles, or 23,040 acres. The next step is to run meridians and parallels one mile apart to divide the township into 36 sections. Monuments are set at intervals of one-half mile on the lines to divide each section into quarter sections. The quarter section is the smallest primary division of the public land surveys.

The determination of areas between known boundaries is accomplished in several ways, but the one commonly used consists in determining the bearings and lengths of the outside boundary lines. This is done by beginning at one corner and running around the area to the starting point, and observing the bearing and measuring the distance of each boundary line in the order in which it is encountered. To illustrate reference will be made to the diagram, in which the lines A B C D E represent the boundary of a field of land whose area is required. Beginning

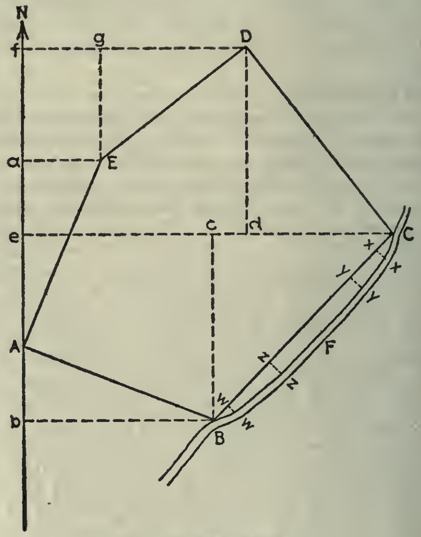


DIAGRAM OF A SURVEY.

at A, the surveyor proceeds around the field obtaining by his compass the bearings, and by measurement with a surveyor's chain, the lengths, of the lines A B, B C, C D, D E, and E A, one after the other in the order named. This being done he states these bearings and distances on paper, giving the figure A B C D E shown by the sketch. He next draws a meridian line NS through the westernmost corner of his boundary, and draws the various perpendiculars shown by the broken lines. These perpendiculars represent what are known as the latitudes of the several lines; thus for line DC, dD is the latitude, Dc is the departure, and $(f\mathrm{D} + d\mathrm{C})$ is the double meridian distance. Knowing the bearings and lengths of the various courses by simple trigonometrical calculation, the surveyor is enabled to calculate the latitudes, departures, and double meridian distances. This being known, the following rule is used for calculating the area: Twice the area of the figure is equal to the algebraic sum of the products of the double meridian distances of the several courses into the corresponding latitudes, north latitude being reckoned positively and south latitude negatively. Expressed symbolically, for the figure shown, this rule is as follows: $2\mathrm{A} = (b\mathrm{B} + e\mathrm{C})\ \mathrm{B}c + (e\mathrm{C} + f\mathrm{D})\ \mathrm{D}d - (b\mathrm{B})\ \mathrm{A}b - (a\mathrm{E})\ \mathrm{A}a - (a\mathrm{E} + f\mathrm{D})\ \mathrm{E}g$. It may often happen that one boundary of a field is not a right line, but is an irregular curved line such as the course of a stream C F B instead of by the right line B C. The area of this field is then the area of A B C D E plus the area of C F B; the surveyor when measuring the line B C measures two or more perpendiculars such as *xx*, *yy*, *zz*, and *ww*, known as offsets and extending from the line B C to the stream. These perpendiculars divide the area C F B into a number of small areas each of which approximates closely a simple trapezoid or triangle whose area is easily determined and the sum of whose areas is the area of the total tract. There is of course a slight error in this method, but it can be made so small by an experienced surveyor as to be practically negligible. Systematic methods have been devised for making field notes so as to include a register of the topographical features incident to the chain lines, the relation of these lines one to another, and a description of monuments sufficient to identify the lines in the field. A column is usually taken in the centre of each page of the field-book to represent the chain line, and the necessary notes are entered on either side. These notes if properly kept enable the surveyor to execute a topographical map of the territory surveyed, and to calculate its area.

TOPOGRAPHICAL SURVEYING. The topographical surveying of a region includes not only the character and geographical distribution of the surface covering, but also the exact configuration of that surface with reference to its elevations and depressions. Thus any point is geographically located when its position with reference to any chosen point and a meridian through it is found, but to be topographically located its elevation above a chosen level must also be known. In making a topographical survey, therefore, the following processes are carried out. First, one or more reference points, according to the area, are geographically located; second, a series of precise levels are run to establish marks at certain intervals whose elevations are computed with reference to a common datum; third, from these established points and elevations the locations and elevations of the surface points are established by one of several methods. The final process is to plat on a map by means of conventional symbols the location of all surface objects and the elevations and depressions of the general surface. See Topographical Map, accompanying MAP.

In the topographic work of the Geological Survey, and in fact in the work of all the United States Government Surveys, the reference point for geographical location is astronomical position and the datum for all elevations is mean sea level. The various reference points are connected by means of a system of triangulation, by which intermediate points are geographically located. Elevations are established by means of lines of precise levels starting from datum. On these as a skeleton the topographical survey proper is hung. The operation of determining an astronomical position consists, first, in the measurement of zenith distances of stars by means of delicate transit instruments for the determination of latitude; second, the exchange of telegraphic time signals between a known astronomical position and an unknown one for the determination of time difference, and hence the difference of longitude; and, third, the determination by astronomic observations on close circumpolar stars of the azimuth of a line, presumably a base line or side of a triangle. The measurement of a base line consists, first, in the selection of a site, the extremities of which are so situated as to permit of easy expansion by primary triangulation; second, the laying out of a site by running a line of spirit levels over it and of setting plugs or other stable measuring marks at fixed intervals; third, the ranging out of a straight line by transit or theodolite; and finally, the measurement of the length of the base by means of base bars, iced bars or steel tapes. The expansion of a system of primary triangulation consists, first, in a reconnoissance to select stations from which others are intervisible in such manner as to permit of the formation of a series of quadrilateral, pentagonal, or similar figures composed of well-conditioned triangles; second, the erection of signals and the marking of station positions by monuments; and third, the measurement of the angles at any one station to the others which are intervisible therefrom, by means of theodolites of high power. Finally, there remains the office computation whereby the lengths of the sides of the various triangles are determined, and by the aid of this and their connection with a known astronomic position and azimuth the geodetic position and coördinates of the various triangulation stations are computed. These or equivalent coördinates at important points on a traverse line are then platted on the topographic map sheets, and this furnishes the primary control for the extension of the secondary detail of the map.

The datum on which all of the representation of the relief by contours is based is mean sea level. In order that pieces of work separated by distances of 100 or 1000 miles may ultimately meet on sheet lines with homogeneity of vertical location, it has been necessary, first, to plan out series of primary triangulation for the control of the whole. These precise levels are connected with tidal gauges referred to the mean level of the sea. With these primary data in existence it is possible to commence field work in widely scattered areas, lines of spirit leveling of lesser precision being run throughout the area to be mapped at distances not exceeding six miles apart. Between these, at distances of one to three miles apart, according to the scale and contour interval, lines of flying or secondary levels are run with only such accuracy as will enable them to close upon the better levels within limits of one or two feet, an amount imperceptible in contours of 10 to 50 feet interval.

The three surveying bureaus of the Government, viz. the Coast and Geodetic Survey, the Engineer Corps of the Army, and the Geological Survey, are all engaged in running lines of precise levels throughout the country, as they are extending the related work of triangulation and topographical mapping. The skeleton of the survey being completed, the next task is to perform the topographical mapping. Starting with two or more primary triangulation stations within the area of the quadrilateral to be surveyed, a secondary scheme of triangulation is extended by plane table (q.v.) by which tertiary points are located with such frequency as to give an average of from one to three good locations per square mile, equivalent to the same number per square inch of map. Elevations are determined of all triangulation points, which are chiefly hill summits, by vertical angulation depending on spirit leveling. Also of all the lower relief of the country by lines of spirit levels run from three to six miles apart. Where the lack of surface relief or the density of forests is unfavorable to the execution of triangulation, the primary and secondary control consists of a system of primary traverses checked by astronomical positions or primary triangulation locations. A second system of horizontal control consists of odometer traverses of all roads and trails, or, where these are not sufficient, of stadia or taped traverses across country and about the shores of lakes and streams. These traverse lines are run by compass and plane table, and are plotted upon the board as the work progresses, and are adjusted upon the map, between the frequent locations resulting from the primary traverse or the plane-table triangulation. The distances between check points on such traverse are so relatively short, being one to four miles, that the error of location is hardly perceptible upon the scales of one or two miles to the inch, and an adjustment to the better positions becomes easily possible. The primary triangulation and precise leveling is executed a season in advance of the topographic mapping. The determination of secondary positions by plane-table triangulation, road and stadia traverse, and flying levels proceeds together a little in advance of the sketching of the map, but by members of the same party. The results of the adjustment and transfer of all traverse lines and level elevations to the secondary locations is a control or sketch sheet upon which are two to five triogonometric locations per square inch, from four to eight inches of road traverse per square inch, and an average of one to two instrumental elevations per square inch. Placing himself at a known position, the height of which is already determined, the topographer sketches, with the aid of hand level and by eye, the plan of the contour line passing through his position on the map, and it may be possible to locate this for a distance of half a mile, the equivalent of half an inch, in either direction. If the country be wooded it cannot be seen beyond his absolute position. Proceeding now over the road, preferably by vehicle, he stops at greater or lesser intervals, according to the amount of change of slope, carrying differences of elevation for short distances between check points by aneroid. When good elevations are insufficient more are procured by flying levels or by vertical angulation, as the work progresses. In this way a network of topographic contouring is built up everywhere along the lines of the roads, and these are frequently so near together that the contours meet and fill up the entire surface of the map. Otherwise the topographer walks in between roads, pacing distances if short, or runs stadia line, if necessary, and thus he fills in the interior of the road circuits and completes the map. This general method is necessarily much modified, according to the conditions.

Mining Surveying. Mining surveys are of two classes: (1) surveys to determine the surface location and boundaries of mining claims, and (2) underground surveys to determine connections, lay out work, establish the relations of the underground workings to the surface lines, points, and so on, and measure the ore removed or still in the mine. The surface methods employed are substantially land surveying methods as modified by the local and general mining laws. The underground surveys comprise carrying surface locations underground, lining on the galleries and shafts, running levels, etc., and laying out tramways and railroads. This work is ordinarily carried on much the same as it is on the surface.

City Surveying. The methods described in the section on land surveying are adequate to the needs of the city surveyor, except that, on account of the value of the land, greater accuracy should be secured. To this end, the transit instrument is used instead of the compass and the steel tape instead of the chain.

Bibliography. The literature of surveying is extensive. A concise technical treatment of the whole subject is contained in Johnson, *Theory and Practice of Surveying* (New York, 1900). Other books of equal value in their particular field are: Wilson, *Topographic Surveying* (New York, 1900); Merriman, *Precise Surveying and Geodesy* (New York, 1899); and *Geodetic Surveying* (New York, 1892); and Gribble, *Preliminary Surveys and Work Estimates* (London, 1897). The voluminous reports of the Coast and Geodetic Survey, the Geological Survey, and the Engineer Corps, United States Army, contain an enormous mass of information relating to their surveys throughout the United States. Many important articles on surveys and surveying are also to be found in the proceedings of the engineering societies and in the volumes of the principal engineering journals. See Geodesy; Map; Engineering Instruments; Engineering, Military; Photographic Surveying; Leveling; Coast and Geodetic Survey; Geological Survey; Plane Table; Stadia; etc.

SURVEYING, Marine. See Hydrography.

SURVEYS, National. See Geological Survey, United States; Coast and Geodetic Survey, United States.

SURVIVORSHIP. A term commonly employed to describe a doctrine prevailing in some jurisdictions to the effect that where two or more persons perish in the same accident or calamity there is a presumption of law that the stronger of them survived the others. This doctrine originated in the Roman and civil law, but generally no presumption exists in England or most of the United States, and a person seeking to establish the survivorship of one who lost his life with others in the same peril must do so by logical and relevant evidence as in any other case, or he will fail to sustain the burden of proof resting upon him. This proof need not be direct; the facts and circumstances may be shown if they furnish any reasonable basis for a conclusion. See PRESUMPTION; EVIDENCE.

SURVIVORSHIP, RIGHT OF. The right of a person holding a title jointly with another to succeed to the latter's rights upon his death, by operation of law. This right exists in case of joint tenancies, in the absence of statutes to the contrary; in a husband and wife where they hold real property as tenants by the entirety; and in surviving partners after the death of another for the purpose of winding up the business, and in some forms (tontine) of life insurance. See PROPERTY, LAW OF; JOINT TENANCY; PARTNERSHIP; INSURANCE.

SŪRYA, so͞or'yȧ (Skt., sun). In Hindu mythology, the god of the sun in its physical aspects. He is honored in the hymns of the Rig-Veda. (See VEDA.) All creatures depend on him, for he drives away disease and upholds the sky. He watches over mankind and beholds their deeds. His father is variously said to be Dyaus, the sky, or Indra (q.v.), or Soma (q.v.). On the other hand, he is the son of Aditi or of Ushas (q.v.), who is also regarded in other hymns as his wife, who bears the Asvins (q.v.). In later mythology Surya is the son of the sage Kasyapa and Aditi. He married Sanjna, who, overpowered by his radiance, left him, substituting for herself Chaya (Shadow). When he discovered this, he prevailed on his wife to return, and at his request his father-in-law, Tvashtar, the artificer of the gods, ground off one-eighth of his brightness, from which were made the disk of Vishnu (q.v.), the trident of Siva (q.v.), and other divine implements. He is still worshiped on the first Sunday of the month of Magha (January-February), although he has degenerated into a petty godling in modern times. Consult: Macdonell, *Vedic Mythology* (Strassburg, 1897); Wilkins, *Hindu Mythology* (London, 1900).

SŪRYASIDDHĀNTA, so͞or'yȧ - sêd - hän'tȧ (Skt., text-book of the sun). The earliest Hindu astronomy that has been preserved. It is written in verse and contains fourteen chapters, furnishing a complete system which remains the chief authority in India for the adherents of the Hindu science of astronomy. The work has been considerably altered in content in course of time. It is probable that Greek astronomy exercised some influence over this as over the succeeding Hindu works on this science. The *Sūryasiddhānta* has been published repeatedly in India, the best edition being that by Hall and Deva Sastri (Calcutta, 1859). It has been translated into English by Deva Sastri (ib., 1860), and by Burgess and Whitney in the *Journal of the American Oriental Society*, vol. vi. (New Haven, 1860). Consult Thibaut, *Astronomie, Astrologie und Mathematik* (Strassburg, 1899).

SU'SA (Lat., from Gk. Σοῦσα, *Sousa*, Heb. *Shūshan*, Pers. *Shūs*). The capital of the Province of Susiana or Elam in Persia, a royal residence, and one of the most important cities of the ancient East. The site, 21 miles southwest of Dizful, in the modern Province of Khuzistan, is on a hilly plateau between the Ab-i-Kerkhah (the ancient Choaspes) and the Shaur (the ancient Eulæus) (Map: Persia, C 5). It is marked by the so-called tomb of Daniel, a pilgrimage shrine of repute, which in reality is a comparatively modern Mohammedan mausoleum, and by the Kaleh-i-Shus (fortress or acropolis of Susa) with ruins that cover a space of about three miles and consist of three spacious artificial platforms more than 100 feet high. The name of Susa occurs on Assyrian monuments of the time of Asshurbanipal (B.C. 668-626), who captured it. At first under Babylonian dominion, it came, at the time of Cyrus, under Persian rule; and the Achæmenian kings raised it to the dignity of a metropolis of the entire Persian Empire. When Babylon had risen again to importance under Alexander and his successors, Susa gradually declined. In the Arab conquest of Persia it held out bravely for a long time, defended by Hormuzan. During the Middle Ages it was still inhabited and known for its manufactures of sugar. Excavations by Williams, Loftus, Churchill, Dieulafoy, and others, have revealed a citadel of semicircular form, and the remains of the extensive colonnade, with a frontage of 343 feet and a depth of 244 feet, of the great palace built by Darius Hystaspis (B.C. 521-485), and restored by Artaxerxes Mnemon (B.C. 405-362), after having been ruined by fire in the reign of Artaxerxes Longimanus (B.C. 465-424). Cuneiform inscriptions, friezes of lions and archers, finely colored, now in the Museum of the Louvre at Paris, and numerous other relics have been recovered. Consult: Dieulafoy, *L'Acropole de Suse d'après les fouilles exécutées en 1884, 1885 1886, etc.* (Paris, 1890-92); and Billerbeck, *Susa* (Berlin, 1892).

SUSA, so͞o'zȧ (Lat. *Segusio*). A city in the Province of Turin, Italy, 32 miles by rail west of the city of Turin, on the Dora Riparia (Map: Italy, B 2). It has a triumphal arch 44 feet high, dedicated, the inscription reads, in A.D. 8 to Augustus. It was formerly of strategic importance, being regarded as the key to the Alpine roads over Mont Cenis and Mont Genèvre. Population (commune), in 1901, 4957.

SUSA. A port of Tunis, on the Gulf of Hammamet, in the Mediterranean Sea. It is 32 miles east-northeast of Kairwan, with which it is connected by rail, as also with Tunis (Map: Africa, F 1). It is surrounded by old walls, and its lofty, ancient, and restored citadel is used as the French military headquarters. In the neighborhood are large plantations of olives and grapes. The roadstead is bad. Susa is on the site of the Roman city of *Hadrumetum*. Population, about 12,000.

SUSAN'NA (Gk. Σούσαννα, *Sousanna*, from Heb. *shūshan*, lily), HISTORY OF, also known as THE JUDGMENT OF DANIEL, and as SUSANNA AND THE ELDERS. One of three apocryphal additions to the Book of Daniel in the Greek Bible, the others being *The Song of the Three Holy Children* and *The History of Bel and the Dragon* (q.v.). The story of Susanna is as follows: In the early days of the Babylonian captivity there lived a woman, Susanna by name, who was celebrated for her beauty and her virtue. She was the wife of Joiachim, a wealthy and respected man, and daughter of a priest, Hilkiah. Two elders, who were also judges and held in high repute, were seized by desire for Susanna, and, meeting each other unexpectedly in Joiachim's garden, agreed to coerce her. Susanna refused to listen to them, and in revenge the elders accused her of adulterous relations with a young man who had fled when surprised by their sudden appearance. She was condemned to death on this evidence, but Daniel, then a very young man, appeared and undertook to prove Susanna's innocence. By questioning the witnesses apart and showing discrepancies in their testimony he succeeded. The people applauded Daniel and put Susanna's accusers to death. There is nothing to warrant the supposition that the story was originally written in Hebrew or Aramaic. In most manuscripts it precedes the first chapter of the Book of Daniel, and so we find it in the old Latin and Arabic versions; but the Septuagint, the Vulgate, the Complutensian Polyglot, and the Hexaplar Syriac place it at the end of the book, and reckon it as the thirteenth chapter. Consult: Ball, in the *Speaker's Apocrypha*, vol. ii. (London, 1888); Fritzsche, *Apokryphen* (Leipzig, 1871); Zöckler, *Apokryphen des Alten Testaments* (Munich, 1891); Kautzsch, *Apokryphen und Pseudepigraphen des Alten Testaments* (Tübingen, 1899 et seq.).

SUSEMIHL, zōō'ze-mēl, FRANZ (1826-1901). A German classical scholar, born at Laage, in Mecklenburg-Schwerin. He was appointed professor of classical philology at the University of Greifswald in 1856. Among his works the most valuable are: *Die genetische Entwickelung der Platonischen Philosophie* (1855-60); text editions of Aristotle's *Politics* (with German translation, 1879); the *Ethica Nicomachea* (1880); and a *Geschichte der griechischen Litteratur in der Alexandrinerzeit* (1891-92). The last work is regarded as one of the most popular and trustworthy treatises on the subject.

SUSO (zōō'zô), or **SEUSE,** HEINRICH (c.1295-1366). A German mystic. He was born at Ueberlingen, Baden. At the age of thirteen he entered the Dominican Order and spent most of his life in monasteries at Constance and Ulm. He was impulsive and an enthusiastic disciple of Eckhart (q.v.), but gives the master's speculative ideas a spiritual expression. He was truly called 'the sweet' Suso on account of his poetry and child-like religion. He was not a member of the Brethren of the Free Spirit, as has sometimes been supposed. His *Autobiography* and his *Book of Everlasting Wisdom* have been translated into many languages, and are both of unique importance for the study of the psychology of mysticism. He died at Ulm, and was beatified by Gregory XVI. in 1831. Consult Diepenbrock, *Heinrich Suso: Leben und Schriften* (Regensburg, 1829, 1837, and Vienna, 1863). A more critical edition of Suso's works is that by Denifle (Augsburg, 1878) and there is an English translation (London, 1865).

SUSPENSION (Lat. *suspensio*, from *suspendere*, to hang, from *sub*, under + *pendere*, to hang). A term in music. A note is said to be suspended when it is continued from one chord to another to which it does not properly belong, and to a proper interval of which it must eventually be resolved.

SUSPENSION BRIDGE. See BRIDGE.

SUSPENSOR (ML., that which suspends, from Lat. *suspendere*, to hang). A special, usually filamentous organ developed by and at the base of the embryo, which is thereby related more effectively to its food supply. The suspensor chiefly appears among seed-plants, its largest development occurring among the conifers. See EMBRYO.

SUSPICIOUS HUSBAND, THE. A comedy by Benjamin Hoadly, produced in 1747. Strickland, the husband, is made jealous by the intrigues of two attractive visitors in his home, in which he fancies his wife involved.

SUSQUEHANNA, sŭs'kwe-hăn'ȧ. A river draining the greater part of Pennsylvania (Map: Pennsylvania, E 4). It rises in Otsego Lake in central New York, and flows southward in three large zigzag bends across Pennsylvania and into Maryland, where it empties into the northern end of Chesapeake Bay at Havre de Grace after a total course of more than 400 miles. It is almost throughout a shallow, swift, and unnavigable stream, but its whole course is through very picturesque country as well as through some of the most populous industrial and mining regions. After flowing through the northern plateau it enters the anthracite districts of the Appalachian valley. First it follows one of the western longitudinal valleys, and then turning to the southeast it breaks through all the Appalachian ridges, after which it traverses the more open but still picturesque Piedmont plain. It receives its chief tributaries from the west, the Chemung, which joins it near the New York boundary, the large West Branch, 200 miles long, and the Juniata. Its lower and middle course is followed by a lateral canal, but its only importance as a waterway is for floating lumber. The traffic along its valley is carried chiefly by the railroads which follow its course throughout its length. The chief cities on its banks are Harrisburg and Wilkesbarre in Pennsylvania, Port Deposit in Maryland, and Binghamton in New York. The principal city on the West Branch is Williamsport.

SUS'SEX. A southeastern maritime county of England, bounded on the north by Surrey and Kent, on the south by the English Channel, and on the west by Hampshire (Map: England, F 6). Area, 1458 square miles. Population, in 1891, 550,446; in 1901, 605,052. The South Downs traverse the county from west to east, ending about 20 miles east of Brighton, in the lofty cliff of Beachyhead, and the northern escarpment of the Downs leads down to the fertile and richly wooded district of the Weald. The chief rivers are the Arun, Adur, and Ouse, which rise in the north of the county, and flow south into the Channel. A remarkably productive tract of land extends west from Brighton along the coast to the Hampshire border; and in the southeast of the county the rich marsh lands that line the coast make excellent pasture grounds. The Down-lands are covered with a fine, short, and delicate turf, on which the well-known breed of Southdown sheep are pastured. The principal industries of the county are agriculture and cattle-raising. Thick beds of gypsum are worked at Netherfield. Capital, Chichester.

SUSSMANN-HELLBORN, zụs'män hĕl'-bôrn, Louis (1828—). A German sculptor, born in Berlin, where he studied under Wredow and settled in 1857 after a sojourn in Rome (1852-56). Of his genre and mythological subjects, a "Drunken Faun" (1856) and "Sleeping Beauty" are in the National Gallery, while his monumental work is represented by statues of "Frederick the Great in Youth" (1862), City Hall, Breslau; "Frederick the Great in Mid-age" and Frederick William III. (both 1869), City Hall, Berlin; "Holbein" and "Peter Vischer," both in the Art-Industrial Museum, Berlin, which he helped to establish in 1867. He was artistic director of the Royal Porcelain Factory in 1882-87.

SUTECH, sōō'tĕk. An Egyptian deity. See Set.

SUTH'ERLAND. A northern county of Scotland, bounded on the east by Caithness and the North Sea, on the north and west by the Atlantic, and on the south by Ross and Cromarty (Map: Scotland, D 1). Area, 2028 square miles; population, in 1891, 21,896; in 1901, 21,440. The coast line is 60 miles in extent, and the shores, rugged on the north and west, where they are broken by the force of the Atlantic, are comparatively flat on the east. The southern and central regions of Sutherland are the most elevated; the principal mountain peaks are Ben More in Assynt (3273 feet) and Ben Clibrigg (3154 feet). The chief rivers are the Oikel and the Shin. Extensive moors stretch across the county; and the rivers and lakes, the chief of which is Loch Shin, form numerous low-lying valleys or straths. In the eastern districts the soil is very fertile, yielding all kinds of agricultural produce. Coal, granites of various colors, marble, limestone, etc., are found; there are good salmon, herring, and other fisheries. The capital is Dornoch.

SUT'LEJ, or **SATLEJ.** The chief tributary of the Indus. It rises in the southern part of Tibet near the sources of the Indus and the Brahmaputra, and, after breaking through the main range of the Himalayas, it flows southwest through the great arid plains of the Punjab, joining the Indus in the southwesten part of that province after a course of about 950 miles (Map: India, B 3). After passing through Lake Manasarowar (q.v.) the river, whose upper course is very rapid, flows through a series of lofty and highly picturesque mountain valleys. In the low 'doabs' of the Punjab its waters are largely used for irrigation, but its volume is nevertheless almost equal to that of the Indus. The Sutlej is the eastern and southernmost of the 'Five Rivers of the Punjab,' the other four being its two main tributaries, the Beas and the Chenab, together with two branches of the latter. Below the confluence of the Beas the river is known as the Ghara, and its lowest course, after receiving the Chenab, is called the Panjnad, or Five Rivers.

SŪTRA, sōō'trȧ (Skt., thread, string, clew). In Sanskrit literature, the technical name of more or less brief, aphoristic rules, and works consisting of such rules. The *sūtra* style of writing is preëminently the scientific style of India. The object of the *sūtras* is to supply a short survey of the facts of any given science in a form so brief that the whole theme may be memorized. In the later works of this class brevity and allusiveness are carried to such an excess that, but for the aid of commentaries which regularly accompany them, they would be obscure and sometimes absolutely unintelligible. Probably this peculiar style of writing originated with the methods of teaching which have prevailed in India from the earliest time. The school work is purely mnemonic; the teacher recites, and the pupil learns by heart piecemeal. It seems, therefore, likely that the *sūtras* were intended as memorial sentences which the pupil had to learn by heart, in order to obtain a grasp of the outline of his subject, as well as the fuller explanation which his teacher appended to it orally.

The importance of the *sūtras* will be understood from the fact that they form in very early times the standard medium of most of the ritual, legal, grammatical, metrical, and philosophical literature. The ritual *sūtras*, known as *Śrāuta Sūtras* and *Gṛhya Sūtras*, are systematic compendiums of the priestly sacrifices and the homelier religious practices of the householder respectively. The *Dharma Sūtras*, the oldest sources of Indian law, are also rooted in the Veda (q.v.). There is another class of Vedic *sūtras*, concerned with religious practice, the *Śulva Sūtras*, of which class the last chapter of the great Vedic *sūtra* collection of the school of Apastamba is an example. There are practical manuals giving the measurements of the altars, and so forth. They show quite an advanced knowledge of geometry, and constitute the oldest Indian mathematical works. In addition, the systematic study of the Vedas, which was prompted by the increasing difficulty of understanding and preserving the hymns, produced a series of ancillary Vedic sciences in *sūtra* style, the so-called six *Vēdāngas* or 'members of the Veda.' These are *śikṣā*, or phonetics, *c̣handas*, or metrics, *vyākaraṇa*, or grammar, *nirukta*, or etymoloy, *kalpa*, or religious practice, and *jyōtiṣa*, or astronomy. The most important class of these texts, belonging to the class *śikṣā*, phonetics, are the *Prātiśākhya Sūtras*, which deal with accentuation, pronunciation, and other matters, but are chiefly concerned with the phonetic changes undergone by Vedic words when combined in a sentence. Their observations are so minute and acute as to approach the best results of the modern science of phonetics, and they are unrivaled in their way in the whole history of antiquity. A still more important branch of *sūtra* literature is grammar, in which the Hindus again surpass all nations of antiquity. Little has been preserved of the preliminary stages of grammar. The student of native Sanskrit grammar, therefore, enters at once upon the intricate structure which bears the name of Panini (q.v.). His systematic analysis of words into roots, suffixes, and inflexional elements has been adopted with unimportant changes by modern European scientific grammar.

Later systematic philosophy, which has grown up on the basis of the theosophic hymns of the Veda and the *Upanishads* (q.v.), also adopts the *sūtra* style of presentation in the six systems of philosophy. Even so remote a theme as erotics is in the *Kāmasūtra*, or 'Love Sutra,' of Vatsyayana, naïvely treats this subject in the set form of *sūtra* rules. In one quarter, however, the *sūtra* has abandoned its typical style and has become the reverse of brief, for the Buddhist *Sūtras*, or *Suttas* (see Pitaka), the sermons ascribed to Buddha, excel in prolixity almost every other type of literature in existence.

SUTRI, so͞o'trê (anciently **SUTRIUM**). A town in the Province of Rome, Italy, 29 miles northwest of Rome. It is interesting for its ancient walls and gates, its Etruscan tombs, and the ruins of an amphitheatre dating from the time of Augustus. Sutri is known as the scene of the synod which in 1046 deposed Popes Gregory VI. and Sylvester III. Population (commune), in 1901, 2795.

SUTRO, so͞o'trô, Adolph Heinrich Joseph (1830-98). A German-American mining engineer, philanthropist, and Mayor of San Francisco. He was born at Aix-la-Chapelle, in Rhenish Prussia; came to the United States in 1850; and soon after went to the Pacific Coast. He was best known as the designer and constructor of the famous Sutro Tunnel, built to drain and ventilate the mines of the celebrated Comstock silver lode in Nevada. It is 20,500 feet long, and cost about $6,500,000. It did not prove so valuable as had been hoped, but by investing the returns which he got from it in San Francisco real estate Sutro became a millionaire. In 1880 he laid out in San Francisco the Sutro Heights Park, and he made numerous gifts to the city. He also founded the Sutro Library, containing about 250,000 volumes. In 1894 he was elected Mayor of the city by the Populists. By the terms of his will Sutro Heights was given to the city for a public park, the Sutro Library was to be opened to the public, and San Miguel ranch was given to support a scientific school. The will was, however, set aside by the courts on the ground that he was not mentally competent at the time he made it.

SUTTEE (from Skt. *satī*, virtuous wife). The practice which prevailed in India of a wife burning herself on the funeral pile, either with the body of her husband, or separately, if he died at a distance. Suttee for the orthodox Hindus is based on the injunctions of their sacred books, and there can be no doubt that various passages in the Puranas (q.v.) and codes of law countenance belief in its merit and efficacy. These, however, are all rather late texts. The custom is alluded to in Hindu literature, and classical authors refer to it as early as B.C. 316. It has even been referred to the Rig Veda as authority, and it was formerly thought that a Vedic verse had been falsified to give support to the practice. It has been shown, however, that this view is untenable. The Rig Veda does not recognize the custom. Manu (q.v.), the law-giver, does not sanction it, though it was known before his time. It appears at first to have been a royal custom and privilege, afterwards generalized and made legal. The custom was abolished by the British in 1829. Suttee is by no means confined to India. Under other names, and in other forms, the widow's death at the grave of her husband is known in many parts of the world, notably in the South Pacific, where a king's favorite wives were wont to let themselves be buried alive in his grave. Consult: Colebrook, *Digest of Hindu Law* (London, 1801); id., *Miscellaneous Essays*, vol. i. (new ed., ib., 1873); Grimm, *Kleinere Schriften*, vol. ii. (Berlin, 1849); Wilson, *Collected Works*, ed. by Rost, vol. ii. (London, 1862).

SUT'TER, John Augustus (1803-80). An American pioneer, born in Kandern, Baden. He was of Swiss parentage and was educated at the military college at Berne. He emigrated to America in 1834, and became a trader at Santa Fe, N. M. In 1838 he made his way to the Pacific Coast, thence to the Sandwich Islands, and finally to Alaska. Obtaining a grant of Mexican land, he established in 1841 a settlement called New Helvetia, where the city of Sacramento now stands. He was Governor of the north district of California under the Mexicans, and alcalde and Indian agent after it passed to the United States. In February, 1848, gold was discovered on his estate. The discovery, however, brought him nothing but disaster. Gold-diggers preëmpted his lands, and except an annual pension of $3000 granted him by the California Legislature he received nothing. He settled in Pennsylvania in 1873.

SUTTNER, zo͞ot'nẽr, Bertha von (1843—). An Austrian novelist, especially known for her efforts to promote peace. Born at Prague, the daughter of Count Franz Kinsky, she married, in 1876, Baron Arthur von Suttner (1850-1902), also known as a novelist, and lived with him for ten years in Tiflis. In 1891 she founded the Austrian Society of Peace-lovers, and, as its president, took a prominent part in the peace congresses at Rome (1891), Bern (1892), Antwerp (1894), and Hamburg (1897). Her novels include: *High Life* (1884; 3d ed. 1902); *Ein Manuskript* (1885); *Erzählte Lustspiele* (1889); *Die Waffen nieder* (1889; 14th ed. 1896), translated into most European languages; and its sequel *Marthas Kinder* (1902). She also wrote *Das Maschinenzeitalter* (3d ed. 1898) and *Die Haager Friedenskonferenz, Tagebuchblätter* (1900); and edits the monthly *Die Waffen nieder* (Dresden, 1892, et seq.), organ of the Peace Bureau at Bern.

SUT'TON. A town in Surrey, England, four miles northeast of Epsom. Population, in 1891, 13,977; in 1901, 17,224.

SUTTON COLD'FIELD. A municipal borough in Warwickshire, England, seven miles north-northeast of Birmingham (Map: England, E 4). The chief objects of interest are an ancient Early English church, the grammar school founded in 1543, and the celebrated Sutton Park, a recreation ground of 3500 acres, these two latter institutions due to the beneficence of Bishop Vesey of Henry VIII.'s reign, who also bequeathed real estate yielding an annual revenue of $15,000, which is applied to educational and charitable purposes. Population, in 1891, 8685; in 1901, 14,264.

SUTTON IN ASH'FIELD. A town in Nottinghamshire, England, three miles southwest of Mansfield, known for its hosiery manufactures (Map: England, E 3). Population, in 1891, 10,562; in 1901, 14,862.

SU TUNG-P'O, or **SOO TUNG-P'O**, so͞o'-tŭng'pō' (1036-1101). The name by which Su Shih, a Chinese statesman and poet, is best known. He entered public service in 1060, and soon attracted the attention of the Emperor. At his own request he was appointed Governor of Hang-chow (q.v.). He opposed the reforms of Wang An-shih, then in favor at the Court, and was degraded in consequence and banished. On the death of the Emperor in 1086 he was recalled to the capital, where he filled several high posts, becoming president of the Board of Rites in 1091. The sarcasm of his verse, however, continued to make him enemies, and, being accused of speaking ill of the Emperor, he was again banished. A new Emperor having come to the throne, he was recalled in 1101 and restored to honor, but died soon after at Ch'ang-chow, in Kiang-su. In the estimation of the Chinese, Su stands in the first rank as a poet. An edition of his works in 115 books was issued in his lifetime, and there have been many since then with commentaries and new arrangements. Copious translated extracts are to be found in Giles, *Gems of Chinese Literature* (London, 1884), and his *Chinese Literature* (New York, 1901).

SUTURE (from Lat. *sutura*, seam, from *suere*, to sew; connected with Skt. *siv*, Goth. *siujan*, OHG. *siuwan*, *siwan*, AS. *siwian*, Eng. *sew*). A term employed both in anatomy and surgery. In anatomy it is used to designate the modes of connection between the various bones of the cranium and face. A suture is said to be *serrated* when it is formed by the union of two edges of bone with projections and indentations (like the edge of a saw) fitting into one another. The coronal, sagittal, and lambdoidal sutures (see SKULL) are of this kind. A suture is termed *squamous* when it is formed by the overlapping of the beveled (or scale-like) edges of two contiguous bones. There are also the *harmonia* and *schindylesis* sutures, the former being the simple apposition of rough bony surfaces, and the latter being the reception of one bone into a fissure of another. See JOINT.

In surgery the word suture is employed to designate various modes of sewing up wounds. The term is also applied to a single stitch. Two main varieties of suture are recognized, the *continuous* and the *interrupted* suture, and from these two a great number of modifications have been made, of which the quill suture, button suture, the glover's suture, the quilt suture, and the intestinal sutures of Lembert and Duypuytren are examples. A buried suture is one which unites some deeper structure, such as a muscle or a layer of fascia, and which does not appear above the skin. It is often made of some absorbable material. Many materials are at present employed for sutures, such as silk, catgut, silkworm-gut, horse-hair, animal-tendon, and silver wire. Consult McGrath, *Surgical Anatomy and Operative Surgery* (Philadelphia, 1902).

SU'VA. The capital and chief port of the British colony of the Fiji Islands (q.v.). It is situated on the southwestern coast of Viti Levu, 1100 miles from Auckland and 1540 miles from Brisbane. There is good anchorage in a harbor accessible at all tides; wharf extension was made in 1901. There is a European population of over 1000.

SUVALKY, sōō-väl'kē. A government of Russian Poland, situated in the northeastern part. Area, 4852 square miles (Map: Russia, B 4). The surface is generally flat and interspersed with lakes. The principal river is the Niemen. The soil is mostly fertile. About one-fourth of the area is in forests, which belong chiefly to the State and are extensively exploited. The principal occupation is agriculture. Population, in 1899, 604,945, half of whom were Lithuanians.

SUVALKY. The capital of the Government of Suvalky in Russian Poland, situated on a small tributary of the Niemen, 606 miles southwest of Saint Petersburg (Map: Russia, B 4). Population, in 1899, 27,165.

SUVAROFF, sụ-vä'rôf, or **SUVOROFF,** ALEXEI VASSILIEVITCH, Count (1729-1800). A Russian field-marshal. He was of Swedish descent and was born in Finland. He served in the campaigns of the Seven Years' War and was made a colonel after the battle of Kunersdorf (1759). His services in the Polish War (1768-72), in the war against the Turks (1773-74), in suppressing the uprising of Pugatcheff, and in subduing the Tatars of the Kuban (1783), gave him increased reputation and he rose to the rank of general. In the Turkish War of 1787-92 he was commander-in-chief, for the first time brought the bayonet prominently into use in the Russian army, and decided by it the battle of Kinburn (1787). At the siege of Otchakov (1788), the battle of Fokshany (1789), which he gained in conjunction with the Austrians, and the decisive victory of Rymnik (1789), his system of rapid and repeated attack by overwhelming numbers secured him complete success. For this last victory, which saved the Austrians under the Prince of Saxe-Coburg from annihilation or capture, Suvaroff was created by the Emperor Joseph II. a count of the Empire, and from his own sovereign received the title of Count Suvaroff-Rymnikski. One of his greatest successes was the storming, in 1790, of the fortress of Ismail, where the whole Turkish garrison was put to the sword. He was appointed (1791) Governor of the newly conquered provinces. In 1794 he was sent into Poland, where he completed the annihilation of the Polish monarchy by a victory won, in conjunction with Fersen, over the army of Kosciuszko, the capture of Praga, where a horrible massacre of the inhabitants took place, and the occupation of Warsaw. The grade of field-marshal rewarded these successes. Under Paul I. he fell into disgrace (1798), from his impatience of the Emperor's fantastic military regulations, and was deprived of his rank; but being restored through English influence, he commanded the army sent to coöperate with the Austrians in Italy against the French. He reached Verona in April, 1799; compelled Moreau to retire behind the Adda after defeating him at Cassano (April 27th); entered Milan (April 29th); again defeated the French under Macdonald at the Trebbia (June 17th-19th), and a third time under Joubert at Novi (August 15th), driving them out of the whole of Northern Italy. He next entered Switzerland in order to join Korsakoff and effected a toilsome march across the Saint Gotthard, in the course of which he lost one-third of his army. But Masséna defeated the army of Korsakoff at Zurich (September 25th), and Suvaroff was compelled to execute a retreat through the Grisons and Vorarlberg. For these remarkable services he received the title of Prince Italiski. In 1800 he was named commander-in-chief of the Russian armies and ordered home. He arrived in the capital, where he died May 18, 1800. He left an autobiography in French, which was edited by Glinka (Moscow, 1819). Consult also: Smith, *Suworows Leben und Heerzüge* (Vilna, 1833-34); id., *Suworow und Polens Untergang* (Leipzig, 1858); Reding-Biberegg, *Der Zug Suworows durch die Schweiz* (Zurich, 1869); Macready, *A Sketch of Suwarrow and His Last Campaign* (London, 1851).

SUWANEE, sū-wạ′nė. A river of Florida (Map: Florida, E 2). It rises in the Okefinokee Swamp in southern Georgia and flows southwest, emptying into the Gulf of Mexico, 12 miles north of Cedar Keys, after a course of 240 miles. The scenery along its banks is attractive, and the river has been celebrated throughout the country by the song, "Old Folks at Home."

SUYUTI, sōō-yōō′tė (Ar. *Abū al Faḍl 'Abd al-Raḥmān al-Suyūṭī*) (1445-1505). An encyclopædist and the most prolific writer in Arabic literature. His family was of Persian origin, but had emigrated to Egypt, where his father was a judge and professor at Cairo. Hither the son returned after the usual travels to Mecca and the centres of learning, and here he rose from one professorship to another. But at last his arrogant and dishonest conduct drove him from his position and he died in retirement. The production of great numbers of books seems to have been his affectation, and although they do not reveal genius, they are of value for the encyclopædic information they contain. About 315 titles of extant books of his are enumerated, touching upon every subject. Consult: Wüstenfeld, *Die Geschichtsschreiber der Araber* (Göttingen, 1882); Brockelmann, *Geschichte der arabischen Litteratur* (Berlin, 1899).

SVARGA, swär′gȧ (Skt., heaven). In Hindu mythology, the paradise of the god Indra (q.v.). It is the residence of some of the inferior gods and deified mortals, who there rest in the shade of the five wonderful trees, *Mandāra*, *Pārijāta*, *Santāna*, *Kalpavṛkṣa*, and *Harichandana*, drink *amṛta*, the beverage of immortality, and enjoy the music of the heavenly musicians, the *Gandharvas*, and the dancing of the celestial courtesans, the *Apsarasas*. Svarga is situated on Mount Meru (q.v.), and is 800 miles in circumference and 80 miles high. Its pillars are of diamonds and its palaces of gold. The inhabitants do not remain there forever, but after a lapse of years they descend to earth to be born and die according to the doctrine of metempsychosis (q.v.).

SVEABORG, svā′ȧ-bộr-y'. A fortress of Finland, Russia. See Helsingfors.

SVEARIKE, svā′ȧ-rē′ke. One of the three historical divisions of Sweden. It lies between Götarike and Norrland. Area, 32,589 square miles. Population, in 1900, 1,579,954.

SVENDBORG, svĕnd′bŏrg. A seaport of Denmark, on the southeast coast of the island of Fünen, on the Svendborg Sound, 27 miles south of Odense (Map: Denmark, D 3). The town occupies a charming site in a hill-encircled valley. The chief industries are iron-founding, tanning, and shipbuilding. Population, in 1901, 11,531.

SVEND′SEN, Johan (1840—). A Norwegian violinist and composer, born at Christiania. He studied at the Leipzig Conservatory, toured extensively, later was appointed Concertmeister of the Leipzig 'Euterpe' concerts, and from 1872 to 1877 was conductor of the Christiania Musical Association. Afterwards he became Court conductor at Copenhagen, and in 1896 was appointed conductor of the Royal Theatre. His works include string quartets and quintets; symphony in D; violin concerto in A; overture to Björnson's drama *Sigurd Slembe; Carnaval à Paris*, for the orchestra; *Coronation March* (for Oscar II.); *Wedding Cantata*, for chorus and orchestra; *Carnaval des artistes norvégiens;* Norwegian rhapsodies for the orchestra; overture to *Romeo and Juliet;* Scandinavian airs for string quartet; and Romance in G, for the violin and orchestra.

SVERDRUP, svĕr′drụp, Johan (1816-92). A Norwegian politician, born at the Château of Jarisberg. He studied and practiced law, but from 1850, when he was elected to the Storthing, gave his entire attention to politics and became the leader of the radical peasant faction. As president of the Storthing since 1871, he violently fought against the royal prerogatives. He was called to preside over the Ministry in 1884, but did not satisfy the radical portion of his adherents, and, yielding to the combined attacks of the Conservatives and the extreme Left, resigned in 1889.

SVERDRUP, Otto (1855—). A Norwegian Arctic explorer, born at Haarstad Farm, District of Helgeland. He followed the sea at the age of seventeen, was subsequently in command of a merchant vessel, and in 1888 joined Nansen's expedition to Greenland. In 1893 he started with Nansen for the North Pole as commander of the *Fram*, which had been built under his supervision, and when Nansen, in 1895, proceeded north on dog sledges, Sverdrup took the ship to the Arctic Sea and in 1896 back to Norway. In 1898 he led another expedition in the *Fram* as far as Cape Sable, was caught in the ice for a year, and, after advancing into Jones's Sound in the summer of 1899, was again icebound for three years. Having explored the southwest and western shores of Ellesmere Land and discovered islands north of the Peary Archipelago, he reached Goodhaven, Greenland, in August, 1902, and returned to Norway in the autumn.

SWA′BIA, or **SUABIA** (Ger. *Schwaben*, Lat. *Suevia*). A mediæval duchy in the southwest of Germany. It took its name from the Suevi, by which the Germanic people of the Alemanni (q.v.), who occupied Southwestern Germany in the third century, were also known. The name Suevia alternates with that of Alemannia as the designation of the country in the early part of the Middle Ages, but the former finally prevailed. The region occupied by the Alemanni embraced Western Bavaria, Württemberg, Baden, Alsace, and a great part of Switzerland. The bulk of the nation was subjected by the Franks at the close of the fifth century. As part of the Frankish realm, Alemannia was governed by native dukes, but the duchy was abolished before the dissolution of the Frankish Empire. The country from which Alsace and part of the Alpine territories had been detached, and which now came to be known as Swabia, was then placed under the rule of counts and *nuntii* *cameræ*, and for a time it was nearly independent.

In 919 Swabia was constituted one of the great duchies of the German Kingdom. It comprised the region between the Rhine and the Lech and part of Switzerland. The office of duke was frequently kept in the royal family. In 1079 the duchy passed to the House of Hohenstaufen, being bestowed by the Emperor Henry IV. upon Frederick of Staufen. Under the rule of this house, which occupied the Imperial throne of Germany from 1138 to 1254, Swabia was the most wealthy and powerful of the German duchies. In 1096 Frederick of Staufen was compelled to give up to Berthold of Zähringen the Breisgau and the Imperial bailiffship in Zurich. On the extinction of the Hohenstaufen dynasty in 1268 disintegration took place and the ducal vassals (cities, prelates, counts, etc.) claimed independence except for their allegiance to the emperors. The Count of Württemberg occupied the leading place among the petty rulers. The numerous lesser lords were for the most part obliged to accept the overlordship of the House of Zähringen or of Austria. The cities, of which many had become wealthy and powerful, were striving for local independence. In 1376 some of them formed the first Swabian League, which extended beyond the bounds of Swabia. In 1405 Württemberg, Baden, and seventeen cities joined together in the League of Marbach. The two Leagues were of little importance as political powers, but they paved the way for the Great Swabian League, formed in 1488, which under the leadership of the Count of Württemberg exercised administrative and judicial authority over the whole country. During this long period of strife a considerable portion of old Swabia had passed into the power of Bavaria. In 1512 Swabia became one of the ten circles into which Germany was divided for administrative purposes by Maximilian I. The dissolution of the Great Swabian League took place in 1533. Among the many city commonwealths which arose in Swabia were Augsburg, Ulm, and Constance. The southwestern Government District of Bavaria bears the name of Swabia (or Swabia and Newburg). Its capital is Augsburg. The best general history is Stälin, *Geschichte Württembergs* (Gotha, 1882-87).

SWADLINCOTE, swŏd'lĭn-kot. A town in Derbyshire, England, four miles southeast of Burton-upon-Trent. Its industries comprise coal-mining and the various branches of earthenware manufacture. Population, in 1891, 13,889; in 1901, 18,014.

SWAHILI, swȧ-hē'lē. A Bantu people of the Kau District, Tana-Ozi Delta, British East Africa, mingled more or less in blood with Semites. They are Mohammedans and differ little from the Arabs in general culture. They number about one million. They are noted traders, and their language, the Kiswahili, is the great medium of intercourse throughout east Central Africa. Consult: Büttner, *Wörterbuch der Suahelisprache* (Berlin, 1890); Seidel, *Grammatik der Suahelisprache* (Vienna, 1891); Steere, *Handbook of the Swahili Language* (4th ed., London, 1894); Krapf, *Dictionary of the Suahili Language* (ib., 1882); Madan, *English-Swahili Dictionary* (Oxford, 1894); Delaunay, *Grammaire Kiswahili* (Paris, 1898).

SWAIN, Charles (1801-74). An English writer known as 'the Manchester poet.' He was born in Manchester, and lived all his life in England. For fourteen years he was a clerk in the dye house of his uncle; he afterwards carried on a business in engraving and lithographing. Between 1827 and 1867 he published several volumes of verse, among which are *Dryburgh Abbey* (1832), an elegy on Sir Walter Scott; *English Melodies* (1849); and the more ambitious *The Mind and Other Poems* (1832). Several of his songs, which have been set to music, are well known, as "Somebody's Waiting for Somebody" and "Tapping at the Window." Consult the edition of his poems, with portrait and introduction by C. C. Smith (Boston, 1857).

SWAIN, George Fillmore (1857—). An American civil engineer. He was born in San Francisco and was educated at the Massachusetts Institute of Technology, where he graduated in 1877. He then studied three years in the Government engineering school at Berlin, Germany. Upon his return he settled in Boston, where in 1887 he became professor of civil engineering at the Institute of Technology, and engineer to the Massachusetts Railroad Commission. In 1894 he was also made a member of the Boston Transit Commission. His most important publication is a "Report on the Water Power of the Atlantic Watershed" (vol. xvii. of *Tenth United States Census*).

SWAIN, Joseph (1857—). An American educator, born at Pendleton, Ind. He graduated at Indiana University in 1883; studied in the University of Edinburgh, and with the astronomer royal of Scotland in 1885-86; was professor of mathematics in his alma mater from 1886 till 1891; and in the latter year was called as professor of mathematics to Leland Stanford University. Two years afterwards he returned to Indiana University as president, and remained in that position until 1902, when he accepted the presidency of Swarthmore College in Pennsylvania.

SWAIN'SON, William (1789-1855). An English naturalist, born in Liverpool. He traveled in South America, and on his return to England began the publication of works on natural history. In 1841 he emigrated to New Zealand, where he became Attorney-General. Important among his works are: *Zoölogical Illustrations* (1820-23; 1829-33); *Exotic Conchology* (1821-22); *Ornithological Drawings* (1834-41); *Birds of Western Africa* (1837); *The Naturalist's Guide, etc.* (1840).

SWALLOW (AS. *swalewe*, OHG. *swalawa*, Ger. *Schwalbe*, swallow; perhaps connected with Gk. ἀλκυών, *alkyōn*, Lat. *alcedo*, kingfisher). A passerine bird of the family Hirundinidæ, a family represented by many similar species in almost all parts of the world. This family consists of birds which prey on insects, catching them in the air. They have remarkable powers of flight, now soaring to a great height, now skimming near the surface of the ground or of the water, and wheeling with great rapidity. The bill is short and weak, broad at the base, and deeply cleft, so that the gape is wide; the wings are very long, pointed, and more or less sickle-shaped when expanded, and have only nine primaries; the legs are short and weak. The tail is generally forked, and the plumage is close and glossy. The family is perhaps the most sharply defined and easily recognized of any in the order. The species are about eighty, widely diffused, being found in all countries except near the poles. Such of them as occur in the colder parts of the world are summer birds of passage, migrating to warmer regions when winter approaches and insects become scarce. Only seven species of swallow occur in North America, and all but one of these winter south of the United States, though in summer they range to the Arctic Ocean. The largest species is the purple martin, while the smallest is the bank swallow (q.v.). Perhaps the commonest of North American swallows is the barn-swallow (q.v.). Another swallow numerous about farmyards and barns is the cliff or eaves swallow (*Petrochelidon lunifrons*), whose nest is the remarkable flask-shaped structure of pellets of mud often seen attached in rows to the outside walls of barns, just under the eaves. Formerly, as in the case of other swallows (see Barn-Swallow), this species bred in rocky places and placed its nests in large companies against the faces of cliffs.

A large and handsome swallow common throughout North America is the white-bellied or tree swallow (*Tachycineta bicolor*), which is steel blue or green above and pure white beneath. Of the same genus is the exquisite little violet-green swallow (*Tachycineta thallasina*) of the Western United States, which is less than five inches long; the upper parts are velvety green and violet purple, while the under parts are pure white. The rough-winged swallow (q.v.) completes the list. South America has a large series of swallows very similar to those of the United States, and especially of that group of which the tree and violet-green swallows are a type. Some naturally breed in holes of rocks, others in hollow trees, or form nests of mud, straw, and feathers in some similar situation; but nearly all have abandoned their wild ways as fast as the country has been settled, and placed their abodes near or within buildings. The same pleasing habit characterizes the tribe in India, Africa, Australia, and everywhere else, and has led to the growth of much pleasant folk-lore, poetry, and sentiment. In Great Britain *Hirundo rustica*, the common or 'chimney swallow' (to be distinguished from the American chimney swift, q.v.), is much like our barn-swallow, and makes a similar nest, usually placed under a shed roof, in a half-ruined building, or often in a chimney. The geographical range of this species extends over a great part of Europe, Asia, and Africa. The window swallow, or house-martin (*Hirundo urbica*), is another very common European species, glossy black above, white below and on the rump; the feet covered with short downy white feathers, which is not the case in the chimney swallow.

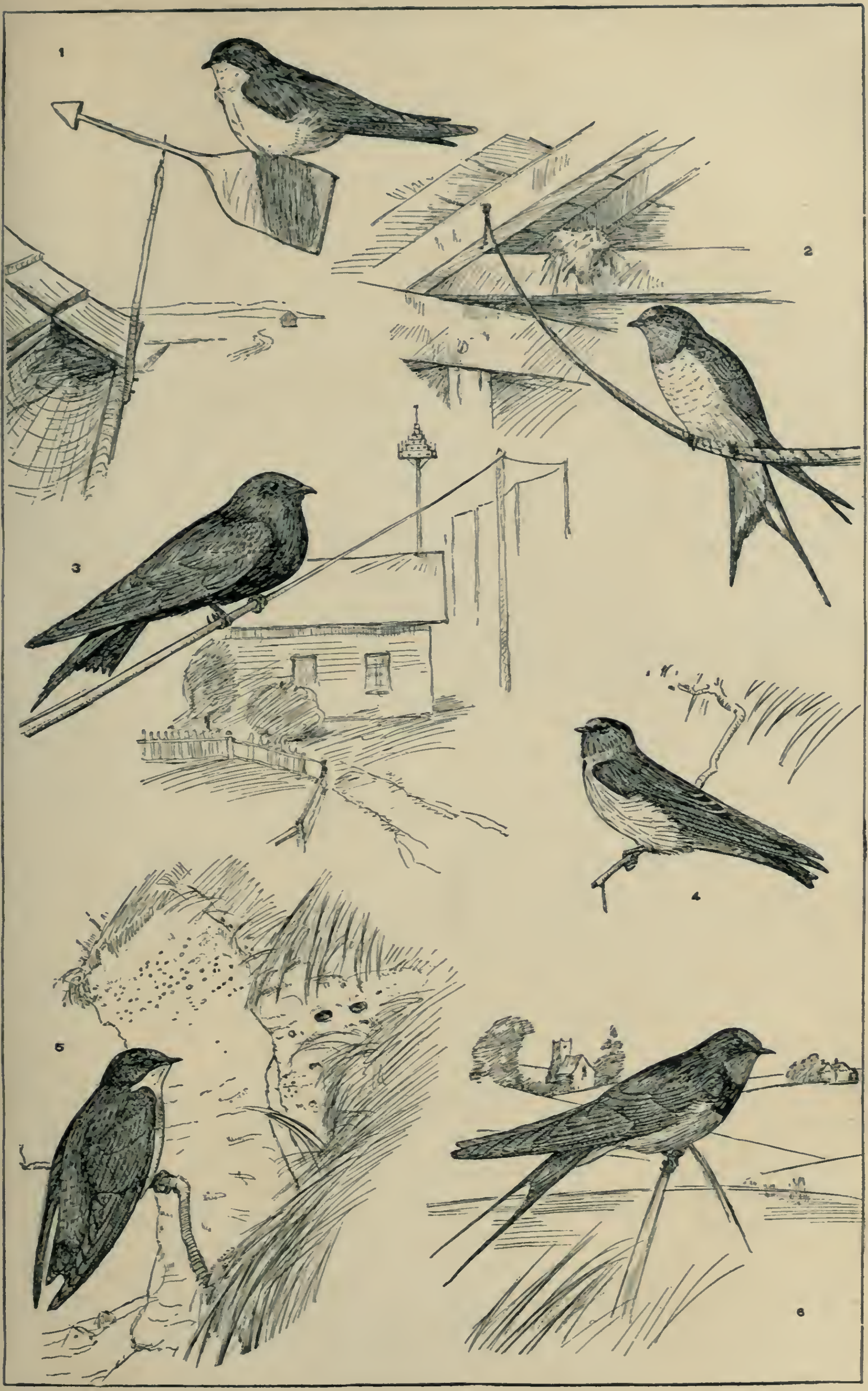
Consult Sharpe and Wyatt, *Monograph of the Hirundinidæ* (London, 1885-94), which contains a description, with colored plates, of all the species of the world, and a full bibliography.

SWALLOWTAIL. Any member of a family of large butterflies, Papilionidæ, with tail-like prolongations of the hind wings. Black, yellow, blue, and green are the prevailing colors. About 25 species occur in the United States. South America is most rich in these butterflies. About 700 species have been described in all. The larvæ of the swallowtails possess a curious process on the thorax called an 'osmaterium,' which is usually retracted, but may be thrust forth at will. It is a Y-shaped process and contains a scent-gland which emits a strong odor when the organ is thrust out. The pupa is placed with the head upward, fastened by the tail to the supporting object, and is kept in place by a silk band around the middle of the body. (See Butterflies; also Plate under Butterflies, Fig. 5.) In certain species the males and females differ so much both in form and coloration that they might easily be mistaken for distinct species. In New Guinea there occurs a swallow-tail butterfly (*Ornithoptera paradisea*) the female of which is black, white, and gray, and the male is gold and green, with very long tails on the hind wings. The males of another species of the same genus are numerous and the female is rare; the proportion is said to be about 1000 to 15. Not only does the female show sexual dimorphism, but even considerable seasonal dimorphism. The tiger swallowtail (*Jasoniades glaucus*) is a North American species which shows a striking sexual dimorphism in a portion of its range. The form now known as *Turnus* is straw-colored above, banded and marked with black. In the South and West black forms of the female sex occur, and belong to the so-called '*glaucus*' form. The caterpillar of these two forms is dark green with two purple eye-spots, one on each side of the third thoracic segment, which are bordered with black, yellow, and black again in turn. When not feeding, this caterpillar rests on a bed of silk spun on a leaf. The zebra swallowtail (*Iphiclides Ajax*) presents one of the most striking cases of seasonal dimorphism known among butterflies, so that until the life-history of this form was known three different species had been described from it. There are several broods a season and the last brood winters in the chrysalis stage. The butterflies that appear in the early spring are known as the *Marcellus* form and those that appear later in the spring as the *Telamonides* form. The latter are larger butterflies with longer tails and more white than the *Marcellus* form. (See Colored Plate of American Butterflies.) All the late spring broods produce a third form which is still larger and with longer tails. This summer brood is known as the *Ajax* form. See illustration at Skipper.

SWALLOWTHORN, or Sea-Buckthorn (*Hippophaë*). A genus of shrubs of the natural order Elæagnaceæ, natives of Europe. The commonest species (*Hippophaë rhamnoides*) is a spiny shrub often planted for ornament in sandy soil, especially near the sea. It is valued for its silvery leaves and yellow, acid, one-seeded berries, which, besides being attractive, are useful for sauces and jellies.

SWAMMERDAM, swäm′mẽr-däm, Jan (1637-80). A Dutch naturalist, born in Amsterdam. He studied medicine at Leyden, but devoted most of his life to the study of insects and other animals. He was a skilled dissector of small animals, and was the father of the scientific study of the morphology and metamorphosis of insects. He first made a natural classification of insects by distinguishing between those which have a complete metamorphosis and those which have not. He wrote: *De Respiratione usuque Pulmonum* (1667); *Allgemeene Verhandeling van*

FAMILIAR SWALLOWS



1. WHITE-BELLIED or TREE SWALLOW (Tachycineta bicolor).
2. BARN SWALLOW (Chelidon erythrogaster).
3. PURPLE MARTIN (Progne subis).
4. CLIFF or EAVES SWALLOW (Petrochelidon lunifrons).
5 BANK SWALLOW or SAND MARTIN (Clivicola riparia).
6. ENGLISH HOUSE SWALLOW (Hirundo urbica).

Bloedloose Dierkens (1669); *Biblia Naturæ, sive Historia Insectorum in Certas Classes Redacta* (ed. Boerhaave, 1737-38).

SWAMP (AS. *swamm, swam*, swamp, Goth. *swamms*, sponge, *swumsl*, ditch, OHG. *swam*, MHG. *swam, swamp*, Ger. *Schwamm*, sponge; connected with OHG. *sumpft*, Ger. *Sumpf*, swamp, and with Gk. σομφός, *somphos*, spongy). An area of wet ground usually covered with certain coarse grasses, trees, and other plants peculiar to such land. While the direct cause for differences between typical swamps has not been fully worked out, drainage seems to be the principal controlling factor. It seems probable that in undrained swamps, such as peat bogs, the products of plant decay, including various acids, necessarily accumulate and that aëration is imperfect. Hence it seems reasonable to believe that only xerophytic plants can grow in such places. On the other hand, river swamps, which are comparatively well drained, may show reverse conditions. Since they are hydrophytic, as habitats they maintain plants whose structures are hydrophytic. (See HYDROPHYTES.) Thus undrained swamps are hydrophytic with respect to soil moisture, but xerophytic with respect to plant structures. See XEROPHYTES.

Perhaps no type of plant society better illustrates the order of succession or encroachment of one zone upon another than the most xerophytic swamps, the peat bogs or moors. A typical bog, for instance, may show a central pond with water lilies and other aquatics, surrounded by bulrushes, behind which may be a zone of sedges, and then grasses or swamp forests, e.g. of tamarack or arborvitæ. Since each of these zones in turn advances toward and encroaches upon the centre, the swamp gradually becomes filled and drained naturally in a few years.

Other characteristic xerophytic swamps are salt marshes, both the typical northern salt meadows and the mangrove swamps of the tropics. Plants of salt marshes (halophytes, q.v.) are very largely succulent. In many cases the coarse grasses resemble those of the prairies. In mangrove swamps xerophytic structures, represented typically by the mangrove leaf, are not the sole interesting features. Above the foul water many plants develop knee-like processes which supposedly are of advantage in aëration; and vivipary (q.v.) here reaches its highest expression. (See MANGROVE.) A closely allied type is the so-called cypress swamp of the Southern United States.

All swamps may be considered as ephemeral plant societies, developing either into prairies or mesophytic forests as they become better drained. Climate doubtless plays some part in this development, since the prairie rather than the forest is likely to develop in the prairie regions or in the forest regions adjoining the prairie, whereas in the heart of the forest regions most swamps eventually become covered with trees. This, is, however, not a universal explanation, since some swamps in forest regions never become sylvan.

SWAMP DEER, or BARASINGHA. A deer of Northern India, of rather large size, with smooth and somewhat flattened antlers, with a prominent brow-tine and sometimes 16 to 20 points. It is a grazer, keeps in the outskirts of the woods, and on grassy lands, and in winter gathers into small bands. Its scientific name is *Cervus Duvaucelli*. Consult Lydekker, *Deer of All Lands* (London, 1898).

SWAMP HARE, or SWAMP RABBIT. A hare of the swamps of the Lower Mississippi Valley (*Lepus aquaticus*), 24 inches long, finely mottled above with buff, rufous, and black, and more buffy than the 'cottontail;' belly and under side of tail pure white. Its habits are little known. Compare MARSH HARE.

SWAMP'SCOTT. A town, including several villages, in Essex County, Mass., adjoining Lynn and 13 miles from Boston; on Massachusetts Bay, and on the Boston and Maine Railroad (Map: Massachusetts, F 3). It is attractively situated and is known as a summer resort. There are two parks, a public library with 7500 volumes in the town hall, and the Phillips School, the most prominent building along the shore. Fishing is of some importance, but the community is engaged largely in the industries of Lynn (q.v.). The government is administered by town meetings. The water-works are owned and operated by the town. Population, in 1890, 3198; in 1900, 4548.

SWAMP WARBLER. A large genus (Helminthophila) of American warblers (q.v.), so called because of their fondness for low, swampy places. They are small, trim, insect-catching migratory birds prevailingly gray or green and yellow in color, and most of them breed north of the United States and winter in the tropics. A good example is the 'goldenwing' (*Helminthophila chrysoptera*), which is gray on the upper parts and white below, with the throat and auricular region black, and a conspicuous yellow patch on the wing.

GOLDENWING.

SWAN (AS., OHG. *swan*, Ger. *Schwan*, swan; probably connected with Lat. *sonus*, sound, Skt. *svan*, to resound). A water-bird of the duck family, the seven or eight species of which constitute the subfamily Cygninæ, composed mainly of the genera Cygnus and Olor, the latter distinguished by the great keel of the breast-bone being divided into two plates, between which lies the curvature of the windpipe—an organ greatly developed in this group. Swans are larger in body than geese, and are recognizable by their long arched necks, enabling them to reach food on the bottom of streams and shallow ponds without diving. They nest mostly in high latitudes, constructing on the ground a rude receptacle of rushes and the like for the half a dozen greenish eggs. They feed chiefly on vegetable substances, as the seeds and roots of aquatic plants, but also on fish-spawn, of which they are great destroyers. They hiss like geese, and strike with their wings in attack or defense.

The typical and most familiar example of the tribe is the tame or 'mute' swan (*Cygnus olor*), which is about five feet in entire length, and weighs about thirty pounds. It is known to live for at least fifty years. The male is larger than the female. The adults of both sexes are pure white, with a reddish bill; the young (cygnets) have a dark bluish-gray plumage, and lead-colored bill, surmounted by a black knob at the base of the upper mandible, and with a black nail. (See Colored Plate of WATER BIRDS.) In its wild state this species is found in Eastern Europe and in Asia; in a half-domesticated state it has long been a common ornament of ponds, lakes, and rivers. The ancients ascribed to it remarkable musical powers, which it was supposed to exercise particularly when its death approached. It has, in reality, a soft low voice, plaintive, and with little variety, to be heard chiefly when it is moving about with its young.

Swans, according to the law of England, are birds royal; those actually kept by the Crown had a mark, and the King's swan-herd once was an important person. The royal swans of the Thames are so marked to this day by notches and lines cut upon the beak, and the process of collecting and marking them annually is called 'upping.' Other Old World swans are the Polish, with an orange bill; the whistling swan or 'whooper;' Bewick's swan, and the aberrant black swan (*Chenopis atrata*) of Australia, which is comparatively small and deep black except the white wing-quills and the red bill.

The North American swans belong to the genus Olor. The most common species (*Olor Columbianus*) breeds in the far North and is seen in the United States only on its migrations, which extend to the Gulf of Mexico; and it is very rare east of the Alleghanies. The trumpeter swan (*Olor buccinator*), noted for its sonorous cry, breeds from Iowa and Dakota northward, and winters southward to the Gulf. It is one of the largest species, measuring 5½ feet in length. The black-necked and duck-billed swans are South American species. See DUCK; and authorities there cited.

SWAN, ORDER OF THE. A religious association of princes and nobles formed in 1440 by Elector Frederick II. of Brandenburg for benevolent purposes. It was extinguished during the Reformation, but was renewed in 1843 by Frederick William IV. of Prussia as an association, open to men and women of all creeds, for the amelioration of physical and moral ills.

SWAN, THE KNIGHT OF THE. A very old and popular myth found in French, German, and English mediæval romances, first mentioned by William of Tyre about 1180. Helias, Knight of the Swan, is one of eight children of Oriant of Lilefort. Seven are changed to swans, one drawing the hero in a boat to become champion for Clarissa of Bouillon, the ancestor of Godfrey, thus connecting the story with the Crusades. After marriage the knight departs when his wife breaks the taboo on his name, a Grail feature common to all variants, as *Lohengrin,* showing its partly Celtic origin. The scene is generally on the Lower Rhine, connecting it with the dukes of Brabant and Cleves, whose symbol was a swan.

SWAN, JOHN MACALLAN (1847—). An English painter and sculptor, born at Old Brentford. He studied in London and in Paris. In 1889 his "Prodigal Son" (bought by the Chantrey Fund) established his reputation. His sculptured works —in nearly every material—are usually studies of cats, and his modeling is broad, flexible, and naturalistic. "The Jaguar," "Puma and Macaw," "Wounded Leopard," and "Leopard Running," challenge comparison with Barye. His subjects in oil include animals, figures, and landscapes, and are distinguished by massive, simple treatment, and a strongly imaginative element. His color is delicate and discriminating, but nearly always low in tone. Notable paintings are: "Ocelot and Fish;" "Tigers;" "Tigers Drinking;" "Ceylon Leopards;" "Lioness Defending Her Cubs;" and "Polar Bear Swimming." He was elected an associate of the Royal Academy in 1894.

SWAN, JOSEPH WILSON (1828—). An English inventor, born at Sunderland, and there educated. He made several inventions of great value, among them the carbon process for making permanent photographs, called autotypes, a miner's electric safety lamp, improvements in electrometallurgical deposition, but most notable of all the incandescent electric lamp which bears his name, the forerunner of all the electric lamps now in use. These inventions brought him many honors, including a fellowship in the Royal Society.

SWANPAN. A Chinese calculating device. See CALCULATING MACHINES.

SWAN RIVER. A small river of Western Australia entering the Indian Ocean at the Fremantle, a few miles below Perth (Map: Australia, B 5). It is navigable for steamers to the latter city. On its banks was founded in 1829 the Swan River Colony, which formed the nucleus around which the colony of Western Australia was built up.

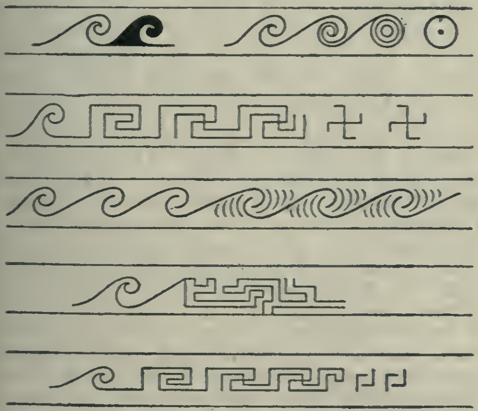
SWANSEA, swŏn'sĭ. A seaport in Glamorganshire, South Wales, at the mouth of the Tawe, 60 miles west-northwest of Bristol (Map: Wales, B 5). Swansea is the chief seat of the tin-plate trade of England, and one of the most important copper smelting and refining centres in the world. The vast resources of the surrounding coal field began to be exploited about 1830, and since that time the progress of Swansea has made it next to Cardiff the most important town in South Wales. The principal edifices, for the most part of modern construction, comprise a guild hall with the crown and law courts and municipal offices, the Royal Institution of South Wales, the grammar school founded in 1682, a good public hall, and a spacious and well-arranged infirmary. The harbor is formed by piers of masonry projecting from either side of the mouth of the Tawe into Swansea Bay, a wide inlet of the Bristol Channel. An average of 6000 vessels enter and clear nearly 4,000,000 tons of merchandise annually. In the immediate vicinity are smelting works, in which many thousands of tons of copper ores, silver ores, and zinc ores are smelted annually. About 20,000 tons of copper, valued at $15,000,000 to $20,000,000, are annually produced, and about 2,000,000 tons of tin plate, valued at $15,000,000, are exported annually. The annual value of exports and imports is estimated at $50,000,000 to $60,000,000. Swansea owes its origin to a castle erected in 1099. In 1260 the castle was burned down. It was twice rebuilt, but was finally dismantled by the Parliamentarians in 1647, and is now an interesting ruin. Population, in 1891, 90,349; in 1901, 94,514.

SWARTH, swärt, HELENE (1859—). A Dutch poet, born at Amsterdam and, since 1893, married to the poet Frits Lapidoth at The Hague. From

1865 to 1884 she lived at Brussels, and after publishing two volumes of poems in French, *Fleurs du rêve* (1879) and *Les Printanières* (1882), took high rank among the younger generation of poets in Holland with the lyrics, mostly in sonnet form, *Blauwe Bloemen* (1884), *Beelden en Stemmen* (1887), *Sneeuwvlokken* (1888), *Passiebloemen* (1891), and other collections. She also wrote sketches in prose, such as *Fronisch en tragisch* (1895), *Van Vromenleed* and *Van Vrouwenlot* (1896), *Ernst* (1902), and others.

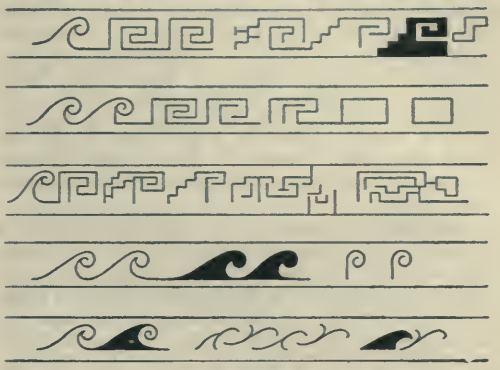
SWARTH'MORE COLLEGE. A co-educational institution at Swarthmore, Pa., 12 miles west-southwest of Philadelphia. It was founded in 1864 by members of the Society of Friends, to secure to the youth of the Society higher educational training under instructors of their own faith. The college conferred the degrees of bachelor of letters and bachelor of science until 1903, when the degrees of bachelor of arts and bachelor of science in engineering were made the only ones given. The work is partially elective, and special courses of study are provided. The master's degree in arts, letters, and science and the degrees of civil, mechanical, and chemical engineers are given for advanced work. In 1903 there were 205 students in all departments, with 25 instructors. The college library contained 22,100 volumes. The productive funds amounted to $300,000, the income to $100,000, and the total valuation of the college property to $800,000.

SWASTIKA (Skt., weal-making). A fylfot or 'four-foot' cross, a monogrammatic sign having four branches, of which the ends are bent, generally at right angles, thus 卐 or 卍. It is a sign of benediction or of good luck, and in one form or another has been used as a symbol of welfare from a very early time. The sign appears in a variety of modifications, often connected in a continuous scroll, of which there are two well-defined types, forming on the one hand the European and Asiatic series, and on the other hand the American series, as illustrated by the following diagrams:



EUROPEAN AND ASIATIC SERIES.

Though the swastika has been found in Europe, Asia, and America, yet it is unknown to many races. There is, for example, no evidence to show that it was current as a native symbol in Egypt, Babylonia, Assyria, Phœnicia, or (till a late period) in Persia. It was particularly adopted by Buddhism and its presence in China, Japan, and Tibet can easily be explained as due to that religion. The swastika is unknown in early India (all evidence to the contrary rests on false assumptions) and when (c.300 B.C.) it first appears, it is as a simple cross, as in crossed arms.



AMERICAN SERIES.

Many of the swastikas found at Hissarlik (Troy) are now acknowledged to be no true swastikas. They are not found before the third city. Its original place and significance are alike unknown, but it has been the object of endless speculation. Some scholars see in the swastika a solar symbol, which represents, in its so-called female and male forms, 卐 and 卍 respectively, the annual circuits of the sun to north and south. It has been derived from the *triskalion* or 'three-leg' symbol

, but this sign is of later origin. The swastika has also been interpreted in other ways, as a wind-symbol, an earth-symbol, an emblem of productivity, a phallic emblem, etc. Temple regards it as in origin merely decorative, and suggests that the running design may have been taken from a coil of string. In the opinion of d'Alviella, who calls it, from its shape, gammadion, the swastika was chiefly talismanic. The swastika has been derived by some from the cross; by others, from the circle; it has been regarded as an evolution from the lotus-petal in architecture; and as a mystic design it has been associated with fire and with water. The sun and fecundity are its most probable sources, if it had any meaning beyond that of an ornament becoming a mystic sign. The swastika appeared first in the Bronze Age, and occurs in the Swiss lake-dwellings. In the historic period it is found in Japan, Korea, China, Tibet, Armenia, Asia Minor, Greece and its islands (especially Cyprus and Rhodes), Italy, France, Germany, Scandinavia, Great Britain (perhaps only under Scandinavian influence), North America (e.g. Ohio, Tennessee, Mississippi, Alaska), Mexico, and South America (e.g. Brazil). In assigning its original home, it must be remembered that no case of Oriental swastikas precedes the period of Greek influence in India. It seems probable that d'Alviella may be right in ascribing an eastern emigration from a western centre, if not from Troy itself. It is said that there is in Tibet a sect of rationalists called Swastikas, but this is probably an error, and the sect meant is that of the Jains.

BIBLIOGRAPHY. The literature directly or indirectly relating to the swastika is very large (more than 100 works are mentioned by Wilson), but most of it is useless, being composed by theorists rather than by careful scholars. Besides the article by R. C. Temple (referred to above), which appeared in the first number of the *Journal of the Anthropological Society of Bombay,* and d'Alviella's great work, *La migration des symboles* (Paris, 1891), there is an exhaustive treatise in the *Report* of the United States National Museum (Washington, 1894), by Thomas Wilson, *The Swastika, the Earliest Known Symbol, and Its Migrations,* which, besides giving an account of the various theories of the symbol, has a complete bibliography of the subject.

SWATOW, swä'tou' (a local corruption of Chinese *Shan-t'ow,* fish-trap head). A treaty port in the Province of Kwang-tung, Southeastern China, situated in latitude 23° 21′ N., longitude 116° 39′ E., on the left bank and near the mouth of the river Han (Map: China, E 7). It is dependent on the departmental city of Ch'ao-chow fu, 35 miles farther up the river, where the consuls are supposed to reside. It was opened to foreign residence and trade by the Treaty of Tientsin (1858), and the British and United States consuls were appointed in 1860. The foreign community is small and isolated, partly in the vicinity of the native town and partly on the hilly ground on the opposite side of the river. The natives are noted for their turbulence and their hostility to foreigners. Sugar-making is the chief industry of the region served by Swatow. Sugar is the heaviest export, and bean-cake from Niu-chwang for use as manure in the sugar fields is one of the heaviest imports of native products. There are several large sugar refineries here, and a steam flour mill. Other products are tea, grasscloth, indigo, vegetable oils, paper, tobacco, joss-sticks, joss-paper, etc. The population in 1901 was 38,000.

SWATS, swäts. A people of the Indo-Afghan frontier belonging by race and language to the Aryan stock. Their country, called Swat, traversed by the river of the same name, an affluent of the Kabul, is included in the recently constituted Northwest Frontier Province of India. Formerly Buddhists, they were converted to Mohammedanism in the eleventh century. The lower Swat country was occupied by the Yusufzais in the middle of the fifteenth century, and at the end of the sixteenth the Swats were nearly exterminated.

SWAZILAND, swä'zē-lănd. A small Kaffir country in South Africa under British rule, bounded by Portuguese East Africa (Lourenço Marques), Natal (Tongaland), and the Transvaal Colony (Map: Transvaal Colony, P 4). Area, about 8500 square miles. The region is mountainous. The Lebombo chain lies on the east, the Drakensberg on the west. The general elevation is given as about 5000 feet. Swaziland is well watered, and is a fine grazing country. It is considered also well adapted for farming. There is much rich soil and the climate is healthful. The forests are large and valuable, possessing rare varieties of woods. Its gold deposits are now being mined. Copper, coal, and tin are said to exist. The British resident commissioner has his seat at Bremersdorp. The population is about 70,000, the Europeans numbering 1600. Swaziland became an independent State in 1843, its people having thrown off the yoke of the Zulus. In 1894, by convention between the Boers and British, the region came under the rule of the South African Republic (Transvaal), with whose downfall the sovereignty passed to Great Britain.

SWEARING, PROFANE. See BLASPHEMY.

SWEAT (AS. *swāt,* OHG. *sweiz,* Ger. *Schweiss,* sweat; connected with Lat. *sudor,* Gk. *ἱδρώς, hidrōs,* Lith. *swidrs,* Skt. *svēda,* sweat). The fluid that is excreted through the pores of the skin; perspiration. The nature, composition, and uses of this fluid in the normal state have been noticed in the article on SKIN (q.v.). The sweat is diminished in amount in many febrile diseases, especially if the temperature is high and prolonged. *Anidrosis,* as this condition is called, accompanies diseases in which there is a profuse discharge of fluid from the kidneys, as in diabetes, or from the bowels or stomach. In anasarca or general œdema and myxœdema sweat is diminished from stretching of the skin. Certain drugs, as belladonna and strychnine, markedly diminish the amount of sweat; others, notably pilocarpine, increase it. Profuse sweating (*hyperidrosis*) occurs in acute rheumatism, Asiatic cholera, and certain adynamic fevers, the sweating stage of malaria, the advanced stages of pulmonary phthisis, and septicæmia. Certain ailments are characterized by localized sweats; for example, the hands and feet in conditions of general debility; the head in rickets; and unilateral or one-sided sweating of the head or face or body in some nervous diseases, or from pressure on the sympathetic nerves by thoracic aneurism. The composition and color of the sweat may in rare instances undergo remarkable alterations. When through disease the action of the kidneys has become impaired the sweat has sometimes a urinous odor and deposits white scales or urinary solids upon the skin. This is known as *uridrosis. Bromidrosis* is an affection of the sweat glands characterized by offensive-smelling perspiration.

SWEATING SICKNESS. An extremely fatal epidemic disease which prevailed in Europe, and especially England, during the fifteenth, sixteenth, and early part of the seventeenth centuries. From the fact that the English people both at home and abroad were chiefly attacked, the malady was known as the 'English sweat' or 'English ephemera.' It first appeared in August, 1485, in the army of Henry VII. shortly after his arrival in Wales from France to fight the battle of Bosworth, and in a few weeks it had spread to London. It was a violent inflammatory fever, attacking as a rule robust, vigorous men, and characterized by a short chill, painful oppression over the epigastrium, headache, stupor, and a profuse fetid sweat. The disease took its course in about twenty-four hours. The patient suffered profound prostration and intense internal fever, but refrigerants seemed only to do harm. This epidemic lasted about a month, but during this short period many thousands died. The disease returned to England in 1506, 1517, 1528, and 1551. The epidemic of 1528 was particularly severe and was long referred to as 'the great mortality.' It raged over Europe—Germany, the Netherlands, Denmark, Sweden, Norway, Poland, Lithuania, and Livonia were all attacked.

In Hanover alone 8000 persons died. After 1551 no further epidemic occurred until the beginning of the eighteenth century. Since that time numerous outbreaks have been noted, but in a milder form. The disease is nearly always prevalent in some part of the world, most frequently in France (Picardy) and Italy, under the more modern name of *miliary fever*. (See MILIARIA.) In Germany it is still known as the 'English sweat.' As now observed, the disease is characterized by fever, profuse sweats, and an eruption of miliary vesicles. As in influenza a large number of people are attacked, but the epidemic lasts sometimes not more than seven or eight days, and the mortality is not high. For full historical accounts of the epidemics of the Middle Ages, consult Dr. Cains, *A Boke Against the Sweatyng Sicknesse* (1552); Hecker, *Epidemics of the Middle Ages* (*Sydenham Society Transactions*); Hirsch, *Geographical and Historical Pathology;* (*new Sydenham Society Transactions, actions.* vol. i.); and Creighton's *History of Epidemics in Britain* (1891).

SWEATING SYSTEM. The practice pursued by certain manufacturers, particularly of clothing, of giving out piece work to individuals on which the work is to be done at home and at starvation wages.

The system is a survival of the household form of industry that still exists in certain trades in large cities. The term 'sweater' was used first by journeymen tailors in London, who worked long hours. As more work was given out, the home worker employed his family and outsiders, and thus a system of sub-contract developed in which the middleman was called the sweater. To-day 'the sweating system' designates the fag end of all industries where low wages and bad conditions prevail. The work is on a cheap grade of goods, principally cigars, bread made in cellars, candy, and garments. The people sweated belong to a low class of unskilled labor, generally foreign born. The sub-contractors usually are Jews.

Evils of the sweat shop are long hours—ten to eighteen hours a day, including Sunday; overcrowding in the shops and surrounding tenements; unsanitary conditions in the work rooms and tenement houses, lacking in light, air, and cleanliness; child labor, very young girls and boys often running the machines; disease and deformity brought on by confinement and dust; irregularity of the work; and poor pay. The chief causes of the sweating system are (1) the excessive supply of unskilled labor; (2) an economic advantage to large dealers, in having their work done in small shops, thereby saving rent and evading factory laws, in cheap labor, in the inability of isolated workers to combine, and in the irregularity of work; (3) finally, the irresponsibility of employers, and the indifference of the public.

Among proposed remedies may be mentioned (1) stringent legislation, backed by public opinion, to force these kinds of work into large shops and factories; (2) coöperative production; (3) trade unions for unskilled workers; (4) public workshops; (5) restriction of foreign immigration; (6) an eight-hour day; (7) consumers' league. Factory laws of Ohio, Massachusetts, Illinois, and New York require licenses, or permits, describing rooms in which work may be done. Massachusetts only enforces such laws successfully; and she cannot protect herself against sweat-shop goods from elsewhere.

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SWE'DEN (Sw. *Sverige*). The eastern and larger part of the Scandinavian peninsula. It is separated from Denmark on the southwest by the Cattegat and on the west, north, and east is bounded by Norway, Finland, and the Baltic Sea. It extends from latitude 55° 20′ N. to 69°, and from longitude 11° E. to 24°. Area, 172,876 square miles. In several physical aspects it differs much from Norway. It contains more level land and is more fertile and therefore adapted to support a larger population. Its coasts are not so deeply indented; its climate is continental instead of oceanic; and its harbors may be blocked with ice for five months, while those of Norway are unfrozen. Sweden comprises three main divisions. The northern half, which is very scantily inhabited, is called Norrland. The southern half comprises Svealand (Svearike), in the north, and Gotland (Götarike), in the south.

TOPOGRAPHY. The area of all the islands that are a part of Sweden is about 3000 square miles. A group of islands without mountains or vegetation skirt the Cattegat north of Göteborg; and north of Kalmar, on the Baltic side, are many islets, chiefly low rocks in shallow water, the continuation seaward of the Swedish plain. Two large islands in the Baltic lie off the southern or peninsular part of Sweden. The smaller, Öland, a narrow strip of land, 80 miles long, was once a part of the chalk shore of the mainland, from which it is separated by only two miles at the narrowest part of Kalmar Sound. The other, Gotland, is farther at sea, but connected with the mainland by a submarine bank. Only a comparatively small part of Sweden is very mountainous—the portion lying along the Norwegian border. The frontier region is not all mountains, but a part of it is a high and bleak plateau. (See *Topography* in NORWAY.) The greatest heights are in the northwest, Kebnekaisse being 7004 feet. In the south is a hilly district rising from a plateau that is several hundred feet above the surrounding plains of the coast, and is separated from the mountains of the north by the great depression occupied by the southern lakes. Most of the remainder of Sweden is a plateau sloping rapidly from the mountain fringe to a plain which stretches along the east coast to the southern extremity of the country, and which includes the fertile lowlands of Gotland, strewn with erratic boulders, where the largest and most productive farm lands are found.

HYDROGRAPHY. Sweden is well watered and is rich in lakes. Many rivers flow from the mountains southeast to the Gulf of Bothnia or the Baltic, affording much water power, but little navigation, on account of their rapid fall. They pass through many lakes, particularly in the upper part of their courses, and the lakes have the effect of equalizing the floods so that the rivers are quite regular in their discharge. The numerous falls and rapids give picturesque charm to the rivers. The Klar Elf ('large stream'), the largest river, flows south into Lake Vener. The Göta Elf, which discharges the waters of Lake Vener into the Cattegat, is more important, because its falls and rapids have been circumvented by canals, making it a part of the waterway system of South Sweden. The principal river emptying into the Baltic is the Dal Elf. Many of the Swedish lakes are large and beautiful, and are distinguished by the clearness of their water and their picturesque surroundings. The four great lakes of the country lie in the depressed area north of the plateau of Southern Sweden. Lake Vener, the largest of them, is the third largest in Europe (over 2000 square miles). Lakes Vetter (about 700 square miles), Hjelmar, and Mälar (about 670 square miles) drain into the Baltic.

Climate and Soil. As the western mountains shut off the tempering influence of the Atlantic, the climate is much colder than in Norway. The country being in the latitude of Labrador, the summer is short and the winter is cold and long. At Stockholm the mean temperature in January is about 25° F. and in July about 61°. The climate of Sweden is very healthy. The mountains prevent the greater part of the precipitation from reaching the eastern plateaus and plains, so that the mean rainfall in Sweden is only about 20 inches. The greatest rainfall is on the southwest coast, facing the Cattegat, where the average is 35 inches annually. The country is almost completely covered with snow in winter, when snow traveling on ski, or long wooden runners attached to the feet, is a favorite amusement. The splendid and extensive forests and the farms of Gotland and Scania, where the grain fields return as much to the acre as in England, show that the soils of the central and southern parts of the country are not deficient in fertility.

Flora. Forests cover about two-fifths of the country, pines and firs predominating, and extend beyond the Arctic Circle. Over 2000 European plants have their northern limit in the Scandinavian peninsula. In Sweden beeches are found only in the extreme south, the oak disappears a little north of Stockholm, while the pine, fir, and alder extend nearly to the limit of arboreal vegetation. The forests of the southern plains differ little in appearance from those of the more temperate parts of Europe, but farther north, in the region of prevailing conifers, the labyrinth of moss-covered boulders, amid which the towering trees rise, where even a path is scarcely possible, gives a special character to the woodlands. The Dal Elf, north of Stockholm, is practically the northern limit of wheat, but barley is grown to the Arctic Circle.

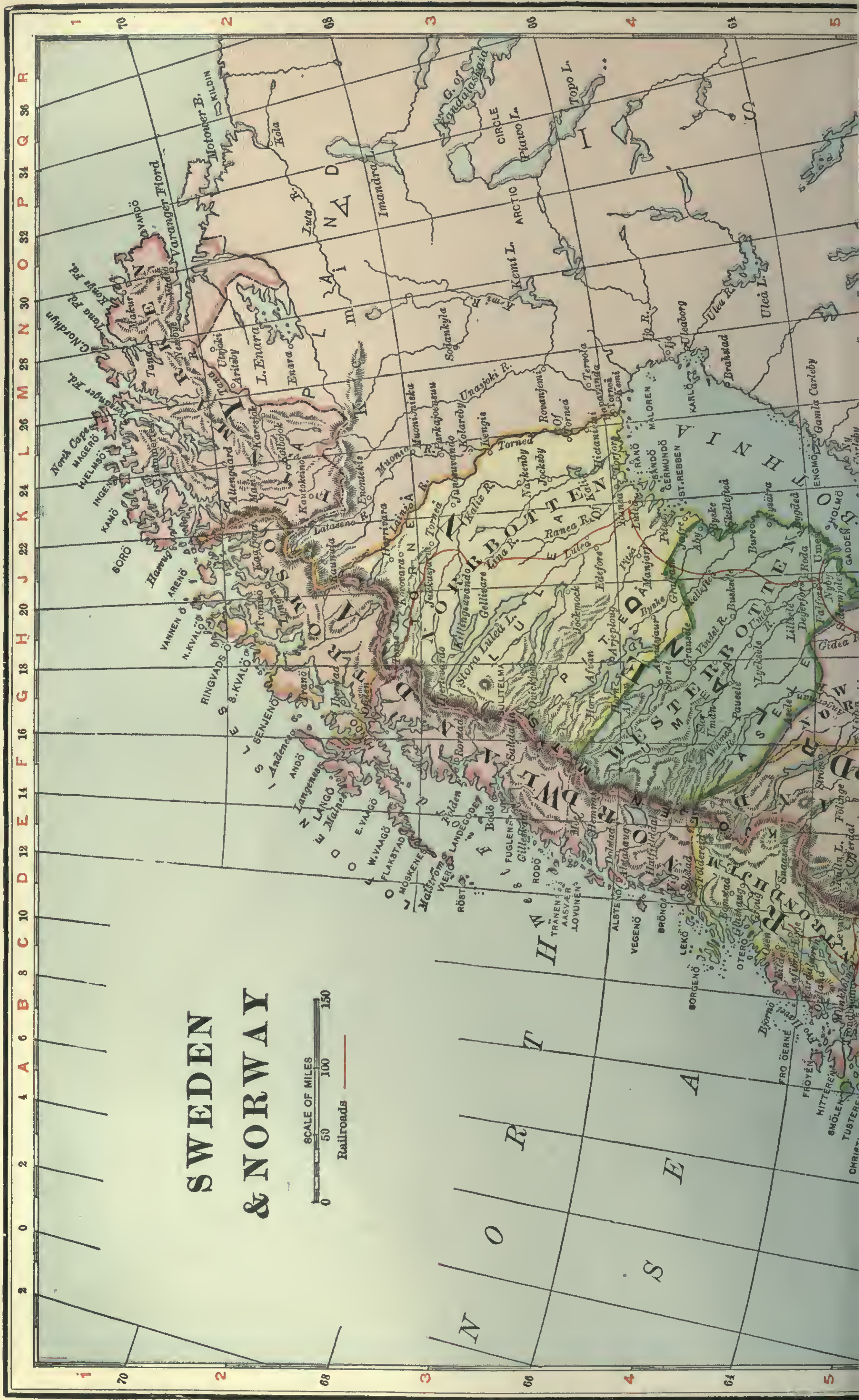
Fauna. The bounties paid for bear, lynx, wolf, and fox skins and for birds of prey have resulted in nearly exterminating the leading wild animals. The beaver and hare survive, but the wild reindeer is no longer found. Fish are much less abundant in Swedish than in Norwegian waters.

Geology and Mineral Resources. Archæan rocks are predominant, and in some districts, especially around the great lakes, they are overlaid by Cambrian and Silurian formations. In large areas also the ancient rocks are covered by extensive glacial deposits of clay, sand, gravel, and erratic boulders. Triassic, Jurassic, and Craetaceous rocks appear only in Scania, in the extreme south. Some time after the glacial epoch the Scandinavian peninsula subsided till the sea level, in relation to the land, stood 500, 700, and in some places 1000 feet higher than before, as is shown by marine deposits resting on rocks that had been scarred by glacial ice. Then the land began to rise again and the gradual upheaval is still in progress. The movement is best observed, of course, along the coasts. It is nowhere so rapid as on the Swedish side of the Gulf of Bothnia, and it is most rapid at the northern extremity of the Gulf, where the upheaval is estimated at about 5 feet in the past century. In the extreme south no change of level has been observed. Thus the Gulf of Bothnia appears to be slowly draining into the southern basin of the Baltic.

The mining industry competes with difficulty against the powerful rivalry of the leading European countries, although it is more important than that of Norway. Sweden is poorly supplied with coal (only 271,509 tons having been mined in South Sweden in 1901). Manufacturers are compelled to import coal or use charcoal. The most important and valuable mineral product is iron. In 1901 2,793,566 tons of iron ore were mined in the kingdom.While about 1,000,000 tons are mined every year near Gefle, Falun, and Dannemora, the largest supply comes from Gellivare (q.v.), 130 miles north of the Arctic Circle. Swedish iron is regarded as unsurpassed in the world, as it is almost entirely free from phosphorus (.05 per cent. or less), and is therefore of superior value for the manufacture of steel. For this reason it now rivals the ores of Spain in British and German markets, and large quantities are exported. Magnetite and manganese ores (2271 tons of manganese in 1901) used in steel-making also abound. The copper industry of Falun was long widely renowned, but the yield was formerly much larger than at present (23,660 tons of ore in 1901). Three-fourths of the total yield of zinc ore (48,630 tons in 1901) is produced at the Ammeberg mines, on the north side of Lake Vetter. The silver product in 1901 was 1557 kilograms, and the yield of lead was 988,396 kilograms. The number of persons engaged in mining declined from 35,000 in 1890 to 30,776 in 1901.

Agriculture, Live Stock, and Fisheries. Three-fourths of the population support themselves by agriculture, though only about 8 per cent. of the land area is under cultivation. Hay meadows and pastures cover 4 per cent. of the surface, forests 44.2 per cent., and 43.6 per cent. is unproductive. In 1900, 388,416 farms were

	Area	Yield
Wheat	192,413	4,726,700
Rye	1,015,417	21,447,900
Barley	537,225	12,954,425
Oats	2,037,503	55,210,375
Mixed grain	320,606	8,372,925
Pulse	114,114	1,612,325
Potatoes	381,862	44,841,775


SWEDEN & NORWAY
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Railroads
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VARDÖ
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KILDIN
Kola
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Piavo L.
Kemi L.
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Haparanda
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FRÖYEN
HITTEREN
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Mosjöen
Sulitelma
Karesuando
Muonio
Jockmock
Arjeplog
Lycksele
Sorsele
Storuman
Vilhelmina
Åsele
Malgomaj
Dorotea
Stora Luleå
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Kalix R.
Råneå R.
Pite R.
Skellefteå R.
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Ume R.
Tana R.
Alten R.
BOTHNIA
SANDÖ
GERMUNDÖ
ST. REBBEN
KARLÖ
MALOREN
HOLMÖ
GADDEN
ENGMÖ
Brahestad
Gamla Carleby
Ijo R.
Ulea R.
Kemi R.
Unasjoki R.
Sodankylä
Rovaniemi
Kittilä
Enontekis
Jukkasjärvi
Kiruna
Kalix
Överkalix
Pajala
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Gidea R.
Nordmaling
Vännäs
Lögdeå
Snaasen
Foldereid
Leka
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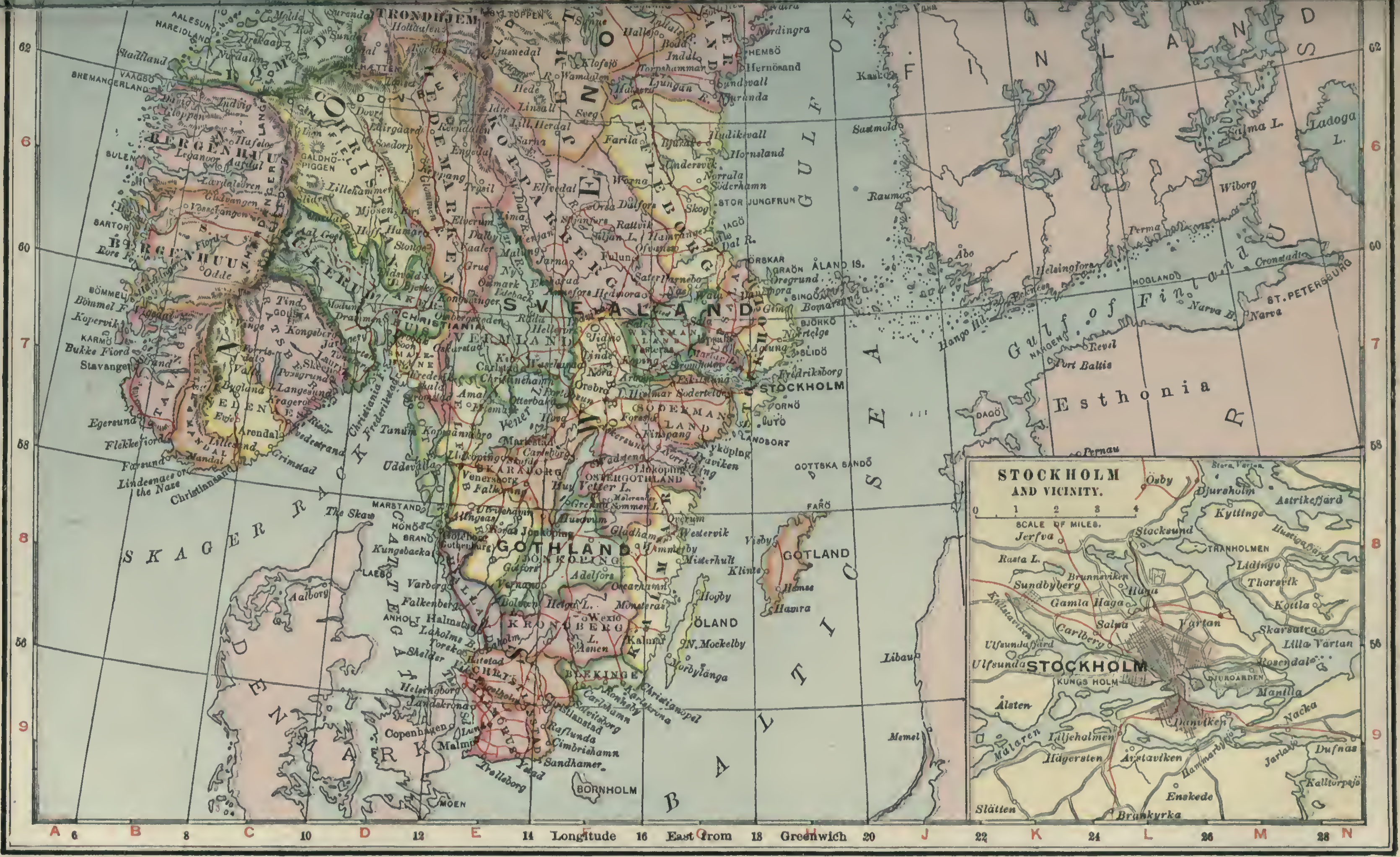

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under cultivation, of which about two-thirds were from 5 to 45 acres in extent. The preceding table shows the area (in acres) under the chief crops in 1900 and the yield (in bushels).

The largest and most productive area of farm lands is in East and West Gotland and Scania, in the south of the country. In spite of the improvement in farming in recent years, especially through the importation of modern farm machinery and implements, the country cannot produce wheat and rye enough for home consumption, and about 12,000 tons of breadstuffs more than the kingdom produces are brought in every year, chiefly from the Baltic countries. Nearly half the total grain raised is oats, which is an export crop. The sugar beet thrives in the extreme south, but the acreage given to it is not sufficient to supply the demand for sugar. Flax, tobacco, and hops are cultivated with much success. At the end of 1900 Sweden had 533,050 horses, 2,582,555 head of cattle, 1,261,436 sheep, and 805,805 hogs. Great quantities of butter are exported to Great Britain. The Government has done much to improve agriculture by founding schools of agriculture and by the appointment of peripatetic teachers. The fisheries are important, though much inferior to those of Norway. They do not suffice for the needs of the country. On the other hand, the timber trade is of much greater value than that of Norway.

Manufactures. Although the manufacturing industries have been stimulated in every way by the Government and have made great progress, Sweden is still largely dependent upon foreign countries for most of these commodities. The kingdom lacks the coal, population, and capital for the most successful development in this respect. The industrial advance, however, has been most substantial, as is seen from the following comparisons: From 1896 to the close of 1901 the number of manufacturing establishments increased from 8812 to 10,904; the workpeople in them from 202,293 to 262,229; and the total value of the product from $192,487,400 to $285,010,200. The sawmills in 1901 contributed 13.53 per cent. of the total value of product; flour mills, 7.70 per cent.; textile mills, 5.22 per cent.; machine shops, 5.14 per cent.; and iron and steel manufactures and foundries, 5.01 per cent. The timber industry in all its branches, including wood pulp, is the leading manufacturing industry. The public forests (area, 18,830,000 acres) yielded in 1899 timber valued at $20,085,650. In 1900 43,312 work people in 1148 saw and planing mills produced lumber worth $43,589,544; furniture and other woodwork were also large products. Swedish matches, everywhere famous, are produced chiefly at Jönköping, where one factory employs 1500 hands. There are woolen and cotton factories at Norrköping, Stockholm, and Göteborg, but the manufacture of linen, a household industry, is the only branch of textile manufacture which meets the domestic demand. The most famous iron works are near Eskilstuna and the chief machine shops at Motala. Swedish bar iron, steel goods, blades, armor plates, cables, nails, and knives are highly esteemed.

Commerce. The average annual trade (in million dollars) is as follows:

	1881-85	1891-95	1898	1900
Imports	85.5	97.5	122.0	143.3
Exports	67.5	88.5	92.4	104.8

The kingdom sells abroad the abundant product of its forests, iron and zinc mines, dairies, and oat fields. Its home supplies of textiles, wool, machinery, railroad iron, and many other things are inadequate, and it must supplement them by foreign purchases. The following table gives the value in kronor of the leading imports and exports for two years (a krona equals in value 26 7-10 cents):

	Imports 1899	Imports, 1900	Exports, 1899	Exports, 1900
	Kronor	Kronor	Kronor	Kronor
Textile manufactures	46,738,248	41,958,659	1,579,218	1,544,852
Grain and flour	49,327,777	51,793,392	4,850,080	2,145,094
Groceries	38,634,760	45,584,093	135,289	336,180
Raw textile material and yarn	47,818,471	46,165,793	1,252,671	1,502,842
Minerals, of imports mostly coal	82,388,362	104,052,262	21,421,309	22,518,863
Metal goods, machinery, etc	74,605,197	65,009,836	22,585,054	25,316,543
Live animals and animal food	23,542,296	29,195,718	48,128,649	43,161,578
Hair, hides, and other animal products	24,459,229	20,438,630	4,300,564	5,370,750
Metals, raw and partly wrought	13,159,371	25,556,124	43,513,013	52,395,037
Timber, wrought and unwrought	4,751,465	5,925,996	178,553,581	200,559,375
Paper and paper manufactures	4,745,770	4,407,698	11,706,764	14,392,265
Other articles	94,617,737	94,846,909	20,158,575	22,090,583
Total	404,788,683	534,935,110	358,184,767	391,333,962

The trade of Sweden is chiefly with the countries bordering on the Baltic and North Seas. The value of its trade in two years with the leading countries in its commerce was:

COUNTRY	Imports from (1899)	Imports from (1900)	Exports to (1899)	Exports to (1900)
	Kronor	Kronor	Kronor	Kronor
Great Britain	154,563,118	176,504,553	157,198,342	169,248,313
Germany	184,113,227	187,897,874	54,860,864	65,244,540
Denmark	60,681,189	62,525,129	43,298,276	47,682,183
Norway	20,449.954	21,761,911	6,451,052	7,186,593
Russia (including Finland)	28,502,131	34,358,984	15,861,424	14,027,846
France	8,992,214	9,692,566	29,065,568	29,807,333
Spain	1,767,701	1,736,294	2,851,295	3,649,832
Netherlands	10,390,719	11,184,842	25,666,540	29,941,211
Belgium	16,804,527	13,166,404	13,783,461	14,839,185

The exports of the United States to Sweden and Norway in 1899 were $10,000,000, and the imports were $4,000,000; in 1901 the exports to Sweden and Norway were $11,000,000 and the imports were $3,600,000. Among the things that the United States sells to these countries are provisions, wheat, machinery, tools, and cotton.

Transportation and Communication. Railroads are cheaply built because of the small cost of land, lumber, and iron. Uninterrupted rail communication extends between Gellivare in the north and Malmö in the south, over 1200 miles. A line has been constructed from Gellivare to Ofoten Fiord, Norway, giving the iron ore of North Sweden an outlet on the Atlantic coast. The total length of railroads in 1900 was 7023 miles. Southern Sweden has an excellent system of waterways by which a series of canals and canalized rivers unite the great lakes with both the North and Baltic seas, providing about 2500 miles of interior navigation. In 1900, 100,806 ships and boats passed through the canals. Swedish trade, like that of Norway, is predominantly maritime, and Swedish vessels are engaged both in the home and foreign trade. The mercantile fleet in 1901 comprised 2987 vessels, of 613,792 tons, including 911 steamers, of 325,105 tons. Göteborg is the principal port, with Stockholm, Malmö, and Helsingborg following.

Banking. The National Bank of Sweden (Riksbank) belongs to the State, regulates financial relations with foreign countries, receives private accounts, and lends money on security to non-speculative enterprises. The bank is under the guarantee of the Diet, its capital and reserve are fixed, and its note circulation is limited by its metallic stock and its current accounts. Its actual circulation is kept far within the authorized limit. The assets and liabilities of the Swedish banks balanced (in kronor) on January 1, 1902, as follows: National Bank, 245,255,457; private banks, 874,039,400; joint-stock banks, 581,424,650.

Government. Since 1814 Sweden has been united with Norway under a common king, but each is in effect a separate kingdom with its own government. The fundamental laws of Sweden have never been embodied in any single written constitution, but consist of various enactments of the Diet from 1809 to 1866. By the fundamental laws a limited monarchy is constituted, at the head of which is a king, who is required to be a member of the Lutheran Church and who is bound by oath to observe the laws of the land. By the law of succession women are excluded from the throne. In case of failure of succession the King is to be chosen by the Swedish and Norwegian Diets acting separately. The King has the exclusive right of legislation as regards trade, commerce, manufacturing, mines, and forests. He is also empowered to issue police regulations and to make rules concerning vagrancy, sanitation, protection against fire, etc. In legislating on other matters he must act with the consent of the Diet. He possesses the right to declare war and make peace upon the advice of a Council of State representing both monarchies. He nominates higher officials, military and civil, negotiates treaties with foreign countries, and presides in the Supreme Court. He is advised and in some manner assisted by a Council of State consisting at present of eleven Ministers, at the head of which is the Minister of State. They have seats in the Diet with the privilege of debate and the right to initiate legislation. They sometimes resign in case of serious disagreement with the Diet, but the principle of Ministerial responsibility is not yet freely recognized.

The National Parliament or Diet (Riksdag) consists of two Chambers, both of which are representative in principle. The Upper Chamber consists at present of 150 members chosen for a term of nine years by the provincial legislatures (*Landstings*) 25 in number, and by the municipal governments of those towns which are not represented in the provincial assemblies. These towns are Stockholm, Göteborg, Malmö, Norrköping, and Gefle. The members are distributed on the basis of one to every 30,000 of the population, and are required to be 35 years of age and in the possession for at least three years prior to their election of property of the taxable value of about $22,000, or an annual income of about $1100. They receive no compensation for their services. The Lower Chamber consists at present of 230 members chosen for a term of three years. Of these, 80 are chosen by the towns and 150 by the rural districts. The rural members are distributed on the basis of one member to every 40,000 inhabitants, while the towns are allowed one member for every 10,000 of the population. All native Swedes 21 years of age possessing property of the taxable value of about $280, or who cultivate for a period of five years a certain amount of land, or who pay an annual income tax on an income of about $225 are qualified voters. Any elector twenty-five years of age is qualified for membership in the Lower Chamber. The number of electors in 1899 was 339,876, less than 7 per cent. of the population, and but 40 per cent. of these actually voted. The members of the Second Chamber receive compensation.

The union of Norway and Sweden under the same executive makes necessary some provision for the administration of those affairs which are common to both monarchies, such as the conduct of their foreign relations. In this domain the King is given power to act for both countries, but his action is subject to the approval of the joint Council of State. Thus he may declare war and make peace, send and recall ambassadors, use ships of war, etc., with the consent of the joint council. This does not, however, destroy the individuality of either nation as regards foreign affairs, since the King may conclude treaties which affect but one of his kingdoms. Matters of common interest not within the power of the King are regulated by concurrent action of the two Diets. For the purposes of local administration Sweden is divided into 24 läns or provinces, each under the supervision of a prefect nominated by the King. In each province there is a general council or *Landsting*, which regulates internal affairs. The city of Stockholm, the capital, constitutes a separate administrative division. In the communes there is almost complete local self-government, all taxpayers being voters. Some of the communes have primary assemblies very much like the town meetings of New England, while those which are larger and more populous have municipal councils. In the parishes there are local assemblies for regulating ecclesiastical affairs.

Finance. The sources and amount of revenue and the expenditures for 1902 and 1903 were as follows:

REVENUE	1902	1903
	Kronor	Kronor
Domains, railways, land taxes, etc.	21,578,000	26,546,000
Customs	49,000,000	48,500,000
Post	12,400,000	13,340,000
Stamps	6,500,000	6,500,000
Impost on spirits, beet sugar, etc.	30,000,000	32,000,000
Tax on incomes, etc	10,500,000	26,950,000
Net profit of the National Bank	2,000,000	2,716,200
Surplus from the previous years	24,165,000	15,916,000
Total revenue	156,143,000	172,468,200

EXPENDITURE	1902	1903
	Kronor	Kronor
(*a*) Ordinary:		
Royal household	1,321,000	1,321,000
Justice	3,852,420	3,911,815
Foreign affairs	652,050	659,150
Army	33,775,094	37,204,600
Navy	10,461,982	11,865,917
Interior	19,319,100	25,015,315
Education and ecclesiastical affairs	13,721,011	14,115,333
Finance	7,299,821	7,338,705
Agriculture	4,680,915	4,859,600
Pensions	3,649,115	3,786,632
	98,732,508	110,078,067
(*b*) Extraordinary	43,872,492	40,466,033
(*c*) Expenditure through the Riksgäldskontor:		
Payment of loans and miscellaneous (diet, etc.)	11,888,000	13,774,100
Carried to floating capital	....	6,500,000
Fund for insurance against invalidity of workmen	1,400,000	1,400,000
Fund for insurance against accidents of workmen, etc	250,000	250,000
Total expenditure	156,143,000	172,468,200

On January 1, 1902, the public liabilities, contracted entirely for railroads, were 349,132,333 kronor, bearing interest at from 3 to 4 per cent. All loans are paid off gradually by means of sinking funds.

Weights, Measures, and Money. Gold is the standard of value. The krona, the unit of coinage, is worth 26 7-10 cents. The metric system of weights and measures became obligatory in 1889.

Army and Navy. See articles **Armies** and **Navies.**

Population. The population, according to the census of 1901, was 5,175,228. The density of population is 30 to the square mile. The growth of population has been as follows: in 1800, 2,347,303; in 1840, 3,138,887; in 1870, 4,168,525; and in 1890, 4,784,981. The emigration, chiefly to America, has been large for many years, and since 1894 has varied from 8000 to 19,000 a year.

Religion. The Lutheran Protestant Church is recognized as the State religion, and most of the people are professors of that faith, its adherents numbering 4,735,218 in 1890. Other Protestants numbered 44,375 and there were a few followers of the Roman Catholic and other faiths. In the State Church are 12 bishoprics and 2572 parishes.

Education. Education is maintained at a high level. It is under the control of the Government, is compulsory, and practically all the inhabitants of school age and over can read and write. The secondary schools and the universities are modeled on the German system. In 1902 there were 1434 students in the University at Upsala and 644 in the University at Lund. The schools included in 1901: 79 public high schools, 18,085 pupils; 29 people's high schools, 1510 pupils; 14 normal schools for elementary teachers, 1325 pupils; 2 high and 6 elementary technical schools; 10 navigation schools, 729 pupils; and besides schools for deaf mutes and the blind, medical, military, agricultural, veterinary, forestry, weaving, mining, and other special schools. In 1900 the expenditure on elementary education was 23,097,746 kronor, of which about one-fourth came from the national treasury.

Ethnology. The Swedes belong to the Scandinavian branch of the Teutonic stock. Their average stature is 1.705 meters, classing them among the tall races; the average cephalic index is 78.2. The Swedes are blondes, sturdy and robust. In the settlement of Sweden the Goths or Gotar were the first conquerors of whom history tells. They occupied the southern parts, and following them came the Svear, who overran the rest of the country and gave their name to the Svenskar or Swedes of today. The Dalecarlians are thought to preserve best the type of the Svear; they are described as tall, slender, and agile, with blue eyes and broad, open brow, courteous, cheerful, and firm, and with a wide reputation for honesty.

History. Tacitus in the *Germania* tells of the two great Germanic tribes in the Scandinavian peninsula, the Suiones, or Swedes, in the north, and the Gothones, or Goths, in the south. These two, like other rival Germanic tribes, seem to have been generally at war with each other, and it was not until about the fourteenth century that the country was really organized and unified through the cessation of jealousy between the two sections. The ancient Swedish people had a bond of union in their religion and a common sanctuary at Upsala, which was the early centre of Swedish nationality. The history of Sweden previous to the tenth century is wrapped in obscurity. In the first half of the ninth century Ansgar (q.v.), a Frankish missionary, came to Sweden from Denmark, and began the teaching of Christianity, which slowly became established in the country. Under Eric the Saint (1150-60) the Swedish power was strengthened and extended and Christianity with it. Churches were built and monasteries founded. Eric carried Christianity into Finland with the sword and established Swedish settlements in that country, whose subjugation, however, was not completed until more than a century after his death. He was defeated and killed in 1160 by the Danish prince Magnus Henriksen, who made an unprovoked attack upon Sweden, the beginning of a long series of wars between Sweden and Denmark, productive of national hatred and bitterness. The reigns of the early Swedish kings were short and stormy. In 1389 the Swedish nobles, disgusted with the conduct of their King, Albert of Mecklenburg, offered the crown to Margaret, Queen of Denmark and Norway, daughter of Valdemar IV., who defeated and dethroned Albert, and in 1397 brought about the union of Kalmar, by which the three Scandinavian kingdoms were henceforth to remain united under a single sovereign. This union continued with interruptions for more than a century, but with constant dissensions and wars between Denmark and the Swedish people. The Swedes themselves were divided between the upholders of national sovereignty and the supporters of the pretensions of the Danish kings. In the latter part of the fifteenth century the family of Sture (q.v.) rose to eminence in the struggle for national independence, Sten Sture, the Elder, being proclaimed administrator of the kingdom in 1470. In 1520 Christian II. of Denmark invaded Sweden to enforce his claim to sovereignty. The administrator, Sten Sture, the Younger, was defeated and mortally wounded and Christian entered Stockholm, where he enacted a carnival of blood, executing a large number of the nobles. Sweden soon rose against the tyrant (1521) under the lead of Gustavus Vasa, who was made administrator. He shook off the hated yoke of Denmark and in 1523 became King of Sweden. In 1529 Lutheranism was formally established as the State religion of the kingdom. Gustavus Vasa organized the kingdom as a hereditary monarchy, in which the power of the nobles was circumscribed and that of the clergy subordinated to that of the State. He fostered trade, manufactures, art, learning, and science, and left a full exchequer, a standing army, and a well-appointed navy.

The great work of the first Vasa sovereign was almost undone by his son and successor, Eric XIV. (1560-68), who became insane and was deposed, being succeeded by his brother, John III. At the beginning of Eric's reign Esthonia, a fragment of the dominions of the Knights Swordbearers, submitted to Sweden. The reign of John III. (1568-92) was notable for a reaction toward Catholicism. He had married Catharine Jagellon, of the Polish royal house, and in 1587 secured the election of his son Sigismund to the throne of Poland. For this Sigismund had to profess Catholicism. The great majority of the Swedes were strong Protestants, and when Sigismund succeeded his father as King of Sweden and attempted to restore Catholicism he was compelled by the Diet to resign the throne in 1599. His uncle Charles, the only one of Gustavus Vasa's sons who inherited his talents as a ruler, was made administrator of the kingdom and in 1604 was crowned King as Charles IX. The policy of Charles IX. was to encourage the burgher classes at the expense of the nobility; and by his successful efforts to foster trade—in furtherance of which he laid the foundations of Göteborg and other trading ports—to develop the mineral resources of the country, and to reorganize the system of Swedish jurisprudence, he did much to retrieve the calamitous errors of his predecessors. (See CHARLES IX.) The deposition of Sigismund gave rise to a long war with Poland. Charles was succeeded by his son, Gustavus II. Adolphus (1611-32). This greatest of Swedish kings was confronted at the beginning of his reign by wars with Russia, Poland, and Denmark, which last-named power still owned Scania and other districts at the southern extremity of the Scandinavian Peninsula. These wars were concluded advantageously for Sweden, which acquired Ingria, Karelia, and Livonia (the last-named not formally renounced by Poland until 1660), and the King addressed himself to the task of making Sweden the dominant power on the Baltic. In 1630 Gustavus Adolphus came to the rescue of German Protestantism, which had succumbed to the arms of Tilly and Wallenstein. (For his victorious career in Germany, and the successes of the generals who were trained in his school, see the articles GUSTAVUS II. ADOLPHUS, and THIRTY YEARS' WAR.) The foreign policy of Gustavus Adolphus was continued after his death at Lützen in 1632 by his able chancellor, Oxenstierna (q.v.), who directed the government during the minority of Gustavus's gifted but eccentric daughter Christina (1632-54). As a result Sweden was for nearly a century the great power of the north. By the Peace of Westphalia (1648) Sweden received Hither Pomerania (west of the Oder), the island of Rügen, and other territories in Germany, and was admitted to representation in the German Diet.

Charles X. Gustavus (1654-60) waged a fierce war against the Polish King, John Casimir, in which the Swedish forces overran Poland. He conquered from Denmark the provinces of Scania, Halland, and Blekinge, which rounded out the Swedish boundaries. The war with Poland was closed at his death by the Peace of Oliva (1660). Misgovernment by a regency followed during the minority of Charles X.'s son and successor, Charles XI. (q.v.) (1660-97). This King was involved as the ally of Louis XIV. in European wars, which the regency had not left him the resources to carry on. In 1675 the Swedes suffered a great defeat at the hands of Frederick William, the "Great Elector" of Brandenburg, at Fehrbellin. Charles XI. reorganized the government and was declared an absolute sovereign by the estates in 1693. His son, Charles XII. (1697-1718), by his military genius raised Sweden to an extraordinary pitch of power. Not long after his accession he successfully met a joint attack by Russia, Poland, and Denmark, dealing blows that astonished the world. His inordinate ambition, however, finally brought ruin upon Sweden. Peter the Great wrested from her Karelia, Ingria, Esthonia, and Livonia. Charles met his death in an invasion of Norway, leaving the kingdom overwhelmed with debts and again disorganized. With him the male line of the House of Vasa expired. His sister Ulrica Eleonora, who succeeded him, and her husband, Frederick of Hesse-Cassel, who shared the throne, were mere puppets of the nobles, whose dissensions as the factions of the 'Hats,' or French party, and the 'Caps,' or Russian party, brought on the country calamitous wars and almost equally disastrous treaties of peace. The weak

Adolphus Frederick of Holstein-Gottorp, who was called to the throne on the death of Frederick in 1751 and died in 1771, did little to retrieve the evil fortunes of the State. (See Structure.) His son, Gustavus III. (q.v.) (1771-92), skillfully availed himself of the general dissatisfaction of the people with the nobles, to destroy the factions of the Hats and Caps, and under a new constitution to restore the power of the Crown and of the popular estates at the expense of the nobles. His extravagance and dissoluteness detracted, however, from his merits as a ruler. He was assassinated in 1792. His son and successor, Gustavus IV. Adolphus (q.v.), was but three years of age at his accession, and was forcibly deposed in 1809, and obliged to renounce the crown for himself and his direct heirs in favor of his uncle, Charles XIII. (1809-18), who was compelled at once to conclude a humiliating peace with Russia, by the terms of which Finland was severed from Sweden. The early part of the reign of Charles, who was childless, was troubled by domestic and foreign intrigues to regulate the choice of an heir to the throne. Finally, hoping to conciliate Napoleon, the dominant party in Sweden elected General Bernadotte to the rank of Crown Prince. Bernadotte led the Swedish forces in suport of the Allies against the French Emperor in 1813-14. With the aid of England, Sweden compelled Denmark, in January, 1814, to cede Norway to her, the Swedish possessions in Pomerania being handed over to Denmark. The Congress of Vienna (1814-15) recognized the union of Norway with Sweden; Swedish Pomerania passed to Prussia. In 1818 Bernadotte mounted the throne as Charles XIV. John (q.v.). Under his able administration the united kingdoms of Sweden and Norway made great advances in material prosperity and political and intellectual progress; and although the nation at large entertained very little personal regard for their alien sovereign, his son and successor, Oscar I. (1844-59), and his grandsons, Charles XV. and the present King, Oscar II., who came to the throne in 1872, won a large share of the affections of the Swedes. The great problem of the dual kingdom under the present sovereign has been to satisfy the demands of the Norwegians, who are more democratic than the Swedes and are restive under the union. See Norway.

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SWE′DENBORG, *Sw. pron.* svā′den-bŏry′, Emanuel (1688-1772). A Swedish scientist and theologian. He was born in Stockholm and died in London. His father was Jesper Svedberg, subsequently Bishop of Skara. He was educated at Upsala, and traveled for four years in England, Holland, France, and Germany. On his return to Sweden he was appointed by Charles XII. to an assessorship of mines. Swedenborg was ennobled in 1719, and the family name changed from Svedberg to Swedenborg. Swedenborg published short treatises on various topics in the fields of mathematics, astronomy, physics, and chemistry. He devoted himself for eleven years to the duties of his assessorship and to a systematic description of mining and smelting, and the construction of a theory of the origin of creation. The result appeared at Leipzig in 1734, in three massive folios, entitled *Opera Philosophica et Mineralia.* This was followed in the same year by a treatise on *The Infinite, and the Final Cause of Creation; and the Mechanism of the Operation of the Soul and the Body*, carrying the doctrine of the *Principia* into higher regions. Dissatisfied with his conclusions, he determined to track the soul to its inmost recesses in the body. His studies in human anatomy and physiology, with this end in view, appeared as *Œconomia Regni Animalis*, in two volumes, 1741, and as *Regnum Animale*, in three volumes, unfinished, 1744-45.

At this point his course as scientist was arrested, and he entered on his career as seer, by which he is known in history. After 1745 he professed to have had his spiritual senses opened. His recorded experience was unique in this respect, that it did not consist in having communication with spirits, as is the claim in modern spiritualism; nor did it consist in having visions merely, and receiving communications, as was the case with the prophets; but it consisted in being himself consciously an inhabitant of the spiritual world as if he had died, and thence in associating with the people of that world as one of them. In 1749 he made his first public appearance in his new character in the issue in London of the *Arcana Cœlestia*, completed in 1756 in eight quartos. It is a revelation of the internal, or spiritual, sense of Genesis and Exodus. Adam signifies the Most Ancient Church, and the flood its dissolution; Noah, the Ancient Church, which, falling into idolatry, was superseded by the Jewish. The spiritual sense pervades the Scriptures, with the exception of Ruth, Chronicles, Ezra, Nehemiah, Esther, Job, Proverbs, Ecclesiastes, the Song of Solomon, the Acts of the Apostles, and the Epistles. By reason of its symbolism of the inward sense, the letter of Scripture is holy in every jot and tittle, and has been preserved in immaculate perfection since the hour of its divine dictation. The Jewish dispensation having reached its period, God appeared in Jesus Christ. He assumed human nature in its lowest condition in the Virgin, wrought it into conformity with himself, "glorified and made it divine." There is a Trinity, not of Persons, but of Divine Essentials, consisting of the Father, or God as He is in himself, and thus incomprehensible to man; the Son, or God as revealed to man in Jesus Christ; and the Holy Spirit, or divine operation thence. It is imaged in man by his soul, his body, and their operation. Swedenborg acknowledged God in Jesus Christ, and regarded Him as the sole object of Christian worship. The Church which Christ established at His advent in the flesh came to an end in 1757, and Swedenborg witnessed the last General Judgment at that time effected in the world of spirits. Then commenced a new dispensation, and a New Church, signified by the New Jerusalem in the Revelation, of which the writings of Swedenborg contained the doctrines.

The grand and distinctive principle of Swedenborgian theology, next to the doctrine of the divine humanity, is the doctrine of life. God alone lives. Creation is dead—man is dead; and their apparent life is the divine presence. God is everywhere the same. It fallaciously appears as if He were different in one man and in another. The difference is in the recipients; by one He is not received in the same degree as another. There is an inmost, or highest, degree, or plane, of man's reception of the divine life, called the celestial or love plane; there is a second, or lower degree of receptivity called the spiritual or wisdom plane, and there is a third called the natural or plane of obedience. The life of evil is the perversion of divine life into disorderly forms. These degrees of man's reception of God's life are entirely separate from each other, and can never be commingled. They are related by correspondence, by which each lower degree derives its existence and its life from the plane above. The relation of correspondence is plenary, there being nothing in a higher plane which is not represented by something corresponding to it in the plane below; and there is nothing in the lower plane which does not exist from some corresponding thing in the plane above; and all this to the most minute detail, even to the things on this earth. Earthly things beautiful and useful manifest spiritual good; and earthly things ugly and hurtful, spiritual evil. The Scriptures are written according to correspondences, and by the aid of that science their mysteries are unlocked. By it, too, the constitution of heaven and of hell is revealed. There are three heavens in which there live three orders of angels, the first, the second, and the third, or the natural, the spiritual, and the celestial; they are three planes, or degrees, of man's receptivity of divine life described above. All angels were once men, and have lived on this or some other planet. They marry and live in societies, in cities and countries as in the world, in outer appearance differing only in the vast superiority and glory of these things there. But the similarity between the life of angels in heaven and that of men on earth is of the outer appearance only, while the differences between them are internal and radical; for it is not in degrees of outer perfection and glory that the life in heaven and the life on earth may be compared truly, but in their capacity to supply a field for the realization of the inner life of the soul. To the angels the images presented to their senses are the expressions of ideas and emotions which are by this means revealed to them; and so concerned are they in these meanings, that they are unconscious of the objects of their senses, or of their own bodily life, as such. To them their sense-life therefore is made only a visible, audible, and tangible—a concrete spiritual life. There is no denominational favoritism with God; all in whom the love for God and man prevails in any degree whatever, and whatever may have been their Church, or religious connection, go to heaven after the death of their bodies. Between heaven and hell, there is an intermediate state called the world of spirits, where all those who pass into the spiritual world are prepared for their final states. Hell is not merely a place of punishment for the sins done in the body, but is a provision of divine love, and the necessary state and condition of the unregenerated natural man. No one is sent there, but the unregenerated seek a place there of their own accord. Hell as a whole is called the devil, or Satan; there is no supreme individual bearing that name. There are three hells opposite the three heavens.

All of Swedenborg's works were written in Latin and received little attention from contemporaries. The American Swedenborg Printing and Publishing Society of New York issued complete editions of the theological works in English, a nearly complete edition in Latin, certain of the works in Latin-English, and some in other languages. Most of the original manuscripts have been reproduced by photolithographic processes. Complete editions have been issued in English by the Swedenborg Society of London, which has also issued a concordance to the works by Potts (6 vols. 1888 et seq.). The *Rotch Edition* of Swedenborg's works in small volume is published by the Massachusetts New-Church Union. About forty biographies of Swedenborg have been published. The most important of those now in print are by Wilkinson (London, 1849), White (ib., 1856), Swift (ib., 1883), and Worcester (Boston, 1883). Consult also *Documents Concerning the Life and Character of Emanuel Swedenborg, Collected, Translated, and Annotated* by R. L. Tafel (London, 1875-77), a very scholarly work, compiled with great labor.

SWEDENBORGIANS. The name popularly applied to those who accept the doctrines of Christianity and of philosophy as set forth in the writings of Emanuel Swedenborg (q.v.). They do not call themselves Swedenborgians, but members of the New Church. Swedenborg formed no ecclesiastical organization, and many of his followers do not sever themselves from their previous Church connections; but the majority have organized a Church which they have named 'The Church of the New Jerusalem,' after the New Jerusalem of Apocalyptic vision (Rev. xxi.). The first movement toward organization began in Great Britain in 1782, when Robert Hindmarsh, a printer of London, and certain associates formed a class for reading and studying the writings of Swedenborg. This grew into a society for worship and preaching. Public services were first held in 1788. The General Conference of the New Jerusalem Church in that country began its sessions in 1789, and since 1815 has met annually. In 1902 the Conference consisted of 73 societies, with an aggregate membership of 6337. There were twelve societies, with a membership of 193, which do not belong to the Conference, and also 996 believers not connected with any society, enrolled as 'isolated receivers,' making a grand total of 7526 enrolled Swedenborgians in Great Britain. On the Continent of Europe there is a society of Swedenborgians in each of the cities of Paris, Zurich, Florence, Budapest, Vienna, Stuttgart, Copenhagen, Stockholm, and Gothenburg. In the United States the first society of Swedenborgians was organized in Baltimore in 1792. The General Convention of the New Jerusalem in the United States and Canada held its first meeting in Philadelphia in 1817. With little interruption this body has held annual sessions ever since. In this country the Swedenborgian societies are grouped into State organizations, called associations. The General Convention is composed of twelve of these associations, and of nine separate societies. The individual membership of the bodies composing the Convention as reported in 1902 was 6812. There is a smaller organization of the Swedenborgians called *The General Church of the New Jerusalem*. Its headquarters are in the United States, though it has members in other countries. It is an offshoot from the Convention, having withdrawn from that body in 1891. It reports a membership of 600. In Australia there are four societies of Swedenborgians, with an aggregate membership of about 350; and there is a society in New Zealand; one on the island of Mauritius, in the Indian Ocean; and one at Durban, South Africa. There are also circles of readers and students of Swedenborg of sufficient importance to be reported in the journals of the organization in British India, China, Japan, and South America. Taken all together there are not far from 16,000 registered adult members of the Swedenborgian faith in the world.

The ministry of the Swedenborgians is patterned after the Episcopal order. In the General Conference of Great Britain there are 7 ordaining ministers, 35 ordained ministers, and 12 recognized leaders and missionaries, making a total ministerial force of 54. In the General Convention of the United States there are 6 general pastors, 102 pastors and ministers, and 16 authorized candidates and preachers, making a total of 124 in its ministerial force. The General Church of the New Jerusalem reports one bishop, 16 pastors, 4 ministers, and 2 candidates, making a ministerial force of 23. The pastors and ministers of the societies scattered throughout the world for the most part act under the authority of some one of these three general bodies, and their ministerial force of about 200 as reported above may be considered as constituting the entire clergy of the Swedenborgians in the world. In this classification the ordaining ministers of the General Conference, the general pastors of the General Convention, and the bishop of the General Church hold among Swedenborgians a position similar to that of a bishop of the Episcopal Church, though with the exception of the bishop of the General Church they do not exercise such authority.

A number of Swedenborgian societies in England conduct secular schools in connection with their religious societies. There are ten such institutions, with an aggregate enrollment (in 1902) of 4375 scholars. There is also a New Church College, London, concerned for the most part in preparing young men for the ministry. In the United States there are The Waltham New Church School, at Waltham, Mass.; The Urbana University, at Urbana, Ohio; The New Church Theological School, at Cambridge, Mass.; and The Academy of the New Church, at Bryn Athyn, Pa., conducted by the General Church, which has also several parochial schools in the United States and Canada. The sect publishes many journals.

SWEDISH LANGUAGE AND LITERATURE. Swedish belongs to the northern branch of the Germanic family, within which it is an eastern development of the old *donsk tunga*, or Danish tongue, a name anciently applied to the language spoken not in Denmark only, but in the rest of Scandinavia as well. It was very much the same in the entire Northland down to about A.D. 900, or a little later, when it began to differentiate into an eastern type, ramifying into Danish and Swedish, and a western type, giving rise to Norwegian and Icelandic. From 900 to 1500 the Swedish branch is called Old Swedish. Until after 1200 the only records are runic inscriptions, cut for the most part on gravestones. The use of the Latin alphabet began in the thirteenth century. In the fourteenth century, when a literary language began to develop out of the Södermanland dialect, the differentiation from Danish proceeded slowly; after this came a period of extensive approximation to Danish, to be followed in time by an archaizing period, which restored original forms. Aside from divergencies of vocabulary, Swedish now differs from Danish especially in its retention, after a vowel, of the old voiceless consonants, *k*, *t*, *p*, which in Danish changed to *g*, *d*, *b*, and in its retention of the vowels *a* and *o* in unstressed syllables, where Danish has *e* or no vowel at all; thus Swedish *bok*, 'book,' *mat*, 'meat,' *apa*, 'ape,' are in Danish *bog*, *mad*, *abe*. Swedish *talar ni svenska* 'do you speak Swedish?' is in Danish *taler de svensk;* and Swedish *flickan liknar sin mor*, 'the girl resembles her mother,' is in Danish *pigen ligner moderen*. Under this head it may be added that Swedish has not the 'glottal catch' of Danish, and that Danish has not the delicately modulated musical accent of Swedish.

The main body of the Swedish vocabulary is old Germanic stock, the principal foreign ingredients being (1) Latin and Greek words that came in with Christianity or with the growth of scholarship; (2) Low German words dating from the time of the Hanseatic League, as *arbeta*, 'to work,' *störel*, 'boot,' *smaka*, 'taste;' (3) German words from the time of the Thirty Years' War, as *tapper*, 'brave,' *prakt*, 'splendor;' (4) French words borrowed in the seventeenth and eighteenth centuries, as *affär*, 'business,' *talang*, 'talent,' *charmant*, 'charming.' Like the other North-Germanic tongues, Swedish has the postpositive definite article (originally a pronominal affix); thus *flicka*, 'girl,' *flickan*, 'the girl.' As in English, nouns have but one case (the genitive) which is now distinguished by inflection. The genitive ending is *-s*, which is appended after the article; thus *flickans mor*, 'the girl's mother.' The plural of nouns is formed by means of the endings *-or*, *-ar*, *-er*, *-en*, to which the definite article is appended in the forms *-na*, *-ne*, according to a feeling for vowel-balance which shows itself as early as the fourteenth century; thus *flickorna*, 'the girls,' but *dalarne*, 'the dales.' A new pronoun of address, *ni*, taking the place of *I*, came into the language in the seventeenth century and is now commonly used in books; but in conversation Swedish politeness prefers to avoid it and substitute the title of the person addressed, putting the verb in the third person; thus *är frun sjuk*, 'is the lady sick?' = 'are you sick, madam?' The verb still retains the old Scandinavian passive in *-s*, which was originally an affixed reflexive pronoun; thus, *kalla*, 'call,' *kallas*, 'to be called.' A more peculiar feature of conjugation is the differentiation of the perfect passive participle into two forms, one of which, called the supine, is used to inflect the perfect tenses, while the other is declinable and serves as a true participle; thus *jag har älskat*, 'I have loved,' but *jag är alskad*, 'I am loved,' and *vi äro älskade*, 'we are loved.'

In the printing of Swedish the Roman letters have long since prevailed. Speaking somewhat roughly, the written language of to-day represents the pronunciation of about two hundred years ago; and as phonetic change has been at work during the interval, it is the case, just as in English, that the written form is often a bad index to colloquial utterance. Swedish print teems with 'silent' letters; thus, *jag skal vara i staden*, 'I shall be in the city,' is pronounced *ja ska vara i stān*; and *hvad är det*, 'what is it?' becomes *va ä de*. For the learner of Swedish one of the greatest difficulties is presented by its peculiar accent, which involves both stress and variations of musical pitch. Every word has either the simple or the compound tone. The simple tone is a rising modulation, while the compound (to quote from Sweet) "consists of a falling tone on the stress-syllable, with an upward leap of the voice and a slight secondary stress on a succeeding syllable." Not only the correct pronunciation, but the very meaning of a word often depends on the exact modulation of its musical accent.

Bibliography. For Old Swedish the leading authority is Noreen, *Altschwedische Grammatik* (Halle, 1897). He has also treated the subject in his *Geschichte der nordischen Sprachen* (Strassburg, 1898), a reprint of his article in the second edition of Paul's *Grundriss*. The great work on Swedish grammar is Rydqvist, *Svenska språkets lagar* (6 vols., Stockholm, 1850-83). A good small grammar is Schwarz and Noreen's *Svensk språklara* (ib., 1881). There is no good grammar in English. The best Swedish-English dictionary is that of Björkman (Stockholm, 1886). The great dictionary of the Swedish Academy, *Ordbook öfver svenska språket* (Lund, 1894 et seq.), is only in the initial stages. On the subject of the dialects consult Lundell, *Nyare bidrag till kännedom om de svenska landsmalen*, etc. (Stockholm, 1879 et seq.). An excellent account of Swedish pronunciation by Sweet is given in *Transactions of the Philological Society* (London, 1877-79).

The Literature. About 160 of the runic inscriptions of Sweden, the oldest dating from the tenth century, contain alliterating verses evidently quoted from preëxisting sagas. This and other lines of evidence show that the poetic art was widely cultivated in the Viking Age. But this 'literature,' which may have been comparable to that preserved in Old Icelandic, is lost. By the middle of the twelfth century Christianity was firmly established, and the old pagan songs and sagas fell under the ban of the Church. From that time on for five hundred years the national literature was dominated, rather more than elsewhere in Western Europe, by the religious spirit. The earliest writings that have come down in the Latin alphabet are certain codes of provincial laws (*landskapslagar*). The most important is the "Elder West Göta Law," dating from the thirteenth century. Magnus Eriksson's *Landslag* (about 1350) is that King's attempt to provide a common law for all the provinces he had brought under his rule. It was probably a scholar from the entourage of this same King Magnus who wrote the celebrated *Um styrilsi konunga ok höfþinga* ("On the Conduct of Kings and Magnates"). To the fourteenth century belong the writings ascribed to Saint Birgitta, a pious nun and mystic revealer of heavenly things. There are nine books of her "Revelations." Saint Birgitta is the most eminent personage in the annals of Catholic Sweden. She made the Convent of Vadstena a literary centre, where many Latin writings, chiefly mystical and hagiographic, but including a part of the Bible, were translated into Swedish for the benefit of the nuns. In poetry the mediæval period is not very rich, though its aggregate of metrical production is considerable. The romances of chivalry are represented in the so-called *Eufemiavisor*, certain tales of knighthood done into Swedish verse by a gleeman living at the court of Queen Euphemia of Norway (1303-12). They are *Herra Iwan*, *Hertig Fredrik af Normandie*, and *Flores och Blanzaflor*, *all* in rhyming couplets with four accents to the line. Besides these metrical romances, there are several rhymed chronicles, the oldest being the *Erikskrönika* (about 1320), and the ballads. It is agreed that the ballad-making period in Sweden was in the thirteenth and fourteenth centuries, but the extant collections are of the sixteenth and seventeenth. None of the known specimens are of indisputable antiquity, but the best compare very well in form and matter with the better *Kæmpeviser* of Denmark. From the fifteenth century we have a few good poems by Bishop Thomas of Strengnäs (died in 1443).

The Reformation transferred the literary centre from Vadstena to Upsala. The literature of the sixteenth century is almost exclusively religious, the two chief writers being the brothers Petri, Carmelite monks who had been converted to Lutheranism at Wittenberg. They stand out as the leading Swedish apostles of the new faith. The elder, Olavus ('Master Olof'), wrote psalms, devotional poems, a prose chronicle of Swedish history, and (probably) the mystery-play *Tobie Comedia*. With his brother Laurentius he directed the publication of the first Swedish Bible

(Upsala, 1541). The first secular author of any note in the new era is the historian Messenius, who also wrote six 'school comedies' on subjects from Swedish history. The best known is *Disa*, which was played by Upsala students in 1611.

The period of Swedish expansion (1630-1730) is marked by the widening of the literary horizon through the introduction of new ideas and forms from Germany, France, Italy, and Holland. The prominent figure is Stjernhjelm (1598-1672), the 'father of Swedish poetry.' He did a work like that of Opitz in Germany, by whom he was influenced; that is, he sought to give his country a worthy poetic literature by imitating good models, old and new. He laid great stress on metrical regularity and ornateness of diction. His poem *Hercules*, a didactic allegory on the conflict of Pleasure and Duty, may fairly be said to have nationalized the dactylic hexameter. It is metrically elegant, but rather florid. Stjernhjelm also experimented with alexandrines, the *ottava rima*, the sonnet, and the ballad. His most noteworthy disciple was the poet-scholar Columbus (1642-79). An opponent of Stjernhjelm, Rosenhane (1619-84), won fame especially as a sonneteer. A jovial and facile rhymester who stood apart from the schools was Johansson, called Lucidor (died in 1684). The eccentric polyhistor Rudbeck (1630-1702), with his amazing *Atlantika*, belongs to the history of literary curiosities rather than of literature.

In the ensuing epoch (1730-1772) the great Swedish names are Swedenborg and Linnæus; but they belong, respectively, to the history of religion and of science. In belles lettres the ideals of Sweden were substantially those of contemporary France and England. The presiding genius is Dalin (1708-63), whose *Swedish Argus*, started in 1732 in imitation of the *Spectator*, became the rallying-point of the dominant ideas. Dalin had something of Voltaire's versatility and cleverness. He wrote much poetry, but is best remembered as an elegant stylist in prose, the first in Swedish annals. Opposed to Dalin in some of his tendencies was the coterie of Fru Nordenflycht (1718-63), the 'Northern Aspasia.' Her salon in Stockholm was not unworthy of its Parisian models. To her circle belonged Creutz (1729-85), best known for his pleasant pastoral *Atis och Camilla*, and Gyllenborg (1731-1808), author of many ratiocinative poems. All these mid-century writers were strongly influenced by their contemporaries in England.

The Gustavian epoch (1772-1809) is marked by royal patronage of letters on a large scale. Gustavus III., himself a playwright and a prize orator, assembled an academic court of talent, which continued the French tradition of the Old Régime. The leading Gustavians were Kellgren (1751-95), Leopold (1756-1829), and Oxenstjerna (1750-1818), all poets of considerable talent and devoted to the ideals and sentiments of the expiring Age of Enlightenment. Here belongs also the name of the gifted poetess Fru Lenngren (1754-1817), famed for her idyls and satires and her literary salon. Quite untouched by academic influence was the much admired Bellman (1740-95), a genial humorist of Anacreontic tendencies, who turned his observations of Stockholm low life into wonderfully tuneful verse. To the Gustavian period belongs, finally, though not of its spirit and distinctly prophetic of a new era, the best work of the eminent lyric poet Franzén (1772-1847).

The great Romantic movement of the nineteenth century, with the concomitant renaissance of national feeling, affected Swedish literature profoundly. The new ideas, coming from Germany by way of Denmark, precipitated at first a wordy war of various schools and tendencies, after which came a season of really brilliant production. In the soulful verse of Wallin (1779-1839); in the best work of the arch-Romanticist Atterbom (1790-1855); in the fine spirituality and exquisite workmanship of Stagnelius (1793-1823); in the stirring Northern poems of Geijer (1783-1847), who was destined to become, next to Fryxell, perhaps, his country's greatest historian; in the productions of the brilliantly endowed but erratic and uneven Almqvist (1793-1866); and of several minor poets like Sjöberg (1794-1828) and Nicander (1799-1839); but above all in the splendid talent of Tegnér (1782-1846), who won world-wide fame with his romanticized *Frithiof's Saga*—the national genius found a richer expression than at any time before or since.

In the mid-century period the prominent names are Fredrika Bremer (1801-65), once widely read at home and abroad, and Runeberg (1804-77), a strong rival of Tegnér for the first place of honor in the whole Swedish Parnassus. Somewhat later come Topelius (1818-98), best known for his novels of Finnish history, and Rydberg (1829-95), eminent as poet, novelist, and translator of Goethe's *Faust*. The newer realism is most conspicuously represented by Strindberg (1849—), and recent poetry by Count Snoilsky (1841-1903).

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SWEDISH MOVEMENT. See MOVEMENT CURE.

SWEDISH MUSIC. See SCANDINAVIAN MUSIC.

SWEDISH NIGHTINGALE. A popular name given to the Swedish singer Jenny Lind.

SWEE'NEY, THOMAS WILLIAM (1820-92). An American soldier, born at Cork, Ireland. He came to the United States in his boyhood; in 1846 enlisted as second lieutenant in Burnett's New York Volunteers, and fought under General Scott in Mexico. At the outbreak of the Civil War he was in command of the arsenal at Saint Louis, Mo. In reply to efforts of Confederate sympathizers to induce him to surrender that important post he declared that before he would do so he would blow it up. As second in command he participated in the capture of Camp Jackson in May, 1861; assisted in organizing the Home Guards, and was chosen brigadier-general of that organization, and commanded the Fifty-second Illinois at Fort Donelson. At Shiloh he successfully defended a gap in the Union line. He commanded the second division in Sherman's Atlanta campaign. In 1866 he took a prominent part in the Fenian invasion of Canada. He retired from the United States Army in 1870 with the rank of brigadier.

SWEET, Benjamin Jeffrey (1832-74). An American soldier, born at Kirkland, Oneida County, N. Y. At the age of sixteen he moved with his father to Wisconsin. At the outbreak of the Civil War he helped to raise two regiments, and became colonel of one of them, the Twenty-first Wisconsin. At the battle of Perryville he received a wound that incapacitated him from further service in the field. In the spring of 1864 he was put in command of Camp Douglas at Chicago. In the following July and again in November he defeated plots of the Knights of the Golden Circle (q.v.) to capture Chicago and release the 10,000 Confederate prisoners confined in Camp Douglas. For these services he was promoted brigadier-general of volunteers. From 1869 till 1870 he was United States pension agent at Chicago, and from 1870 till his death was First Deputy Commissioner of Internal Revenue at Washington.

SWEET, Henry (1845—). An English philologist, born in London. He was educated at King's College and Balliol College, Oxford. He devoted himself to Anglo-Saxon and phonetics. Of his editions of Anglo-Saxon texts the most important are King Alfred's version of Gregory's *Cura Pastoralis* (1871); *Anglo-Saxon Reader* (7th ed. 1894); *Anglo-Saxon Primer* (3d ed. 1883); *Alfred's Translation of Orosius* (1883); *Epinal Glossary* (1883); *Oldest English Texts* (1885). Among his contributions to Anglo-Saxon philology are his *Dialects and Prehistoric Forms of Old English* (1876), and *A Sketch of Anglo-Saxon Poetry,* in Wharton's *History of English Poetry,* vol. iv. (London, 1871). His work in phonetics includes his *Handbook of Phonetics* (1877); *History of English Sounds* (2d ed. 1888); and *Primer of Phonetics* (1890). He is likewise the author of *Words, Logic, and Grammar* (1876); *Elementarbuch des gesprochenen Englisch* (2d ed. 1886); *New English Grammar* (1892); *Current Shorthand, Orthographic and Phonetic* (1892); and a literary study on *Shelley's Nature-Poetry* (1891), of primers of Middle English (1884-86) and of Icelandic (1886), and *The Practical Study of Languages* (1899).

SWEETBRIER. See Eglantine.

SWEET CALABASH. See Granadilla.

SWEET FERN. A popular name for Myrica asplenifolia and Myrrhis odorata, also known as sweet cicely, both of which have fern-like foliage. The former, being rich in tannin, has been employed as an astringent in domestic medicine; the latter is employed in cooking, for its agreeable flavor.

SWEET FLAG. See Acorus.

SWEET GALE. See Candleberry.

SWEET GUM. See Liquidambar.

SWEET PEA (*Lathyrus odoratus*). An old-fashioned papilionaceous garden flower which has been brought into prominence and greatly improved in form and color during the closing quarter of the nineteenth century. The plant is a free random grower like other peas, but has perfumed flowers of greater beauty. Sweet peas should be planted as early in spring as the ground can be worked. A rich, deeply prepared clay loam suits them best. Thin, dry soils are not satisfactory. Sweet peas should be sown thinly, 2 to 3 inches deep in trenches 4 to 5 inches broad and as deep, 3 to 3½ feet apart. Brush or trellis should be provided when the plants are two inches high, and shallow cultivation should be given all through the growing season and blooming period, gradually filling up the trench. No pods should be allowed to ripen as long as flowers are wanted, as growth ceases with the ripening of the pods. More than 100 named varieties are in cultivation. Two other closely related peas are also cultivated for their flowers—the sweet tangier pea (*Lathyrus tingitanus*) and the perrenial or everlasting pea (*Lathyrus latifolius*). Both have long been in cultivation in Europe. The latter, which is very hardy, has many-flowered clusters, large standard, scentless flowers, strongly veined leaflets, and broad, hairless pods. Consult: Hutchins, *All About Sweet Peas* (1894); id., *Sweet Peas Up to Date* (Philadelphia, 1897); New York Cornell Agricultural Experiment Station Bulletins 111, 127.

SWEET PEA (*Lathyrus odoratus*).

SWEET POTATO, or Batatas (*Ipomœa Batatas*). A perennial plant of the natural order Convolvulaceæ, with long creeping stems, heart-shaped leaves on long stalks, and variously lobed, large purple flowers much resembling those of the best known species of Convolvulus, and large oblong or elongated roots. Authorities differ as to whether it owes its origin to East India or America, but it is now cultivated in all tropical and sub-tropical countries for its sweet, wholesome roots, which are highly esteemed as an article of food.

The sweet potato is propagated by sets obtained from the tubers sprouted in a specially prepared bed and when about four inches tall planted 18 inches asunder in rows 3½ feet apart in the field; the later vine cuttings, which are commonly used in the Gulf States and as far north as Virginia, require from 90 to 105 days to mature their roots. The crop grows best in a warm, sandy, well-drained soil. It requires clean cultivation. Early digging yields only one-half to two-thirds as much as may be obtained from the matured crop, which averages from 250 to 275 bushels per acre. The roots should be harvested before frost and when the ground is dry. The roots must be stored in a rather warm, dry place, as otherwise heavy losses are almost sure to occur from rotting. The so-called 'yams' grown in the United States are all sweet potatoes.

The most serious diseases of the sweet potato destroy the fleshy roots. The black rot (*Ceratocystis fimbriata*), which appears as greenish black, irregular spots which increase in size and eventually destroy the whole root, may be spread through planting diseased tubers in the seed bed or through the presence of the fungus in the soil. At the New Jersey Experiment Station sulphur in the soil has been used with success as a preventive. Dry rot (*Phoma batatæ*) dries, wrinkles, and fills the roots with powder. It attacks the whole root in the field. Rotation of crops and destruction of diseased material are recommended as preventives. A soft rot (*Rhizopus nigricans*) attacks stored roots, usually commencing at places where the skin has been broken. Since moisture favors its spread, sweet potatoes should be stored in well-ventilated, dry rooms. A leaf spot (*Phyllosticta bataticola*) often attacks and turns the foliage white, and a leaf mold (*Cystopus ipomœæ-panduranæ*) turns the leaves, especially the older ones, brown. Spraying with Bordeaux mixture or other fungicide (q.v.) is recommended for these last two and the first disease.

As ordinarily prepared for the table the skin constitutes on an average 20 per cent. and the edible portion 80 per cent. of the root. The edible portion has the following percentage composition: water, 69.0; protein, 1.8; fat, 0.7; nitrogen-free extract, 27.4; and ash, 1.1 per cent., the fuel value being 570 calories per pound. Like ordinary potatoes, sweet potatoes are a succulent food, the chief nutrient being carbohydrates, the principal of which is starch. Sugars are also found, 2.5 per cent. cane sugar and 3.4 per cent. invert sugar being the average amount found in a large number of analyses. In addition to the quantities consumed in the fresh state, sweet potatoes are also canned and evaporated. They are sometimes fed to farm animals, especially pigs. To secure the greatest profit the pigs should harvest the crop and some nitrogenous feed like cowpeas should also be fed. See Plate of YAM, SWEET POTATO, ETC.

SWEET-POTATO INSECTS. The leaves of the sweet potato are punctured by a small bronzed flea-beetle (*Chætocnema confinis*), which eats channels along the veins soon after the plants have been set out and causes the leaves to shrivel. The most serious of the insect enemies of the crop are several species of tortoise-beetles. (See TORTOISE-BEETLE.) Among the commonest species are the two-striped tortoise-beetle (*Cassida bivittata*), which is pale yellow and has two black stripes on each wing-cover. The larva is dirty yellowish white and covers itself with cast skins and excrement. It gnaws irregular holes in the leaves underneath which it transforms to pupa. The golden tortoise-beetle (*Coptocycla aurichalcea*), which is more abundant, resembles gold tinsel and is beautifully resplendent. The larva is dark brown and feeds like the previous species. Arsenical sprays have been recommended.

SWEET-SCENTED SHRUB. See CALYCANTHUS.

SWEET SOP (*Anona squamosa*). A bush or small tree of the natural order Anonaceæ, a native of tropical America and introduced in other warm countries. The scaly greenish fruit has a soft, somewhat mealy, sweet, and luscious pulp with a musky aromatic odor and flavor. It is much used, generally raw, but sometimes cooked, and has proved valuable during famines in Hindustan.

SWEET SULTAN. A garden plant. See CENTAUREA.

SWEET VERNAL GRASS. A slender European grass (*Anthoxanthum odoratum*), about 18 inches tall and bearing a loose cylindrical spike of flowers. It is noted for its pleasing odor due to coumarin which is most noticeable when the plant is in flower. It is often mixed with other grasses to give flavor to hay, but is not considered equal in feeding value to timothy, orchard grass, etc. See Plate of GRASSES.

SWEET WILLIAM, WILD. See PHLOX.

SWELL (AS., OHG. *swellan*, Ger. *schwellen*, to swell; possibly connected with Gk. *σαλεύειν*, *saleuein*, to toss, Lat. *salum*, open sea). A term applied to a local thickening of a mineral deposit. The phenomenon is not uncommon in many metalliferous veins, and is caused by local expansions of the ore-bearing fissure, due to dynamic action or solution. In coal seams a similar phenomenon is often met with, but the swell here is caused by movements of the floor and roof of the coal bed.

SWELL. In music, a set of pipes in an organ, forming a separate department, which are capable of being increased or diminished in intensity of sound by the action of a pedal, or by a series of shades or shutters overlapping each other like Venetian window-blinds, within which the pipes in question are inclosed. The first recorded swell organ was made in 1712 by Jordan, and in 1763 Shudi introduced the so-called Venetia swell, but the compass of all the early swells was very incomplete. See ORGAN.

SWELLFISH. One of the many names applied to plectognath fishes, especially of the family Tetraodontidæ, which inflate their bodies with air until they become globe-like and the spines of their skin rigid, making them unpleasant morsels for an enemy to swallow. A familiar example is *Tetraodon turgidus*, of the Eastern American coast-waters, also called 'swell-toad' and 'puffer.' Compare GLOBEFISH. See Plate of PLECTOGNATH FISHES.

SWELL SHARK. A small, voracious gray shark (*Catullus uter*) of the family Scylliidæ, common on the Pacific Coast from central California to Chile, and often taken in lobster-pots. When caught it will inflate its stomach with air, until its thickness is equal to a third of its length, and will float belly upward until it supposes the danger past; hence its vernacular name. See Plate of LAMPREYS AND DOGFISH.

SWETCHINE, svěch-ēn′, ANNE SOPHIE SOYMANOFF (1782-1857). A Russian-French author, born in Moscow. Her father was Soymanoff, the founder of the Moscow Academy. She married in 1799 General Swetchine and established at Saint Petersburg a *salon* of much distinction, frequented by émigrés. Thus she came into touch with Joseph le Maistre in 1815, and was by him converted to Roman Catholicism. In the next year she moved to Paris, where her equally famous *salon* took on a distinctly religious tone. Her writings, all of a religious or contemplative character, are edited with a *Life* by Falloux (Paris, 1860); her *Lettres* by the same editor (ib., 1862; 5th ed. 1881), who added a journal of her *Conversation* (ib., 1863), and *Lettres inédites* (ib., 1866). Her letters have been translated by H. W. Preston (Boston, 1867). Consult: Sainte-Beuve, *Nouveaux lundis* (vol. i., Paris, 1863-72), and Scherer, *Etudes critiques sur la littérature contemporaine*, vol. i. (ib., 1863).

SWETE, swēt, HENRY BARCLAY (1835—). An Anglican clergyman, especially distinguished for his work in textual criticism. He was born at Redlands, Bristol, and was educated at King's College, London, and at Caius College, Cambridge. In 1877-90 he was rector of Ashdon, Essex; in 1882-90 professor of pastoral theology at King's College, London, and in 1890 was made regius professor of divinity in Cambridge. Among his published works are two essays on the *History of the Doctrine of the Holy Spirit* (1873, 1876), an edition of *Theodore of Mopsuestia's Commentary on the Epistles of Saint Paul* (1880-82), *The Old Testament in Greek* (1887-94; 2d ed. 1895-99), *The Akhmîn Fragment of the Gospel of Saint Peter* (1893), *The Psalms in Greek According to the Septuagint, with the Canticles* (1889; 2d ed. 1896), *The Apostles' Creed in Relation to Primitive Christianity* (1894; 3d ed. 1899), *Church Services and Service Books Before the Reformation* (1896), and *An Introduction to the Old Testament in Greek* (1900).

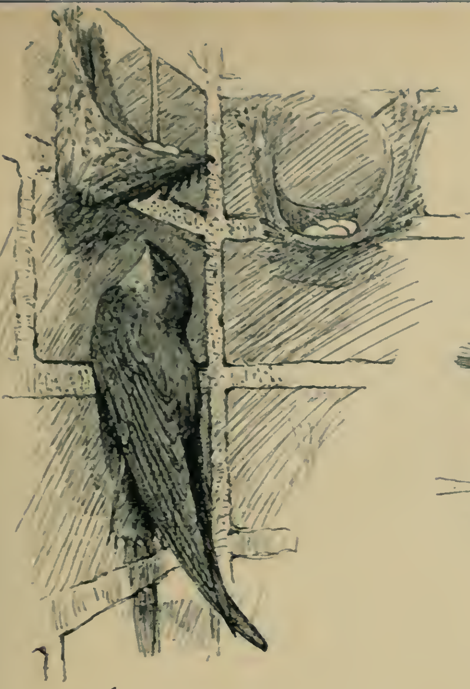
SWEYN, swān, **SWEGEN**, svā′gen, or **SWEND**, svěnd. A King of Denmark, father of Canute (q.v.). See DENMARK.

SWIETEN, svē′ten, GERARD VAN (1700-72). A celebrated Dutch physician and scholar, born at Leyden, where, after studying philosophy at Louvain, he pursued medicine under Boerhaave, whose most distinguished pupil he became. Called to Vienna in 1745 as physician in ordinary to Maria Theresa, he instilled new life into every branch of science, but especially promoted reforms in the study of medicine, which, as director of the faculty, he raised to a high standard through his own teachings as well as by the appointment of famous specialists to chairs at the university. Reforms in the other faculties presently followed, and although greatly hampered by the intrigues of the Jesuits, Van Swieten held his own against them here as well as in the supervision of censorship, in which considerable authority was accorded him as custodian of the Imperial library, and of which he was finally appointed chairman in 1759. In science he sought his fame as an expositor of his teacher Boerhaave. His *Commentaria in Hermanni Boerhaave Aphorismos de Cognoscendis et Curandis Morbis* (new ed. 1787-92) hold a permanent place in medical literature. In 1758 Van Swieten, having saved the life of the Empress, was created a baron.

His son GOTTFRIED (1733-1803) succeeded him as custodian of the Imperial library and was an intimate friend of Haydn and Mozart. For the former he adapted the text of the *Creation* from the English and wrote the text of *The Seasons*.

SWIFT (AS. *swift*, fleet, rapid; connected with *swāpan*, Eng. *swoop*, *sweep*, OHG. *sweifan*, Ger. *schweifen*, to rove). A bird of the family Cypselidæ, nearly related to the humming-birds. The swifts are widely distributed, and some are only found in tropical countries; others are birds of passage, and spend the summer in colder parts of the world. Many are popularly called swallows, as, for example, the chimney-swift of the United States, almost always called 'chimney-swallow.' This confusion is due to a resemblance in the long, pointed wings, the small, widely gaping bill, the weak feet, and to the habit of capturing their insect prey by untiring hunting in the air. About seventy-five species of swift are known, half of which are American, although only four occur in the United States. Swifts are mostly dull-colored birds, black, brown, gray, and white, and are seldom over seven inches in length or more than twice that across the wings. They are remarkable for the development of the salivary glands, the secretion of which is used in building the nest. The latter may be nearly pure saliva, as in the edible nests of the salangane (q.v.), or, as is more commonly the case, may be composed of grass, twigs, or other vegetable matter, glued together and to the support by saliva. The nests are attached to cliffs, the interior of chimneys, or hollow trees, the spathes of palm blossoms, or the leaves of palms, etc. The eggs are pure white, unspotted. The only swift common in the United States is the well-known chimney-swift (q.v.). Along the Pacific Coast occurs also the great black swift (*Cypseloides niger*), whose range includes the West Indies and Mexico and extends north to British Columbia. It breeds on inaccessible cliffs, and is still little known. Another large swift (*Cypselus melanoleucus*), which has the chin, throat, and breast white, occurs in the Southwestern United States, north to Wyoming and Utah, and it also breeds on practically inaccessible cliffs. To the same genus as the last-named species belong the best-known European forms. In this genus, which contains about twenty-five species, three-fourths belonging to the Old World, the tail is usually forked, the legs and toes are feathered, and all the toes are directed forward. The common and widespread European swift is *Cypselus apus*. Another notable species is the alpine swift of the mountainous parts of South Europe. To this same genus belong the palm swifts of the West Indies, of which a Jamaican species (*Micropus phœnicobia*) is noteworthy on account of its nest, which when placed in a palmetto is glued to the surface of one of the great fronds and formed of silk-cotton in the shape of a bag or watch-pocket open at the side. Some of the most curious and interesting swifts dwell in the Orient. One genus

SWIFTS AND THEIR NESTS



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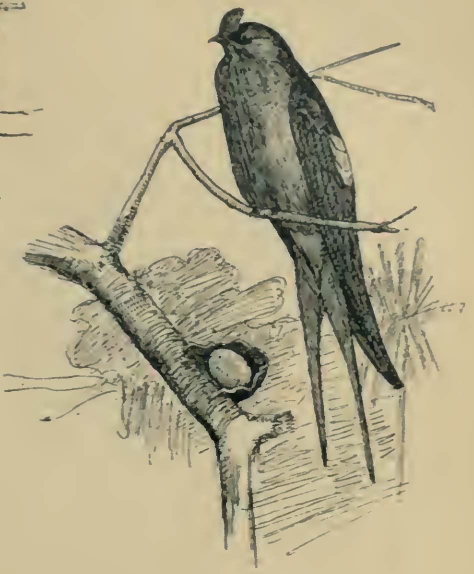

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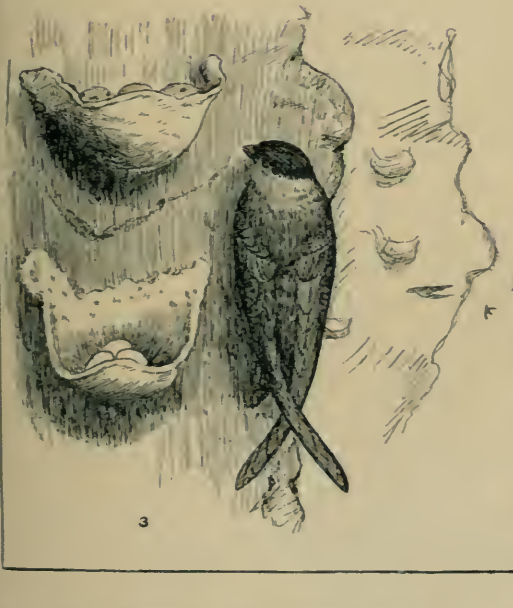

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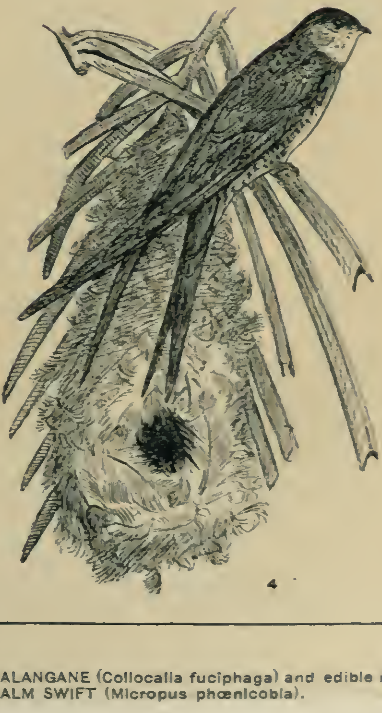


4

1. AMERICAN CHIMNEY SWIFT (Chætura pelagica).
2. TREE SWIFT AND NEST (Macropterix coronata).
3. SALANGANE (Collocalia fuciphaga) and edible nests.
4. PALM SWIFT (Micropus phœnicobia).

(Macropteryx) contains the tree-swifts, whose plumage is peculiarly soft, the tails deeply forked and the head crested. They are shy and breed in rocky jungles, forming a little cup-shaped nest of flakes of bark glued together with saliva and attached to the side of the branch of a tree. There is only one egg, which (as is the case with all the family) is pure white. Five species are found in the Indo-Chinese region and eastward to the Solomon Islands.

SWIFT, Benjamin. The pseudonym of the English novelist William Romaine Paterson (q.v.).

SWIFT, Gustavus Franklin (1839-1903). An American merchant, born at Cape Cod, Mass. After various business experiences he engaged in meat-packing in Chicago, and was the first to ship meat long distances successfully. He founded and was president of the corporation of Swift and Company, one of the largest packing firms in the United States, and was a prominent member of many other similar concerns. His business enterprise did much for the trade development of Chicago.

SWIFT, Jonathan (1667-1745). The greatest of English satirists, born in Dublin, November 30, 1667. He was of Yorkshire origin. His father had been attracted to Ireland by the prospect of political preferment, but died before Jonathan's birth. When he was six years old, his uncle Godwin sent him to Kilkenny School, the Eton of Ireland, where Congreve and Berkeley were his contemporaries. At fifteen he was sent to Trinity College, Dublin. At Trinity the lad read much history and poetry, but was so disdainful of the ordinary curriculum and of college regulations that his degree was only granted to him by a special grace. The disturbances of the Revolution of 1688 drove him to England, and in the following year he obtained employment as secretary to Sir William Temple (q.v.) at Moor Park, in Surrey. Swift found the position trying, though he calls Temple "a man of sense and virtue." In 1694 he quarreled with his employer and returned to Ireland to seek ordination, obtaining the small living of Kilroot, near Belfast. But he soon wearied of rural isolation and in 1696 he went back to Moor Park. Perhaps the impelling motive was the presence there of Esther Johnson, subsequently immortalized as "Stella," a poor relation of Temple's. Swift had a hand in her education; she was now, at fifteen, growing into a beautiful woman, with "hair blacker than the raven and every feature of her face in perfection." Swift remained at Moor Park until Temple's death in 1699. His sojourn there, however galling some incidents of it may have been to his pride, was of inestimable value to him. Besides the daily association with a statesman and a man of culture, he had time for an enormous amount of reading and for practice in writing. His only relics, however, of this period are some Pindaric odes, a species of composition for which he was little qualified and which Dryden characterized frankly with the judgment, "Cousin Swift, you will never be a poet."

His first prose composition betrayed his resentment. This was *The Battle of the Books*, a burlesque of the controversy then raging over the relative merits of the ancients and the moderns, in which for the first and last time his satire recoiled on himself. He returned once more to Ireland, as secretary and chaplain to Lord Berkeley, but lost the secretaryship and did not get the deanery of Derry, which he had expected. He was, however, appointed to the rectory of Agher, with the vicarages of Laracor and Rathbeggan. For the first time his own master, Swift showed that stern regard for duty which characterized him, and gained the respect, if he failed to influence the convictions, of his Catholic neighbors. He realized himself that he was a poor preacher, calling his sermons 'pamphlets.' He soon began his career as a political pamphleteer, which was to be so epoch-making, with *A Discourse on the Dissensions in Athens and Rome* (1700), really a defense of Somers and the other Whig lords threatened with impeachment. In 1704 he published the *Tale of a Tub*, the most amusing of his satirical works, the most strikingly original, and the one in which the full compass of his powers was most perfectly displayed. With matchless irony he ridiculed many forms of pretentious pedantry, mainly in literature and religion. The book led to many doubts of his orthodoxy and injured his chances of ecclesiastical preferment.

Though nominally a Whig, Swift differed from his party on important questions. He hated its war policy and its alliance with dissent. These differences, along with the failure to gain anything from the connection, made it easy for him to break from his former allies. In 1710 the Tories came into power with Harley and St. John at their head and Swift was easily won over to their side. He turned upon the Whigs with a series of brilliant squibs, assumed the editorship of the *Examiner*, the Tory organ, November 2, 1710-June 14, 1711, and produced several independent pamphlets, in all of which he ably defended the policy of the Tories. Of these particular papers the most powerful was the *Conduct of the Allies* (November, 1711), in which the position was maintained that the Whigs had prolonged the Continental War out of self-interest. Swift certainly led the way to the dismissal of Marlborough and the Peace of Utrecht (1713). For three years Swift was among the most conspicuous men in politics and society. His advent marks a new era in English politics, with the accession of public opinion, fostered by him more than by any other man, to supreme power.

He comes into full light in September, 1710, with the beginning of his *Journal to Stella*. He had invited her in 1701 to Ireland, with her friend Mrs. Dingley. They lived in his house at Laracor and Dublin when he was absent, and in lodgings near by when he was present. The diary letters which he sent to Stella and Mrs. Dingley, ending with April, 1713, compose one of the most interesting documents that ever threw light on the history of a man of genius. In London he lodged close to Mrs. Vanhomrigh, whose daughter Hester (called Vanessa by him) fell in love with Swift, and hugged the chains to which Stella merely submitted. In 1714 the Tory Ministry fell, Queen Anne died, and Swift's power was gone. In spite of the Queen's distrust of him, he had been appointed to the deanery of Saint Patrick's in Dublin, in 1713, and thither he now retired, no doubt hoping that the move would settle his complications for him. But, as luck would have it, Vanessa's mother died and she followed him to

Celbridge, in the near neighborhood. It is possible that in 1716 Swift may have married Stella. He undoubtedly loved her and shows a tenderness for her such as he never displays in any other case. From 1717 to 1720 he and Vanessa remained apart, but in the latter year he began to pay her regular visits. In 1723 Vanessa took the desperate step of writing to Stella. Swift rode down to Marley Abbey, where she was staying, with a terrible countenance, petrified her with a frown, and departed, flinging on the table a packet containing her letter to Stella. Vanessa died within a few weeks, leaving behind her the poem he had written for her, *Cadenus and Vanessa,* and their correspondence.

Five years afterwards Stella followed Vanessa, and the wretched lover sat down the same night to record her virtues in language of unsurpassed simplicity. A lock of her hair is preserved with the inscription in Swift's handwriting, most affecting in its apparent cynicism,"Only a woman's hair." Between the death of Vanessa and that of Stella, as though withheld by an evil fate until he could no longer enjoy it, came the greatest political and literary triumph of Swift's life. He had fled to Dublin a broken man, politically extinct; a few years raised him to the summit of popularity, though power was denied him. In 1724 he took Ireland by storm with the *Drapier Letters,* a series of wonderfully effective pamphlets, directed against the patent granted to one Wood, a hanger-on of the Court, for coining copper halfpence in Ireland.

The noise of this success had hardly died away when Swift acquired more lasting glory by the publication of *Gulliver's Travels.* Few books have added so much to the innocent mirth of mankind as the first two parts of *Gulliver.* With the omission of certain passages, it is one of the most delightful children's books ever written. Yet it has been equally valued, as Swift meant it to be, for an unrivaled satire on mankind. He seems to have solaced himself with its composition in the early years of what he called his exile; and if the later books show his most savage temper, it is well to remember that they were written during the years when he was attacking political corruption and when his private happiness was being destroyed. In 1726 he brought the completed manuscript to England with him and it was published anonymously in the winter of that year, meeting with instantaneous success.

His last years, however, were clouded by constantly increasing torture from disease. He governed his cathedral with great strictness and conscientiousness, and for years after Stella's death held a sort of miniature court at the deanery. But death was becoming more and more real and welcome to him. His regular farewell to a friend in these latter years was, "Good night—I hope I shall never see you again." A period of absolute mental decay closed with his death on October 19, 1745. He was buried in his cathedral in the same coffin with Stella, with the epitaph written by himself, "Here lies the body of Jonathan Swift, D.D., dean of this cathedral, where burning indignation can no longer tear at his heart. Go, traveler, and imitate if you can a man who was an undaunted champion of liberty."

Swift's character, as a whole, forms a fascinating psychological study. From some passages of his life he would appear a heartless egotist; and yet he was capable of the sincerest friendship, and could never dispense with human sympathy. Thus an object of pity, as well as awe, he is the most tragic figure in the literature of the eighteenth century—the only man of his age who could be conceived as affording a groundwork for the creations of Shakespeare. "To think of him," says Thackeray, "is like thinking of the ruins of a great empire." Nothing finer or truer could be said.

Consult his *Works,* edited by Sir Walter Scott (19 vols., Edinburgh, 1814 and 1824); *Prose Works* (the best edition) edited by T. Scott, with introduction by W. E. H. Lecky (Bohn's Library, 8 vols., London, 1897-99); various selections, by S. Lane-Poole (ib., 1884-85), by W. Lewin (Camelot Series, ib., 1886), by H. Morley (Carisbrooke Library, ib., 1889), and by H. Craik (Oxford, 1892-93); *Unpublished Letters* (edited by G. B. Hill, London, 1899). The best recent lives of Swift are by H. Craik (London, 1882), Leslie Stephen (ib., 1882), and Churton Collins (ib., 1893). Consult also Forster's incomplete *Life* (1875), Wilde, *Closing Years of Swift's Life* (Dublin, 1849); Lane-Poole's *Notes for a Bibliography of Swift,* reprinted from *The Bibliographer* (London, 1884).

SWIFT, Joseph Gardner (1783-1865). An American soldier, born at Nantucket, Mass. He graduated at the United States Military Academy in 1802, being the first graduate of that institution; became a captain in 1806 and a major in 1808, and in July, 1812, was promoted to be colonel and chief engineer of the United States Army. In the War of 1812 he served as chief engineer of the army under General Wilkinson, in the Saint Lawrence campaign of 1813; later had charge of the construction of the fortifications of New York harbor; was brevetted a brigadier-general in February, 1814; and was superintendent of the United States Military Academy by virtue of his office as chief of engineers from 1812 to 1817. He resigned from the army in November, 1818; superintended the construction of the New Orleans and Lake Pontchartrain Railroad in 1830-31; was for many years in charge of harbor improvements on the Great Lakes; and was engaged in numerous other engineering enterprises.

SWIFT, Lewis (1820—). An American astronomer, born at Clarkson, N. Y. He was educated at Clarkson Academy and about 1854 took up the study of astronomy. He was noted for his numerous discoveries of comets and nebulæ previously uncatalogued. He became director of the Warner Observatory, Rochester, N. Y., 1882. His 16-inch telescope at that institution was presented to him as a gift by the citizens of Rochester and was subsequently removed by him to his present observatory on Echo Mountain, Pasadena, California.

SWIFT, Lindsay (1856—). An American librarian, bibliographer, and literary historian, born in Boston. A graduate of Harvard (1877), he became associated in various bibliographical capacities with the Boston Public Library, and made valuable contributions, editorial and original, to the study of early American literature and history. The most noteworthy of his books is *Brook Farm* (1900), an essay on New England transcendentalism. Noteworthy also is a monograph on *Massachusetts Election Sermons*.

SWIMMING (from *swim*, AS., OHG. *swimman*, Ger. *schwimmen*, to swim; connected with Goth. *swumsl*, pond, and ultimately with Eng. *swamp*). The act by which an animal progresses in the water. Man is the only animal who does not swim naturally, yet keeping the head above the water is an act which most human beings may easily learn.

The swimming of quadrupeds amounts simply to walking in the water, whereas man has adopted many kinds of stroke besides the dog-paddle method by which most land animals propel themselves. These methods involve swimming on the breast, with a broad sweep of the arms and a frog-like motion of the legs; swimming on the side, and swimming on the back. He has also learned to float and to tread water. In the latter case the body is held in a perpendicular position and the hands and feet beat downward. The old side stroke is the favorite style for long-distance racing. It consists of three alternate motions, an under-arm and an over-arm stroke, and a scissors leg stroke, coming between the two arm strokes. The Trudgeon stroke is a form of swimming introduced into England a few years ago from the South Pacific. This is now very popular among all civilized swimmers, and is one of the fastest of all strokes for short distances. It consists of alternate overhead strokes, with a frog kick simultaneous with one of the arm strokes, the body swimming on the belly. A modification of this stroke was introduced a few years ago by Alexander Meffert, the famous American amateur mile-champion, in which the head and forearm are kept submerged as the body is pushed forward, the body being turned from the waist and the face brought above the water as the body checks between strokes. This style of swimming admits of freer animation and obviates any cramped position of the head. It is used by some of the best American swimmers.

The home of organized swimming is England. International swimming races between the various parts of the United Kingdom are held annually, the universities of Oxford and Cambridge include swimming on the list of inter-university sports, and inter-collegiate competitions take place within the universities themselves. An amalgamation of clubs in 1869 first brought swimming under organized control, and this association developed, under several successive names, into the Amateur Swimming Association in 1886. England and the Australian colonies easily head the world in feat swimmers. In addition to the Amateur Swimming Association, great practical good has come to the art by the establishment of classes of already good swimmers to be further instructed in the methods of rescuing drowning persons, and resuscitating those apparently exhausted. Diving has been carried to a greater degree of perfection in Sweden than in any other country. Usually the English practice has been confined to the standing or running dive with the succeeding underwater swim, a very useful accomplishment where life-saving is the object, as the body thereby enters the water with a strong impulse and in the line of the desired direction; but in Sweden the dive from platforms from forty to sixty feet above the surface, singly and in platoons, and either directly or horizontally, or with intermediate somersaults, has been developed.

In the United States, the West is ahead of the East both in general interest and participation, especially beyond the Rockies, where several world's records have been approached. The first championship races were held in 1877 by the New York Athletic Club, and were annual thereafter up to 1888, excepting the years 1879-82. In 1888 the management was ceded to the Amateur Athletic Union. In 1896 an indoor meet was added. The development in time made is shown in the record of the first meet in 1877, when R. Weissenborn won the mile in 45.44¼, a quarter of a minute slower than the present American record. The 100-yard event was established at the third meet, 1883, when A. F. Camacho won in 1.28¼.

Water polo is a department of swimming that has become very popular since it was first recognized as a sport, and there are leagues and national and international championships in Ireland, England, and Scotland (where the game is called water football), Wales, the United States, Canada, India, Australia, and New Zealand. It is played with an Association football (the round ball) in a bath or open water by seven swimmers on each side. The goals are from 19 to 30 yards apart with goal posts at each end. The game is started by the referee throwing the ball into the centre between the line of teams. The ball can be hit or thrown by any player providing he is not standing and only uses one hand. Fouls are awarded for various breaches of rules, the penalty being a free throw for the opposing party. The duration of the game is 14 minutes, 7 each way; a goal is scored when the ball passes through the goal posts and under the cross bar.

SWIN'BURNE, Algernon Charles (1837—). An English poet, son of Admiral Charles Henry Swinburne and Lady Henrietta Jane, daughter of the third Earl of Ashburnham. He was born in London, April 5, 1837, and was educated at Eton and at Balliol College, Oxford. There he contributed prose and verse to *Undergraduate Papers*, ed. by John Nichol. After three years he left Oxford (1860) without a degree and traveled on the Continent, visiting Landor at Florence (1864). Returning to England, he became closely associated with his brother romantics, Dante Gabriel Rossetti and William Morris. Having written *The Queen Mother* and *Rosamond* (1860), two dramas recalling the fire of the Elizabethan age, he published *Atalanta in Calydon* (1865), a beautiful lyric drama cast in the mold of ancient tragedy. The next year he awakened violent criticism with *Poems and Ballads*. To his assailants Swinburne replied with unmeasured scorn in *Notes on Poems and Reviews* (1866). Besides the few pieces that reasonably disturbed the moralists, the volume contained melodious lyrics covering a wide range of motives, Hebrew, Greek, and mediæval. Swinburne now composed a series of eloquent odes, which won universal attention and again exposed him to censure. Beginning with "A Song of Italy" (1867), they reach a point where "the heights flash" in *Songs Before Sunrise* (1871), celebrating the conflict between darkness and dawn, tyranny and freedom in revolutionary Europe. In the meantime had appeared several lyrics on other themes, of which the finest was

"Ave atque Vale" (1868), in memory of Baudelaire. In 1865 Swinburne published *Chastelard,* a romantic tragedy on the first period in the career of Mary Queen of Scots. He continued her history in *Bothwell* (1874) and afterwards completed it in *Mary Stuart* (1881). The imposing trilogy is a chronicle history cast in dramatic form with no view to the stage. The poems thus far enumerated fairly represent Swinburne, his originality, his extraordinary command over hitherto unsuspected sources of melody, his passion and vehemence.

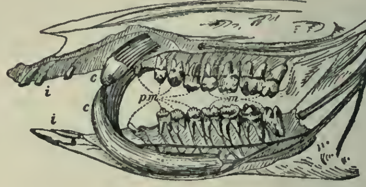
With occasional fall in power, Swinburne produced *Erechtheus* (1876), a second and more restrained classical drama; a second series of *Poems and Ballads* (1878); the grand odes to Victor Hugo; various beautiful sonnets; translations from Villon; *Songs of Two Nations* (1875); *Songs of the Springtides* (1880); *Studies in Song* (1880); *Tristram of Lyonesse and Other Poems* (1882), passionate verse haunted by the rhythm of the sea; *A Century of Roundels* (1883); *A Midsummer Holiday and Other Poems* (1884); *Marino Faliero,* a tragedy (1885); *Locrine,* a tragedy (1887); a third series of *Poems and Ballads* (1889); *The Sisters,* a tragedy (1892); *Astrophel and Other Poems* (1894); *The Tale of Balen* (1896); and *Rosamund, Queen of the Lombards,* a tragedy (1899).

The earlier attitude of defiant revolt against the conventional social order, against kings and priests, prevented his appointment as laureate on the death of Tennyson in 1892, though he was acknowledged as the greatest surviving English poet. In his later years, however, the note of rebellion was less violently sounded, and other feelings, characteristically English, the love of the sea and of little children, held a large place in his poems. As an artist in verse, by his unsurpassed command of all the resources of metrical technique, he takes a unique position. He invented a number of new rhythmic forms, and used none of the old without developing new beauties in them. His chief defect was the natural outcome of his exceptional facility of utterance and impatience of restraint, which allows him frequently to pour forth long sequences of sonorous strains with but little regard to sense. In criticism Swinburne's attention is paid chiefly to the Elizabethan dramatists, though he has indeed made excursions elsewhere, not sparing contemporary singers. These essays have been partially collected in *Essays and Studies* (1875), *A Study of Shakespeare* (1880), and *Miscellanies* (1886). Into his prose Swinburne carried something of the passion of his verse. Notwithstanding the occasional exaggeration into which this leads him, and much faulty reasoning, his conclusions are likely to be true. With wonderful insight he sees the truth, but deceives himself when he comes to state the way in which he arrived at it. His prose, too, has caught the alliteration, resonance, and undulating rhythm of his verse. Consult: Stedman, *Victorian Poets* (rev. ed., Boston, 1887); Theodore Wratislaw, *Algernon Charles Swinburne: a Study* (London, 1901); and Shepherd, *The Bibliography of Swinburne* (ib., 1887). Also *The Fleshly School of Poetry* (1871)—a pamphlet in which Robert Buchanan attacked Rossetti and Swinburne—and Swinburne's reply in *Under the Microscope* (1872).

SWINDLING. See FRAUD.

SWIN'DON. A municipal borough in Wiltshire, England, 77 miles west of London (Map: England, E 5). The old market town, the *Svindune* of Domesday, is built on an eminence commanding fine views of the surrounding country; its urban boundaries were enlarged between 1890 and 1900 to include New Swindon on the marshy plain below. The old town, which received a charter for a fair from Charles I., still maintains the characteristics of an agricultural centre with corn and cattle markets. Population, in 1891, 90,350; in 1901, 94,500.

SWINE (AS. *swīn*, Goth. *swein*, OHG. *swīn*, Ger. *Schwein*, swine; connected with Lat. *suinus*, relating to swine, from *sus*, Gk. ὗς, *hys*, Av. *hu*, pig, OHG. *sū*, Ger. *Sau*, AS. *sugu*, *sū*, Eng. *sow*, and ultimately connected with Skt. *sū*, to generate, produce, or with Skt. *sūkara*, swine, lit. *sū*, maker). The family Suidæ, containing those cloven-hoofed ungulate mammals whose domesticated races are called hogs or pigs. The swine are closely allied to the Hippopotomidæ, on the one hand, and to the Dicotylidæ on the other; the latter (peccaries, q.v.), indeed, are sometimes included in the term in popular usage. The three families form a group, Suina. Swine differ from hippopotamuses in their smaller size, in the terminal nostrils, and mobile, gristly snouts with which they obtain their food (largely roots and herbs) by grubbing in the ground. Each foot has four digits, two of which are functional, while the others, although elevated, are often useful in preventing the foot from too readily sinking into marshy ground. They are generally hairy, the babirussa (q.v.) being an exception. The dentition is complete and of the character exhibited by the accompanying illustration of a hog's teeth. The great canines form tusks, which in the males (boars) become formidable weapons; and in some cases (as the babirussa) are doubly developed. The food consists largely of vegetable matter, but may include tough roots, nuts, etc., and also flesh, fish, shellfish, etc.; the stomach is simple, and there is no cæcum (except in the peccaries). These animals are somewhat gregarious, often gathering into small bands, and some peccaries form large herds. The boars fight terrifically in competition for the favor of the females (sows), and valorously defend their young (which are usually striped); they are also courageous in resisting all foes, so that the hunting of certain species affords exciting sport. The pork is usually nutritious and palatable. The family is not large, and is mainly tropical in its distribution. The Suidæ are confined to the Old World; the Dicotylidæ to the warm latitudes of Ameri-



DENTITION OF SWINE.

i, incisors; *c*, canines (tusks); *pm*, premolars; *m*, molars; the nervous system of the teeth is also shown.

ca. The type-genus is Sus, of which the wild boar (see Boar) of Europe and Asia is the most prominent species. India and the Malayan region have together three other species, and Western Africa possibly a fifth. The African wart-hogs (q.v.) include two species of the genus Phacochœrus, distinguished from Sus principally by the huge tusks and great protuberances on the face. The Celebesian babirussa (q.v.) represents alone another genus; and the African river-hogs (q.v.) close the list with two species. One genus and two species enumerate the peccaries. See Hog for an account of domestic races.

Fossil forms of the genus Sus are known in rocks of Middle Miocene to Pleistocene time in Europe, India, and Africa. The earliest representatives of the hog family appear in the Eocene of both North America and Europe, and the group reached an important stage of evolution in late Tertiary time. One notable genus, not, however, in the direct line of pig ancestry, is Elotherium of the Miocene, which was about the size of a rhinoceros, with large heavy head, massive shoulders, and small hindbody and narrow chest, and the body supported on stilted legs that terminated in two-toed feet.

SWINEMÜNDE, svē'ne-myn'de. A strongly fortified port and fashionable resort on the Baltic Sea, in the Province of Pomerania, Prussia, on the island of Usedom, 37 miles north-northwest of Stettin (Map: Germany, F 2). The Swine here connects the Stettiner Haff with the sea. The harbor is fine. Nearly 5000 vessels of 1,700,000 tons cleared the port in 1899. The town has valuable fisheries. Population, in 1900, 10,251.

SWINE PLAGUE. A reputed contagious disease of hogs attributed to the action of a specific organism. For remedial, preventive, and sanitary measures, see Hog Cholera.

SWING, David (1830-94). An American preacher, born in Cincinnati. He graduated at Miami University, Oxford, Ohio, in 1852, and began to study theology, but for twelve years, beginning in 1853, he filled the position of professor of languages in his college. In 1866 he was called to the Fourth Presbyterian Church in Chicago and soon became one of the prominent clergymen of that city. In 1874 he was tried for heresy and acquitted, but, as a consequence, he resigned his pastorate and withdrew from the Presbyterian ministry. Many of his congregation sympathized with him and a new church was organized, meeting at first in a theatre and later in the Central Music Hall, where Dr. Swing continued to preach to one of the largest congregations in Chicago till his death. His preaching, though diverging from the verbal standards of 'orthodoxy,' was essentially evangelical and spiritual, as well as marked by intellectual power.

SWIN'TON. A manufacturing town in Yorkshire, England, 4 miles north-northeast of Rotherham (Map: England, E 3). It has railway, iron, glass, and pottery works. Population, in 1891, 9705; in 1901, 12,217.

SWINTON, William (1833-92). A Scotch-American author, born near Edinburgh. He came to America in 1843 and studied at Knox College, Toronto, and at Amherst College, with a view to the Presbyterian ministry. Giving up this intention, he became professor in a woman's seminary at Greensboro, N. C., and subsequently in Mount Washington College, New York. On the outbreak of the Civil War he was sent to the front as war correspondent for the New York *Times*, and served principally with the Army of the Potomac, of whose career he was afterwards a historian. In 1869 he was appointed professor of belles-lettres in the University of California. Among his publications are: *Rambles Among Words* (1859); *Campaigns of the Army of the Potomac* (1864; rev. 1886); *The Twelve Decisive Battles of the War* (1867); and several text-books, including a *Condensed History of the United States* (1871) and *Outlines of the World's History* (1874).

SWINTON AND PENDLEBURY, pĕn'd'l-bĕr-ĭ. A town in Lancashire, England, five miles northwest of Manchester. Cotton manufacture and brickmaking are its chief industries. Population, in 1891, 21,637; in 1901, 27,001.

SWISS FAMILY ROBINSON. A story by by the Swiss writer J. R. Wyss, begun by his father and published by him under the title *Der Schweizerische Robinson*. It is the account of a family wrecked on an uninhabited island, whose wants are provided for by the most remarkable resources of the island. The tale is based on the idea of *Robinson Crusoe*, and has been widely popular in many languages.

SWISS GUARD. A famous regiment of royal body-guards in France, composed exclusively of Swiss. This regiment was first constituted by royal decree in 1616. Their fidelity was absolute and on the outbreak of the Revolution of 1789 they were the object of special animosity on the part of the Parisian mob. On August 10, 1792, the Swiss Guards were called on to defend the palace of the Tuileries against the revolutionary mob. After a gallant resistance in the face of overwhelming numbers, the Swiss were ordered to lay down their arms, whereupon most of them were massacred by the infuriated assailants and those who escaped did so with the greatest difficulty. It is estimated that nearly 800 Swiss Guards were slain on that day. It is in memory of their heroic conduct and brave death that the famous Lion of Lucerne (q.v.), designed by Thorwaldsen, was carved in the face of a cliff at Lucerne, Switzerland. A feeble effort to reconstitute the Swiss Guards was made in 1815, and a body bearing that name was organized. But it was a poor imitation of the old corps and was easily dispersed by the revolutionists in 1830. Consult: Pollio et Marcel, *Le bataillon du 10 Août* (Paris, 1881); Ternaux, *Histoire de la Terreur* (8 vols., Paris, 1863-81); Morse Stephens, *The French Revolution* (2 vols., London, 1886-91).

SWITCHBACK. See Railways.

SWITCHMEN'S UNION OF NORTH AMERICA. See Railway Brotherhoods.

SWITHIN, swĭth'ĭn (or, more correctly, Swithun), Saint (?-862). An English ecclesiastic of the ninth century, who was chaplain to King Egbert, and tutor to his son Ethelwulf. In 852 he was consecrated Bishop of Winchester and made one of Ethelwulf's chief councilors. The origin of the tribute called 'Peter-pence' (q.v.) has been often assigned to him, and he is said to have procured an act of the Witenagemot enforcing for the first time the universal obligation of paying tithes. Swithin was buried, according to his own desire, in a place outside of his church at Winchester, where passersby might tread upon his grave and the rain drop on it from the eaves. A century later he was canonized and his body exhumed and buried inside the church. According to the legend this translation, which was to have taken place on July 15, was delayed in consequence of violent rains, which continued without intermission for forty days. Out of this circumstance arose the still current belief that if rain falls on July 15 it will continue to rain for forty days.

SWIT'ZERLAND (Fr. *Suisse*, Ger. *Schweiz*). A country of Europe extending between latitudes 45° 50′ and 47° 45′ N. and longitudes 6° and 10° 25′ E. It is bounded on the west by France, on the north by Germany and the Lake of Constance, on the east by Austria-Hungary (Tyrol and Vorarlberg) and Liechtenstein, and on the south by Italy and the French Department of Haute-Savoie, from which it is separated by the Lake of Geneva. Area, 15,976 square miles. It stretches over 200 miles east and west and 120 miles north and south. The boundaries are complicated and do not follow natural features, excepting that the Jura Mountains form the natural border between Switzerland and France, and the main crest of the Alps is mainly the border on the south side.

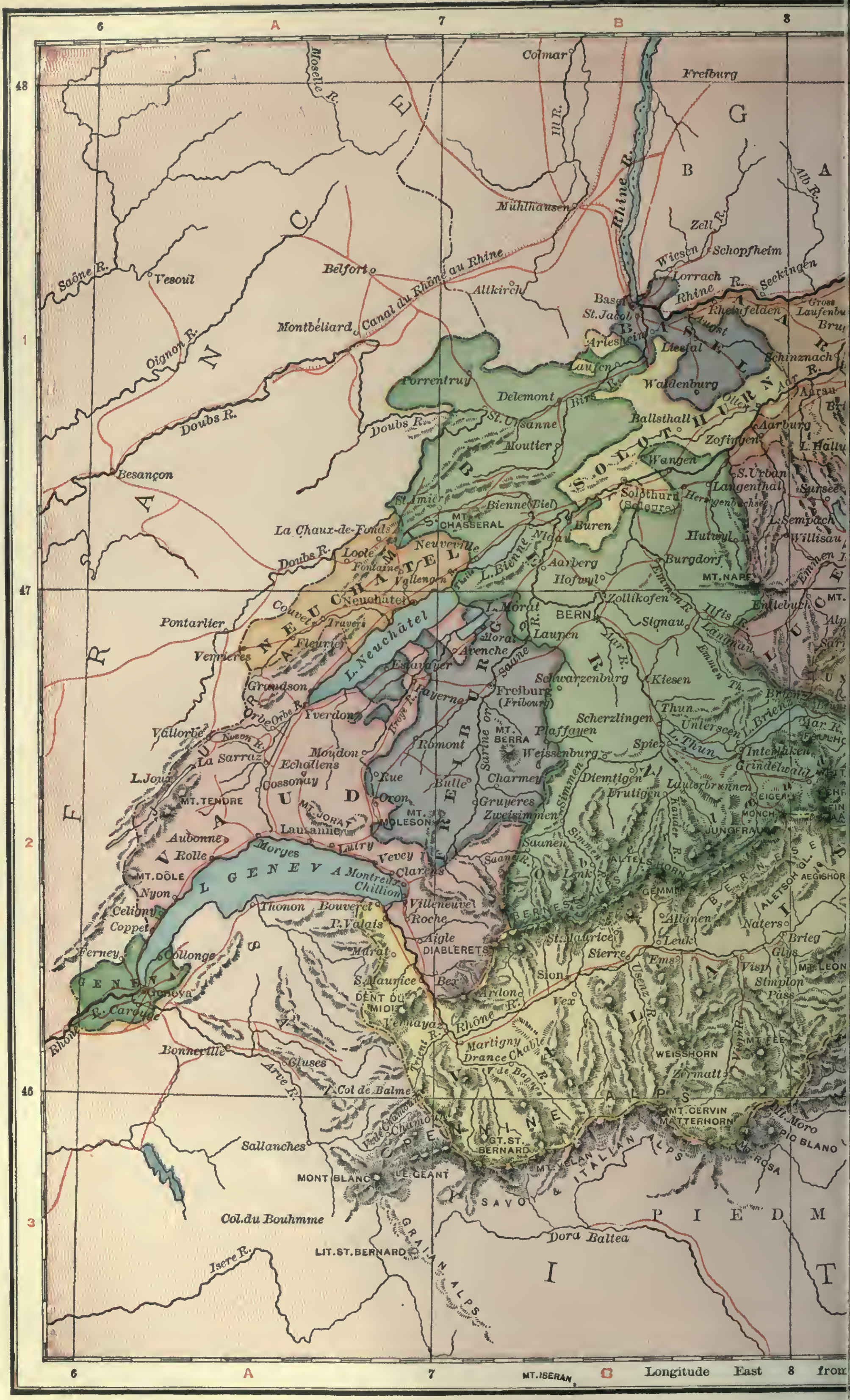
Topography. Switzerland is the most mountainous country of Europe, three-fourths of its area being covered with mountains. The central and southern parts are occupied by the Swiss Alps, which spread over nearly three-fifths of the entire area. The Jura Mountains cover the northwestern portion of the country. Between the Jura Mountains and the Alps is the Swiss high plain, where most of the inhabitants live surrounded by these great natural ramparts. The Jura Mountains form a generally southwest-northeast curve. Their summits do not ordinarily exceed 5000 feet, the loftiest in Switzerland being the Dôle, 5505 feet. The folded Juras have fifteen main folds, nearly parallel with one another, none of them extending the whole length of the district. Between the ranges are long valleys, transverse gorges connecting one valley with another; and these features produce scenery of great beauty and variety. Many fine forests of firs cover the upper slopes and an abundance of rich pastures is spread below them, mingling with the fields and vineyards which extend down to the margin of the small lakes that occupy some of the valley bottoms.

The central plain is steeply walled in between the Juras and the Alps. It is about 1300 feet in general elevation. It is a plain chiefly in contrast with the mountains around it and in other countries would be called an elevated region, thickly studded with picturesque hills. It extends in a southwest and northeast direction from the Lake of Geneva across Lake Constance to Württemberg, and has an average width of about thirty miles. Its hills are due chiefly to unequal erosion, the coarse gravel brought down from the Alps (known as 'Nagelflue,' often cemented into a hard conglomerate) having been able especially to resist the destructive action of time and weather. The débris from the Alps, with which it is covered to a great depth, forms its soil, but the disintegrated granites and gneisses contribute too large a proportion of sand and pebbles to make the soil very rich in plant food, though the conditions are more favorable where there is a considerable admixture from the limestone mountains.

The Alps rising from this central plateau are three times as high as the Juras. The utmost complexity appears to mark the arrangement of the towering ranges, masses, spurs, and precipices of the Swiss Alps. The group of Saint Gotthard, however, is the central knot of this mountain world. It is the middle point from which radiate on almost every side the mighty Alpine ranges that fill the centre and the south of Switzerland. The ranges of Ticino from the south, the mountain masses extending from the Simplon in the southwest, the Bernese Oberland from the west, the Titlis group from the north, the Tödi chains (the Alps of Glarus and Schwyz) from the northeast, and the mighty complex of the Grisons from the southeast, all converge upon Saint Gotthard. This group is also a great hydrographic centre. The headwaters of the Rhine flow from its eastern and of the Rhone from its western sides, cutting the Swiss Alps into a northern and a southern half. The Reuss rises from its northern and the Ticino from its southern slopes.

The Swiss Alps are the middle part of the great highland region of South Europe, which extends in the form of a bow from the Gulf of Genoa to the plain of Hungary. The southern Swiss Alps (south of the Rhine and Rhone) begin in the west in the splendid glacier-covered chain of the Pennine Alps, which have their culmination in Monte Rosa (15,217 feet), inferior in height only to Mont Blanc in France. The Mischabelhörner, the Weisshorn, the Breithorn, and the incomparable pinnacle of the Matterhorn are among the Pennines which extend eastward to the Simplon. Over thirty summits exceed 12,000 feet. East of the Simplon extend the Lepontine Alps, the water parting between the Rhine, the Rhone, and the Po, with many valleys deeply excavated by torrents and crossed by a number of important passes to Italy. East of the Ticino Valley and between the Rhine and the Inn are the Alps of the Grisons, whose snows chiefly feed tributaries of the Rhine, many summits exceeding 10,000 feet. Lastly, south of the Inn and the most eastern group of the southern Swiss Alps are the magnificent peaks of Bernina, whose culminating point is 13,288 feet above the sea. These southern Alps are formed of crystalline rocks, while the northern Swiss Alps are chiefly of limestone stupendously folded.

The chains of the northern Swiss Alps are separated one from another by three deep valleys: (1) that of the Aar with the lakes of Brienz and Thun, which carries nearly all the drainage of North Switzerland to the Rhine; (2) the valley of the Reuss with Lake Lucerne; and (3) the Walensee and Lake Zürich. Thus separated the four great groups of the northern Alps are: First, the Bernese Alps (Oberland), the water parting between the Aar and the Upper Rhone, which include the greatest snow mountains of the Alps; first among them the crystalline summits of the Finsteraarhorn (14,026 feet), the Jungfrau (13,672), Mönch (13,440), Eiger, Wetterhorn, Schreckhorn, and others, a compact mass of snowy and rugged peaks with the Aletsch glacier, 16 miles long, the largest of


6
A
7
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3
F R A N C E
G
B
A
Colmar
Freiburg
Moselle R.
Ill R.
Rhine R.
Mühlhausen
Zell R.
Alb R.
Wiesen
Schopfheim
Lorrach
Rhine R.
Seckingen
Saône R.
Vesoul
Belfort
Canal du Rhône au Rhine
Allkirch
Basel
St.Jacob
Rheinfelden
Augst
Gross Laufenburg
Montbéliard
Oignon R.
Arlesheim
Liestal
Schinznach
B A S E L
A A R
Porrentruy
Laufen
Waldenburg
Aarau
Delemont
Birs R.
Olten
Aar R.
Doubs R.
Doubs R.
St. Ursanne
Ballsthall
Aarburg
S O L O T H U R N
Moutier
Zofingen
L. Hallw
Besançon
Wangen
S.Urban
Langenthal
Sursee
St. Imier
Solothurn (Soleure)
Herzogenbuchsee
L.Sempach
MT. CHASSERAL
Bienne(Biel)
Buren
Hutwyl
Willisau
La Chaux-de-Fonds
Nidau
Neuveville
Burgdorf
Doubs R.
Loole
Fontaine
L.Bienne
Aarberg
MT. NAPF
Emmen R.
Vallengin
Thiele R.
Hofwyl
N E U C H A T E L
Neuchatel
Zollikofen
Emme R.
L. Morat
Entlebuch
Couvet
BERN
Ilfis R.
Travers
Signau
Langnau
Pontarlier
Laupen
L U C E R N E
Fleurier
Morat
Verrieres
L. Neuchâtel
Avenche
Aar R.
Emmen R.
Estavayer
Saane R.
Schwarzenburg
Kiesen
B E R N
Grandson
Payerne
Freiburg (Fribourg)
Thun
Brienz
Orbe R.
Orbe
Yverdon
Broye R.
Scherzlingen
Unterseen
L. Brienz
Aar R.
Plaffayen
Vallorbe
Nozon R.
MT. BERRA
L. Thun
Interlaken
Sarine or Saane R.
Spiez
Moudon
Romont
Weissenburg
Grindelwald
La Sarraz
Echallens
F R I B O U R G
L.Joux
Cossonay
Rue
Bulle
Charmey
Diemtigen
Lauterbrunnen
EIGER
MT. TENDRE
V A U D
Simmen R.
Frutigen
MT. JORAT
Oron
Gruyeres
Kander R.
MONCH
MT. MOLESON
Zweisimmen
JUNGFRAU
Aubonne
Lausanne
Saunen
Rolle
Lutry
Morges
Simmen R.
ALTELS
Vevey
Saane R.
Lenk
BERNESE
AEGISHOR
MT. DÔLE
L. G E N E V A
Montreux
Clarens
Nyon
Chillion
GEMMI
ALETSCH GL.
Celigny
Thonon
Bouveret
Villeneuve
Albinen
Naters
Coppet
P. Valais
Roche
St. Maurice
Leuk
Brieg
Aigle
Sierre
Ferney
Collonge
Murat
DIABLERETS
Ems
Glis
Visp
MT. LEON
GENEVA
Genova
S. Maurice
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Sion
Simplon Pass
Carouge
DENT DU MIDI
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Usenz R.
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V A L A I S
S A V O Y
Trient R.
Martigny
Drance
Chable
Bonneville
Cluses
V. de Bagnes R.
WEISSHORN
Visp R.
MT. FEE
Arve R.
Zermatt
Col de Balme
Val Chamouni
Chamouni
P E N N I N E   A L P S
MT. CERVIN
MATTERHORN
Mt. Moro
Sallanches
GT. ST. BERNARD
PIC BLANC
MT. VELAN
ITALIAN ALPS
MT. ROSA
MONT BLANC
LE GEANT
SAVO
Col du Bouhmme
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Switzerland's 600 glaciers. More than 20 of these summits rise over 12,000 feet above sea level. Second, the Titlis Alps, to the east of the Bernese Oberland. Third, the Alps of Glarus and Schwyz, also known by the name of their highest summit in the centre, Tödi (11,887 feet). The Rigi (5906 feet), commanding one of the magnificent views of the Alps, stands in the northwest corner of this group on the shores of Lake Lucerne. Fourth, the lower Alps, between lakes Constance and Zürich, which nowhere reach the snow line. On the whole the southern slopes of the Swiss Alps are steep, but the northern slopes are more gradual. Glaciers and perpetual snow are spread over 800 square miles, or about one-twentieth of the area of Switzerland. See ALPS.

HYDROGRAPHY. Owing to the Alps, the country is especially well supplied with water. Nearly every valley is traversed by a larger or smaller stream, often interrupted by picturesque waterfalls. The country possesses the headwaters of some of the important rivers of Europe—the Rhine, the Rhone, and the Po. The Rhine and its tributaries flowing to the North Sea form the principal system of rivers, but all the rivers in Switzerland are so rapid that they are almost useless for navigation, though their impetuous character fits them for industrial purposes. The only navigable stream of importance is the Aar tributary of the Rhine, which carries a larger volume of water to that river than the Rhine itself supplies above their point of junction. The Rhone, flowing to the southwest and to the Mediterranean, reaches Lake Geneva as a muddy stream and leaves it to enter France as a clear blue river. The Ticino is the largest river sent down by Switzerland to the Po. It has a larger catchment basin than any other Swiss river and is the least fed by glaciers. The Inn flows east through the deep, narrow valley called the Engadine, and falls into the Danube at Passau, where it is much larger than the Danube itself. The glaciers are a source of perennial water supply, and since they melt most rapidly in summer, the Swiss rivers are larger in summer than in winter.

The Alps are the Lake Country of Southwestern Europe. The lakes are remarkable for size, depth, and the grandeur and beauty of the scenery which surrounds them. Among the fifteen important lakes in Switzerland, eleven are in the basin of the Aar and none in the basin of the Inn. Lakes Geneva and Constance, the largest lakes, balance each other at the opposite ends of the country. Lake Geneva, partly in France, is over 200 square miles in area and has a maximum depth of 1000 feet, its bottom extending almost to the level of the Mediterranean. Lake Constance is a little smaller than Geneva, not quite so deep, lies partly in German territory, and is the filter of the Rhine. Lake Neuchâtel, the largest lake entirely in Swiss territory, lies on the tableland, and hence is not so deep as the lakes in the longitudinal mountain valleys. Lucerne, Zürich, Brienz, Thun, and Bienne are also important lakes. Lake Lugano lies partly in Italy, and only nine miles of Lake Maggiore belongs to Switzerland. The Ticino flows through the latter on its way to the Po.

CLIMATE. The distribution of climate is vertical rather than horizontal. On the central plain and in the lower mountain valleys a temperate climate prevails, the mean annual temperature being about 50° F. The mean temperature diminishes on an average by 3° for every thousand feet of elevation, so that the climate in the higher valleys is very severe. Ticino, Vaud, and Geneva enjoy an almost Italian climate, with a mean temperature of 51° to 53.5° F., in which southern fruits ripen. The snow line on the southern side of the Alps is about 10,170 feet above sea level; on the north side the limit of perpetual snow is about 8530 feet. The growth of grain ceases at about 4000 feet. On the higher Alps, which are wrapped in clouds much of the time, the annual precipitation is from 78 to 97 inches; on the central plain it is 33 inches. The Föhn, a warm south wind, causes some destruction by rapidly melting the snow and so producing avalanches and inundations. The climate of Switzerland, on the whole, is not favorable to agriculture, but is stimulating and healthful.

FLORA AND FAUNA. The vertical zones of vegetation in the Alps correspond to the horizontal zones of Europe between latitude 46° and the Arctic Circle. Olives in a few of the low valleys are succeeded by vines and the plants of middle Europe; then come in succession deciduous trees and grains, conifers, the high pastures, and shrubs and mosses, above which rises the region of perpetual snow. Oaks and chestnut trees are abundant only in the more southern valleys, beech trees are numerous up to 4000 feet above the sea, and pines, larches, and fir trees thrive between 4000 and 6500 feet. Agriculture is mainly confined to the regions not above 2500 feet, but the high pastures extend far above the region of tillage.

The wolf, ibex, and chamois are found in the mountains, but all wild animals are becoming very scarce.

GEOLOGY AND MINERAL RESOURCES. The backbone of Switzerland consists of gneiss and granite with outlying strata of the Carboniferous, Triassic, Jurassic, Cretaceous, and Tertiary formations. These strata are all thrown into a succession of gigantic folds, giving rise to great geologic complexity. Four distinct geologic zones, extending across Switzerland from southwest to northeast, are recognized. The limestone Jura region of roughly parallel folds is the first zone. The second is the plain whose rocks are chiefly sandstone covered, to a great extent, by the deposits of the ice invasions. The other zones cover the Alps, the more northern being that of the limestone Alps whose strata are greatly distorted and piled up over one another. The fourth zone consists of the great crystalline masses of the southern Swiss Alps formed of gneiss, granite, and other crystalline rocks and schists. Denudation has reduced the height of the mountains and deepened and lengthened the valleys, the larger rivers having pushed their sources back to the very heart of the mountain groups. The mining industry is of little importance. Building stone, particularly sand and limestone and rock salt, found in three cantons, are the chief mineral products. A little iron ore is mined in the Jura ranges, but the iron industries depend upon imports of material. A small amount of anthracite is mined near Bern of Fribourg, but Germany sends nearly a million tons of coal to Switzerland every year, and France, Austria, and England also contribute important quantities. Asphalt in the Val des

Travers, marble in Uri, Schwyz, and Ticino, slate in Glarus, and rock-crystals of great beauty, are other mineral products.

Agriculture and Stock-Raising. The soil is distributed among nearly 300,000 peasant proprietors representing nearly two-thirds of the population. More than 28 per cent. of the area is unproductive, chiefly the regions above the zone of tillage. Hay and pasturage lands, more important than the cultivated lands, cover 36 per cent. of the surface; the area under forests is 18.4 per cent., while only 16.5 per cent. of the surface is arable. Switzerland derives less support from its agricultural resources than any country of the Continent, excepting Norway. Only Solothurn, Lucerne, Schaffhausen, and Fribourg, among the cantons, produce nearly enough plant food for their own consumption. Wheat is grown up to 2500 feet above sea level, but the crop averages only about 3,500,000 bushels, while over 11,000,000 bushels are imported from other countries, chiefly Russia and Hungary. Rye, oats, and potatoes are the chief crops, but potatoes are imported in large quantities. During the tourist season of 1901 the amount of vegetables brought into the country was about 20,000 tons, of which nearly two-thirds came from Germany, France and Italy contributing most of the remainder. The cultivation of fruit is in a flourishing condition and nearly all the cantons manufacture wine or spirits from it, such as the cherry brandy produced at Basel. In 1901, 78,931 acres were in grapes, the cultivation of the vine commanding careful attention in most of the cantons. The best wine is made in Geneva, Neuchâtel, and Valais. The wine produced (35,800,000 gallons in 1901) does not cover the domestic demand. Orchards are planted everywhere in sheltered places and grapes thrive especially in the warmer soils around Lake Geneva and some other lakes and on the southern slopes of the mountains. The warmer cantons of the south also produce chestnuts, almonds, walnuts in abundance, olives, and even lemons. Switzerland is no longer so rich in timber as formerly, for unscientific forestry has thinned the woods to a large extent. The entire forest area is about 3300 square miles, of which a large portion is now under Government supervision. Every effort is being made to restore this source of wealth to its former magnitude, and in 1901 there were planted 23,731,376 trees.

As the climate and soil are especially favorable for hay and pasturage, the animal industries are more important than tillage. In comparison with cattle (1,340,375 in 1901) the other domestic animals are much inferior in number and importance. Cattle-breeding is carried on in all the cantons, and in the higher regions it is the chief and sometimes the only resource of the inhabitants. Switzerland is famous for its cheese, and the chief agricultural industries are the manufacture of cheese and condensed milk. The annual production of cheese amounts to about 500,000 cwts., of which three-fifths is exported to all quarters of the globe. The best cheeses are made in the Emmenthal, Maderanthal, Ufernthal, and in Gruyères. Many Swiss cattle are exported for breeding purposes, while, on the other hand, the great influx of tourists in summer makes it necessary to import an average of about 50,000 beef cattle a year, chiefly from Austria and Italy, to make up for the local deficiency in beef. Next in number are goats (354,634), which abound in the higher Alpine cantons and are reared for their skins, flesh, and milk. In 1901 the horses numbered 124,896; mules and asses, 4866; sheep, 219,438; and hogs, 555,261. The lakes abound in fish, and pisciculture is promoted by 155 establishments that produce enormous quantities of fry.

Manufactures. Switzerland is a great manufacturing country, though it lacks coal, iron, and seaports. Its advantages are abundant water power, markets in the adjoining countries in which to buy raw materials and sell manufactured products, good connections with seaports, and the diligence, perseverance, and skill of the people. Nearly as many persons are engaged in manufactures as in agriculture. Large quantities of the manufacturing output are produced in the homes. The textile and metal industries are of greatest importance. The cotton industry, which competes even with English manufactures, is centred chiefly in the cantons of Zurich, Glarus, Saint Gall, and Appenzell. Swiss cotton cloths noted for fineness of texture and excellence of dyes and prints are sent all over the world. The well-known machine-made lace and embroidery industry of Switzerland employs about 10,000 machines and 17,000 workers in Saint Gall, Appenzell, and Neuchâtel. The great centres of the silk industry are Basel, where all kinds of silk ribbons are produced, and Zurich, where dress goods are woven. Watchmaking and machinery lead in the metal industries. The most important centres of watchmaking are Geneva, Chaux-de-Fonds, and Locle. The industry was once very prosperous, but it has suffered severely of late years from the competition of the machine-made watches of the United States. The Swiss, however, have regained a large part of their export trade by the introduction of machinery and the manufacture of the cheaper grades of watches, which they produce by the hundreds of thousands every year, five-sixths of them being sold in foreign countries. The manufacture of jewelry and musical boxes, wood-carving, straw-plaiting, leather-making, and tanning are also very important industries. The well-known machine works of Zurich, Winterthur, and Geneva export a considerable part of their output.

Commerce. The average annual foreign trade of Switzerland is:

	1885-86	1891-96	1901
Imports	$149,000,000	$189,500,000	$223,700,000
Exports	134,000,000	140,000,000	172,600,000

The largest imports are grain, cattle, and other foodstuffs, cotton, coal, iron, petroleum, and groceries. Nearly all the exports are manufactures, such as cheese, wine, silk and cotton goods, watches, fine steel and iron goods (instruments, etc.), machinery, jewelry, lace, embroideries, and straw-plaiting. Manufacturers do not aim to produce large quantities of cheap stuffs, except that cheap watches have, to a great extent, replaced the finer grades. They aim to make a reputation for the excellence and fineness of their goods. Nine-tenths of the import trade and three-fourths of the export trade are with Europe, chiefly with Germany, France, Italy, Great Britain, and Austria-Hungary. The United States sells very little to Switzerland, but its purchases of cotton embroideries, silk goods, cheese, and other Swiss products are important. Switzerland's trade with the United States in three years amounted to:

	1900	1901	1902
Imports from.....	$250,477	$255,360	$217,515
Exports to.........	17,393,268	15,799,400	17,784,855

Transportation and Communication. In the absence of navigable rivers, the international traffic is carried by the railroads. The main arteries are the lines from Lake Constance to Geneva and Basel, and from the north via the Saint Gotthard tunnel to Italy. There are 2490 miles of railroad, and under the law of 1898 the State is acquiring the ownership of the entire system. Switzerland is noted for its admirable wagon roads. Navigation is important on the lakes, where 112 steamboats belonging to fifteen companies were plying in 1901.

Banking. The 36 banks had, at the close of 1901, paid up capital amounting to $39,155,000; note circulation, $47,610,000; and cash on hand, $23,995,000. Banks of issue are under Government inspection; the notes of the 22 cantonal banks are secured by the cantons, and 10 of other banks by the deposit of securities.

Government. The Constitution of 1848, with the important revision of 1874 and subsequent amendments of lesser importance, constitutes the present fundamental law of Switzerland. (For the methods of amending the Constitution, see Referendum.) The Swiss State is composed of twenty-two cantons, with Bern as the capital. The Constitution vests the executive power in a Federal Council of seven members elected for a term of three years by the two Houses of the Federal Legislature. Any Swiss citizen who is eligible to either branch of the Federal Legislature may be chosen to the Federal Council, except that not more than one member may be chosen from the same canton. It is the custom to choose members of the Council from the membership of the Federal Legislature and to reëlect them continually for a long period of time. The work of administration is divided into seven departments, and one member of the Council is put in charge of each department, but the act of any Councilor is considered to be the act of the Council as a whole. The Council is organized under a president (President of the confederation) and a vice-president chosen by the Federal Legislature from among the Councilors to serve for a term of one year.

The powers and duties of the Federal Council are many and varied. In the domain of legislation it plays an important part, although it has no veto upon the acts of the legislature. In this domain the Council sustains a relation to the legislature somewhat like that of the Cabinet in the parliamentary system of government. It makes an elaborate report to the legislature, and although its members cannot at the same time be members of the legislature, they have access to its sessions, take an active part in the deliberations, introduce legislative proposals, give their opinions upon various measures, and exert a great influence upon the work of legislation. It prepares the budget and advocates its adoption by the legislature and takes the lead in the discussion of all important measures introduced by the Government. The Federal Council also has a wide power of action in judicial affairs. It has, for instance, the settlement of a large class of administrative controversies which in other Continental countries is intrusted to special administrative courts. It has a large supervisory power over the cantonal administration, particularly when the cantons are engaged in administering federal law. In addition to the above mentioned functions the Council has the other powers usually exercised by a nation's executive.

The strictly legislative powers of the Government are vested in a Federal Assembly (*Bundesversammlung*), consisting of two Houses, viz. the National Council (*Nationalrat*) and the Council of Estates (*Ständerat*). The two Houses hold separate sessions in all legislative matters and joint sessions for the exercise of certain electoral and judicial functions. There is full equality between the two Houses in all matters whatsoever. The Council of Estates is composed of 44 members, or two from each canton. In three cantons which are divided, each half canton chooses one member. The tenure, amount of compensation, qualifications, mode of election, and the relations which they bear to their constituents are matters which the Federal Constitution does not regulate, but are left to the determination of each canton according to its own ideas with the result that the greatest variety of provisions prevails. The terms of members vary from one to four years. The Council of Estates elects its own president and vice-president under the limitation that neither office can be filled from a canton which furnished the president for the session preceding. The National Council, or popular chamber of the legislature, consists of members chosen by direct universal suffrage for a term of three years. The Federal Constitution apportions the members of the National Council according to population on the basis of one representative for every 20,000 inhabitants. In those districts which choose more than one representative the members are chosen on a general ticket. The Council elects its own officers subject to the limitation that the president and vice-president must be chosen from the body of the Council and are ineligible to succeed themselves for an ensuing term. The president, in addition to his vote as a member, has a casting vote in case of a tie. The members of the National Council receive a compensation from the Federal treasury. The Federal Assembly holds two regular sessions annually, beginning in June and December, each lasting about one month. The discussions take place in French, German, or Italian, according to the convenience of the speakers, while all formal readings occur in both French and German. The two Chambers meet jointly to settle conflicts of jurisdiction between the Federal authorities; to grant pardons; and to elect the Federal Council, the Supreme Court, the Chancellor, and the commander of the army. The ordinary legislative power of the Federal Assembly is very wide and extends to many subjects which in the United States are left to the regulation of the States.

The judicial power of the Confederation is vested in a Supreme Court or Federal Tribunal consisting of fourteen judges and a number of supernumeraries elected for a term of six years by the Federal Assembly, which also designates a president and a vice-president of the court for two years. The court is divided into three sections, each of which holds a session in one of the five judicial districts into which Switzerland is divided. The seat of the court is at Lausanne, in the Canton of Vaud. The jurisdiction of the Federal Court in the domain of public law extends to conflicts of authority between the Confederation and the cantons, to disputes between cantons of a public law nature, and to complaints of the violation of individual constitutional rights. In civil matters of private law its jurisdiction extends to suits between the Confederation and the cantons or between the cantons themselves, or suits against the Confederation or between the cantons and private individuals or corporations. The Federal Tribunal is also a court of appeal from the decisions of the cantonal courts where the amount in dispute exceeds 3000 francs (about $600). Its criminal jurisdiction extends to cases of high treason against the Confederation or violence against the Federal authorities, to offenses against the law of nations, to political offenses which cause disorder and lead to armed intervention, and to certain minor offenses.

For the purposes of local government the political divisions and subdivisions of Switzerland are cantons, districts, and communes. Each canton has its own constitution and local government. With a few exceptions there is a unicameral legislative body called the Great Council, whose members are elected by popular suffrage, as a rule, for a term of three or four years. It enacts laws, votes the taxes, and supervises the administration. In the four cantons of Uri, Unterwalden, Glarus, and Appenzell primary assemblies of all the voters, in many respects like the New England town meeting, take the place of a legislative body. Such assemblies are known as the *Landsgemeinden.* The chief executive authority in all the cantons is a council whose membership varies in number from 5 to 9 in the different cantons. The same may be said of the term of service and the mode of election. At present the members are chosen by popular vote in a majority of the cantons; in the others they are chosen by the local legislatures. In all the cantonal constitutions except that of Fribourg the referendum (q.v.) as a means of legislation has a prominent place. The initiative likewise plays an important part in local legislation. In all the cantons except Geneva constitutional amendments may be initiated by popular petition; and in all except Fribourg, Lucerne, and Valais the same right exists in the case of ordinary statutes.

The cantons are divided into districts. The chief executive and administrative authority in the district is a sort of prefect either popularly elected or chosen by the cantonal Council. A subdivision of the district is called the commune (*Gemeinde*). In some of these the popular town meeting is the chief organ of government; in the others there is a local legislative assembly popularly elected. In all of them the chief executive authority is a small council consisting of a president or mayor and not less than four members.

Finance. The Confederation derives most of its revenue from the customs, though considerable income is yielded by the post-office and telegraphs. The alcohol monopoly, amounting in 1901 to about $1,120,000, is divided among the cantons, one-tenth of the amount being used to combat the spread and evil effects of alcoholism. The revenue of the Confederation in 1901 was $20,384,936, and the expenditure was $21,110,618. The public debt amounted on January 1, 1902, to approximately $17,500,000, most of it bearing 3½ per cent. interest. The monetary standard is gold and silver, with the franc as the unit of coinage. Metric weights and measures are used.

Defense. See under Armies.

Population. The population, according to the census of December 1, 1900, was 3,315,443. In 1900, 2,319,105 inhabitants spoke German, 733,220 French, 222,247 Italian, and 38,677 Romansh. The total number of foreigners living in the country in 1900 was 392,896. The chief towns, with their populations, in 1901, were: Zurich, 152,942; Basel, 111,009; Geneva, 105,139; Bern, 64,864. The list of the cantons of Switzerland, with areas and populations for 1888 and 1900, is as follows:

CANTONS		Area, sq. miles	Population	
			1888	1900
Aargau		542	193,580	206,498
Appenzell	Ausserrhoden	101	54,109	55,281
	Innerrhoden	61	12,888	13,499
Basel	Stadt	14	73,749	112,227
	Land	163	61,941	68,497
Bern		2,657	536,679	589,433
Fribourg		644	119,155	127,951
Geneva		108	105,509	132,609
Glarus		267	33,825	32,349
Grisons		2,773	94,810	104,520
Lucerne		579	135,360	146,159
Neuchâtel		312	108,153	126,279
Saint Gall		779	228,174	250,285
Schaffhausen		114	37,783	41,514
Schwyz		351	50,307	55,385
Solothurn		302	85,621	100,762
Thurgau		381	104,678	113,221
Ticino		1,088	126,751	138,638
Unterwalden	Upper	183	15,043	15,260
	Lower	112	12,538	13,070
Uri		415	17,249	19,700
Valais		2,027	101,985	114,438
Vaud		1,244	247,655	281,379
Zug		92	23,029	25,093
Zurich		666	337,139	431,036
Total		15,976	2,917,754	3,315,443

Education and Religion. Instruction is compulsory and is rigidly enforced in the Protestant but not in the Roman Catholic cantons. The pupils number nearly 600,000, of whom 471,713 were in the primary schools in 1900. Among the famous institutions are the Universities of Zurich, Bern, Geneva, and Fribourg, the Academies of Geneva and Lausanne, and the "Federal Polytechnic" at Zurich, which attracts pupils from all parts of Europe. In religion there is complete liberty of conscience. About three-fifths of the inhabitants are Protestants, nearly all the remainder being Roman Catholics.

Ethnology. Such human remains of the prehistoric Swiss as have been found in their lake-dwellings (q.v.) ally the ancient people with the short-headed Celtic or Alpine race. Racially Switzerland is now overwhelmingly Alpine or Celtic (index, 83.8; Romansh 85), especially in isolated portions, with local invasions of northern and southern types. Great confusion is caused by the conflict between racial characters and environmental influences. Especially in stature is this true, the Teutonic element being shorter instead of taller.

HISTORY. In Roman times the country was inhabited by two races—the Helvetii, supposed to have been Celts, in the northwest; and the Rhætii, who were said to be of common stock with the Etruscans, in the southeast. The Helvetii, having migrated into Gaul, were conquered by Julius Cæsar in B.C. 58, who forced the remnant of them to return to their homes, and before the close of the century the Rhætians were subdued by the armies of Augustus. When the German invasions took place, the Alemanni took possession of the country east of the Aar, while the Burgundians settled in Western Switzerland. About the close of the fifth century the Alemanni were conquered by the Franks and the Burgundian realm succeeded to them in 534. Another Teutonic people, the Ostrogoths, took possession of the part of the country occupied by the Rhætii, which nearly corresponded to Grisons, but their rule was of short duration. The Burgundians embraced Christianity about the end of the fifth century; the Alemanni retained their old pagan creed until the seventh century, when the band of Irish monks which had entered Gaul under Saint Columban (q.v.) came among them, converted the people in vigorous fashion, and founded abbeys and churches, which survive to our own time. Switzerland made great progress under the rule of the Franks. After the dissolution of the great Carolingian realm the bulk of Switzerland was included in the Duchy of Alemannia, which became part of the German Kingdom, while the southwestern portion of the country was included in the Kingdom of Transjurane, Burgundy. In 1033-34 this Burgundian portion passed under the rule of the German emperors, so that from this time the whole of Switzerland belonged to the Holy Roman Empire. In the early part of the Middle Ages feudalism flourished in the Swiss highlands even more than elsewhere. In the twelfth century the dukes of Zähringen rose to great power in Switzerland. They did much to check civil wars and to promote the prosperity of the towns. In 1178 they founded Fribourg and in 1191 Bern. On the extinction of the line of Zähringen (1218) their allodial possessions passed to the counts of Kyburg, while a number of cities were released from feudal overlordship. In the latter part of the thirteenth century the counts of Savoy extended their domination into Western Switzerland. At this time the counts of Hapsburg became a great power in the land, and in 1264 the house succeeded to the bulk of the possession of the counts of Kyburg. At this time there were a large number of petty sovereignties in Switzerland. Prominent among the ecclesiastical princes were the bishops of Basel and Geneva and the Abbot of Saint Gall. The great towns were united in self-defense, and many of them obtained charters as free Imperial cities. The Hapsburg rule soon became burdensome and tyrannical, and the resistance which opened the long struggle that was to end in Swiss independence began in the three Forest Cantons—Uri, Schwyz, and Unterwalden. Uri received a special charter of liberties from the Emperor Frederick II. in 1231 and Schwyz in 1240. They had leagued themselves together in behalf of the Emperor somewhat later. Thus they were accustomed to the idea of a mutual league when after the death of the Emperor Rudolph they sought to resist the Hapsburgs. In 1291 they allied themselves into a 'perpetual league,' which came to be known as the Eidgenossenschaft. Subsequently they entered into an alliance with Zurich and the coalition of which it was the centre. Unterwalden received a charter similar to that of its associates from the Emperor Henry VII. In 1315 hostilities opened between Frederick of Hapsburg and the Eidgenossen, and the latter won the decisive battle of Morgarten (q.v.). To the period preceding this victory belongs the legend of William Tell. The Forest Cantons then renewed their pact by a fundamental agreement which was for five centuries the basis of the political life of independent Switzerland. Lucerne (1332), Zurich (1351), Glarus and Zug (1352), and Bern (1353) entered the confederation. Fresh wars followed with Austria, whose power in Switzerland was shattered by the victories of the confederates in 1386 at Sempach and in 1388 at Näfels. In 1415 the people of the cantons became the aggressors, invading Aargau and wresting it from Austria. Half a century later they made themselves masters of Thurgau. Swiss independence clashed with the ambitions of Charles the Bold of Burgundy, and the invincible prowess of the Swiss mountaineers shone forth when they were assailed by that powerful monarch. In 1476 they overthrew his armies at Granson and Morat, and it was with the aid of Swiss mercenaries that René of Lorraine overwhelmed Charles the Bold at Nancy in 1477. In 1481 the towns of Fribourg and Solothurn were admitted into the confederacy. In 1499 the Emperor Maximilian I. made a final attempt to bring Switzerland once more within the bounds of the Holy Roman Empire. He sought to draw men and supplies from the inhabitants for his Turkish war, but in vain. He was defeated in six desperate engagements. Basel and Schaffhausen (1501) and Appenzell (1513) were then received into the confederation, and its true independence began. The abbacy of Saint Gall and the cities of Saint Gall, Mülhausen, and Bienne became associated States with a vote in the Diet. Geneva, Neuchâtel, Valais, and Grisons also became associated States, but without a vote. In the early part of the sixteenth century the Swiss soldiers, who had become the most famous infantry in Europe, played a great, if not glorious, rôle as mercenaries in the Italian wars. After fighting successfully on the side of Milan against the French they suffered a terrible defeat at the hands of Francis I. at Melegnano in 1515. In 1516 they concluded the so-called Perpetual Peace with France, after which they fought on the French side. In the course of these wars a number of Italian towns and districts (in the present Canton of Ticino) were annexed to Switzerland.

The Reformation (q.v.), which was inaugurated by Zwingli in 1519, brought dissension among the confederates. Zurich in 1523 adopted Zwingli's opinions, and was followed by Bern and other cantons of the north. The Forest Cantons remained attached to the Church of Rome. War broke out in 1531 between the Catholics and Protestants, and a small body of Zurichers was defeated at Kappel. Zwingli, who was with them as their chaplain, was slain. In 1536 Bern wrested the Pays de Vaud from the dukes of Savoy and annexed it to its own territory. In the same year Calvin settled at Geneva, which had succeeded in emancipating itself completely from the jurisdiction of Savoy and of its bishop, and the reformed doctrines spread throughout Western Switzerland. During the Thirty Years' War Bern, which had become, since the conquest of Vaud, the leading canton, and Zurich, contrived to maintain the neutrality of Switzerland; and in the Peace of Westphalia, in 1648, the country was formally declared to be wholly independent of the German Empire.

The complex fabric of the Swiss Confederation, with the division into two hostile religious camps, the relation between governing cantons and subjected districts, the selfish assertion of local and class interests, and the absence of any firm bond of union, was not conducive to a healthy political development. The constitution of the larger cantons became more and more aristocratic. In Zurich, Schaffhausen, and Basel the governing councils were elected by the corporations; and in Bern, Fribourg, Solothurn, and Lucerne a few families had acquired permanent rule. The French Revolution had its effect in Switzerland as elsewhere. In 1798 the country was occupied by the French, who were aided by the dissensions between the democrats and aristocrats. The old cantonal system was abolished and the Helvetic Republic was organized. In 1803, at the dictation of Napoleon and under the Act of Mediation, the cantonal system was reestablished, with nineteen cantons, six new ones being constituted—Saint Gall, Grisons, Aargau, Thurgau, Ticino, and Vaud. After this Switzerland enjoyed peace under an orderly government and began to recover prosperity. The Congress of Vienna (1814-15) recognized the independence of Switzerland and her perpetual neutrality and the inviolability of her territory were guaranteed by the great Powers. The new Confederation was divided into twenty-two cantons (three new cantons, Geneva, Valais, and Neuchâtel, being constituted), each of which was represented in a diet, which was appointed to hold its annual meetings alternately at Bern, Zurich, and Lucerne. The old abuses, however, which had crept into the constitutions of the cantons were revived, and representation in most of them became based on property qualifications. Officials, the aristocracy, and the clergy joined to oppose innovations, and succeeded in doing so until the Revolution of 1830 in France. From that year until 1848 Switzerland passed through a long crisis. There was strife between the democratic and aristocratic elements, and then between the Catholics, who in some of the cantons retained ancient special privileges, and the Protestants, who formed a majority of the Swiss people. In Aargau a struggle took place between the Liberals and the Ultramontane Party, which was settled by an unsatisfactory compromise. In Valais, where universal suffrage had put power into the hands of the reactionary party, a war took place, in which this party was victorious. It then ruled with a strong hand, and forbade Protestant worship within the canton. In Lucerne the Ultramontane Party so persecuted its political opponents that the latter were compelled to leave the canton. In 1844 a proposal was made in the Diet to expel the Jesuits, the chief object of Protestant attack; but that body declined to act. The Radical Party then determined to resort to force; they organized bodies of armed men, called "free corps," which invaded the Catholic cantons, but were defeated. The Catholic cantons then formed a league, named the Sonderbund, for defense against the free corps. There was a general clamor for its suppression, but in the Diet only 10½ votes out of 22 were in favor of that measure. The ruling party in Geneva had been with the majority, and this conduct led to a revolution in that city. One vote was thus gained against the Sonderbund. Saint Gall added another; and a majority in the Diet in 1847 declared the illegality of the Sonderbund, and decreed the expulsion of the Jesuits. The Federal forces under General Dufour defeated those of the Sonderbund; the leagued cantons were made liable for all the expenses of the war, the Jesuits were expelled, and the monasteries were suppressed. An attempt was made by diplomatic notes to intimidate the Swiss Government, but the revolutions of 1848 prevented further interference. This same period of civil strife was also one of intellectual and material development. The results of these stormy but profitable years were seen in part in the Constitution of 1848, which bound the Confederation more firmly together and gave it at last an efficient government. This Constitution subsisted until 1874, when the believers in a stronger federal government won a step in that direction. The Constitution of 1874 has been since amended in some of its details. In 1891 the six hundredth anniversary of the 'Perpetual League' was celebrated by the Swiss with great enthusiasm. The history of Switzerland for the past quarter of a century has been very uneventful, though marked by a steady material, intellectual, and political growth.

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SWIV'ELLER, DICK. A lively young man in Dickens's *Old Curiosity Shop,* very flowery in language and untidy in dress. He finally marries 'the Marchioness.'

SWORD (AS. *sweord,* OHG. *swert,* Ger. *Schwert,* sword; of uncertain etymology). In its general sense, every steel weapon of offense or defense larger than the dagger or poniard; in modern military usage the term *sword* is used to describe the infantry or straight weapon, and *sabre* for the slightly curved weapon of the cavalryman. Although the distinction is clearly marked in Germany by the employment of *Degen* for the straight sword and *Säbel* for the curved weapon, the custom with other nations is to employ a single word for both varieties. The sword always has been, and is at present, a personal weapon; so much so that in the prose and poetry of all nations it is often endowed with human as well as superhuman qualities. To surrender the sword has always been a token of submission, and the breaking of it a most impressive ceremony of degradation, while to kiss the sword is even today with Orientals the highest form of oath and homage. The first sword was undoubtedly of hard wood, and judging from the widely scattered area in which it has been proved to have been known, its employment must have been practically spontaneous among all the peoples whose stage of civilization rendered possible its use. Wooden swords were part of the equipment of the Indians of Virginia, according to the statement of Captain John Smith. Greek literature refers more frequently to the spear and bow than to the sword, as is the case with the Roman and Hebrew writings. According to the testimony of the Greek works of art, the leaf-shaped blade sword was the one used by the Greeks in historical times, although the Greeks, almost alone of the ancient peoples, held the sword in but slight estimation. The ancient sword was usually worn on the left side suspended by a belt from the shoulder, although it was sometimes slung more forward, bringing the hilt in the front, or else suspended from a girdle around the waist. With the Egyptians the sword of bronze was carried in its leather scabbard in front of the body, and thrust in the sword belt in a sloping direction from right to left. The Assyrians seem to have possessed the weapon most nearly approaching the sword of to-day. It was straight and narrow and apparently designed for thrusting as much as for cutting. The pointed sword of the Roman legionaries was invariably successful when opposed to the pointless weapons of their enemies. On the other hand, most Asiatic nations to this day continue to use the sword as a cutting weapon, its curved shape usually preventing any use of the point. Thus the swords, military and civil, of to-day may be said to be descended from the European straight sword and the Eastern *scimitar* or *tulwar.* Under FENCING will be found the history of the sword up to the present day.

Asia has been more prolific in the matter of variety of blades than has Europe; for instance, the *yataghan* of the Mohammedan races with its double curve is a compact and formidable weapon, as also is the *kukri* of the Gukhas, which resembles the *yataghan* except that it is considerably broader in the blade. The *patá,* a long straight-hilted sword, is found in the south of India, while in the north the *katár,* a broad-bladed weapon with a cross-bar handle, was for a long time in favor. The Japanese swords are many in number and characteristic to a degree of the Japanese people. They may be classified as two-edged swords called *tsurugi,* and one-edged swords called in general *katana.* The *tsurugi* is the primitive weapon of Japan, and is now rarely met with except as an ornament in temples. It was from 28 to 40 inches long and about 2½ or 3 inches wide, and in the middle up to ⅗ of an inch thick. It ended in a sharp point and often thickened and broadened toward the point. It was evidently designed more for cutting than for thrusting. The *katana* or one-edged sword is also a cutting rather than a thrusting weapon, but is a much more handy sword than the *tsurugi.* The various varieties of the *katana* are named according to their length, which is measured from the guard (at the inner end) to the hilt of the point, as: *Lachi; katana proper; wakizashi; tautô;* and many others. The *katana* proper is from 2 feet 6 inches to 2 feet 9 inches long, and is the common straight sword of the Japanese military class. The *tautô* or short sword was the weapon allowed to be worn by the tradesmen, and all others not allowed to wear the *katana.* The *kuwaiken* is a small sword worn by the ladies of the military class.

The modern military sword of all civilized nations is so constructed as to combine all the advantages of cutting and thrusting. The thrust is regarded as by far the most effective attack, but as it demands considerable skill and coolness, and as the average soldier (who in modern campaigns will in the majority of instances have been hastily taken from civil life) cannot be always counted upon to remember his training and will very naturally use the cut, it has led to the compromise above described. A good sword is required to be sufficiently elastic to permit of its being bent, or to resist a heavy blow without breaking or other injury, and also to be strong enough to deliver a thrust without bending too much. Equally important is the requirement that it be as light as possible, consistent with the strength required, and that it be well balanced. The military blades of to-day are all closely similar in design. They are nearly straight, but sufficiently heavy toward the point to enable the soldier to deliver a very effective cut. The only exception is the sword adopted by the French Government in 1899, which is a long sword designed only for thrusting. It is 35 inches in length of blade from hilt to point, and weighs 2 pounds 6 ounces without the scabbard, which latter is made of steel, with a wood lining. The German cavalry sword is 32½ inches long from hilt to point, and weighs 2 pounds 8½ ounces without the scabbard. The scabbard, like that of the French and British, is of steel with wood lining. The British cavalry officer's sword measures 35 inches from hilt to point, and weighs without the scabbard 2 pounds; while the sword of the trooper measures 33½ inches, and is 2 pounds 10¼ ounces in weight. The British infantry sword (officer's) measures 32½ inches from hilt to point, and weighs, without scabbard, 2 pounds 3 ounces. In the United States Army the sword proper has been abolished and a single form of sabre is now worn by all officers. These are issued in lengths of 30, 32, and 34 inches. The troopers of the United States cavalry have a sabre which is designed for both cutting and thrusting, and differs from the light artillery sabre, which is intended for cutting only and is more curved. In addition to the article FENCING, already mentioned, the reader is referred to the articles CAVALRY; TACTICS, MILITARY.

SWORD, ORDER OF THE. A Swedish military order of merit, with seven classes, founded in 1522 and renewed by Frederick I. in 1748. The decoration is a white cross of eight points, the arms separated by golden crowns. The blue medallion shows a bared sword surrounded by three crowns. The reverse bears a sword with a laurel wreath and the legend *Pro Patria.*

SWORD DANCE. A dance in which the use of a sword plays the characteristic part. Such dances, held in military attire, and serving as exercises of youth, were probably a feature in the life of all ancient peoples. In Greece a dance of this character was known under the name of Pyrrhic, and in Athens such a performance was said to have been instituted by Athena. Tacitus describes the youths of Germany as dancing naked over a bare blade, and fifteen centuries later a particular form of the sword dance was described by Olaus Magnus as belonging to Denmark. This special dance was widely diffused, and has survived in Germany, England, and Scotland. In it the number of performers was commonly six, with a leader; the movements were various, consisting of a march with weapons erect, directing them toward the centre of the ring, grasping the neighbor's blade by the hilt and point, forming the swords into a shield or rose and dancing with them in that form, leaping over and under the brands, and the like.

SWORDFISH. One of several fishes having an elongated snout, serviceable as a weapon; specifically, the single representative of the family Xiphiidæ, related to the mackerels and common in the warmer parts of the Atlantic and occasional in the Pacific Ocean. This fish has a round, very muscular body (see Plate of SPEARFISH AND SWORDFISH), with large fins and a crescentic tail of extraordinary size and power, so that it is able to move with extreme speed and force. As the young grow, the fore part of the body and the head increase steadily in girth in proportion to the posterior parts, and the upper jaw grows more and more elongated until it finally forms a flattened, sharp-edged 'sword' composed of the consolidated vomer, ethmoid and premaxillary bones, and coated with a finely granulated hide. This weapon is about half as long as the body, and becomes so strong that it may be driven far through the planking of a rowboat or even a sailing vessel, as has repeatedly happened, probably by accident. The swordfish reaches its largest size off the coast of New England, where in midsummer it comes near shore in pursuit of the schools of herring, mackerel, menhaden, and other gregarious fishes upon which it mainly feeds. A swordfish finding such a school pushes into its midst from beneath, and, striking right and left with its sword, kills or disables dozens of victims. The average size in the Atlantic is about seven feet in total length and 250 pounds in weight, but there are authentic records of fish more than twice that size. The flesh is of excellent flavor, and the capture of a swordfish is reckoned fine sport. Their spawning habits are little understood; and where they spend the winter, when they disappear from the American coast, is unknown.

Several other large related fishes are called 'swordfish,' among them the 'sailfish' and 'spearfish' (qq.v.) of the family Istiophoridæ; the large handsome 'papagallo' (*Nematistius pectoralis*) of the Pacific coast of tropical America; and the cutlass-fish (q.v.). The best general account of the swordfish and swordfishing is by Goode, *Fishery Industries,* sec. i. (Washington, 1884).

SWORDFISHING. The catching of swordfish is pursued in summer both for profit and sport off the coast of New England, and especially in the neighborhood of Nantucket, and is often the occasion of exciting incidents. Small swift vessels are employed, provided with a short bowsprit, at the outer end of which is set a small platform and a strong iron stanchion surmounted by a circular horizontal band at the height of a man's waist. The fisherman, standing within this contrivance, with a connecting strap buckled behind him, is held safely in spite of the pitching of the vessel, while both his arms are left free. A swordfish having been sighted at the surface, where it is feeding upon menhaden or some similar prey, the schooner bears down upon it until the fisherman is able to hurl a barbed spear, or a heavy grains, into its body. To this spear a line is attached, fastened inboard; and if a successful strike is made the crew gradually haul the struggling fish near enough to be knocked on the head and disabled. As the swordfish is big and strong, and is armed with formidable weapons in his 'sword' and his powerful tail, much strength, skill, and agility are required to overcome and secure it; and the sport is justly regarded as exhilarating and courageous in the extreme. Consult: Goode, *Fishing*

Industries, sec. i. (Washington, 1884); Halder, *Marvels of Animal Life* (New York, 1885).

SYB'ARIS (Lat., from Gk. Σύβαρις). A celebrated Greek colony in Magna Græcia (q.v.). It was situated in northeastern Bruttium, between the river Crathis (*Crati*) and Sybaris (*Coscili*), about three miles from the Tarentine gulf. It was founded by Achæans and Trœzenians at an early period in the colonization of Magna Græcia, and it soon acquired control of territory extending entirely across the peninsula. Sybaris was a great mercantile city, with strong democratic tendencies. The wealth and luxury of the inhabitants became proverbial. Of the history of the city almost nothing is known, but during the sixth century B.C. it had attained a circumference of more than five miles, and ranked with Miletus as one of the most powerful and wealthy of Grecian cities. The party strife which disturbed so many of the Greek mercantile communities raged here also, and toward the end of the century we find the city in the hands of a tyrant, Telys, supported by the popular party. A Crotonian noble who married Telys's daughter was exiled by his townsmen, and they also gave asylum to a large body of the banished nobles of Sybaris. The refusal of a demand for their surrender led to a war between the two cities, in which the Crotonians, in spite of inferior numbers, won a great victory, which was followed by internal strife in Sybaris, leading to the easy capture of the city (c.510 B.C.). The victors razed it to the ground and turned the bed of the Crathis over the site. The few survivors withdrew to their colonies, Scidros and Laos, on the west coast. Excavations in 1879 and 1888 have determined the site of the ancient city, but yielded little else of interest.

SYBEL, zē'bĕl, HEINRICH VON (1817-95). A German historian, born at Düsseldorf, December 2, 1817. He studied four years at Berlin and at Bonn, and in 1841 published his first work, the *Geschichte des ersten Kreuzzugs*. In 1844 he was made professor extraordinary at Bonn and two years later went to Marburg as professor in ordinary. It was there that he wrote his *Geschichte der Revolutionszeit von 1789 bis 1795* (1853-58), the most important of his works with one exception. In 1856 he became professor at Munich, where he instituted the historical commission of the Royal Bavarian Academy and founded the *Historische Zeitschrift*, and in 1861 was appointed professor at Bonn. He was made director of Prussian archives in 1875 and thus had access to the most valuable material for his chief work, *Die Begründung des deutschen Reichs* (Munich, 1889-94; trans. by Perrin, New York, 1890-97). Sybel was from 1862 to 1864 and from 1874 to 1880 a member of the Prussian Diet, and in 1867 was elected to the Constituent Reichstag of the North German Confederation. He died at Marburg, August 1, 1895. —His son LUDWIG (1846—) is an archæologist, professor at Marburg since 1877, and author of: *Die Mythologie der Ilias* (1877); *Kritik des ägyptischen Ornaments* (1883); *Weltgeschichte der Kunst im Altertum* (2d ed. 1902), and others.

SYC'AMORE. The county-seat of Dekalb County, Ill., 52 miles west by north of Chicago; on the Chicago Great Western and the Chicago and Northwestern railroads (Map: Illinois, D 2). It is in a farming section, but is important rather for its manufactures, which include farm implements, gray iron castings, insulated wire, canned goods, etc. The water works are owned by the municipality. Population, in 1890, 2987; in 1900, 3653.

SYCAMORE, or **SYCOMORE** (OF., Fr. *sycomore*, from Lat. *sycomorus*, from Gk. *συκόμορος*, *sykomoros*, mulberry-tree, from *σῦκον*, *sykon*, fig + *μόρον*, *moron*, *μῶρον*, *mōron*, black mulberry), *Ficus*. A genus of generally large, long-lived trees of the natural order Moraceæ, mostly natives of Africa and Asia. The Egyptian sycamore (*Ficus sycamorus*), supposed to be the sycamore of the Bible, is a large spreading tree often planted for shade in Egypt and Western Asia, where it is abundant in forests. The figs are top-shaped, and grow in clustered racemes on the trunk and oldest branches. They are sweet, well-flavored, and somewhat aromatic. The sycamore of Western Europe is a species of maple (q.v.); those of North America are various species of plane (q.v.).

SYCAMORE INSECTS. The sycamore or plane tree is comparatively free from insect attack, for although several caterpillars feed upon the leaves of the tree, none seems specifically confined to it. The leaves sometimes turn brown and fall from the attacks of colonies of one of the lace-bugs (*Corythuca fimbriata*), and the seed balls are attacked by a true bug (*Melanochilus numideus*), which punctures the leaves and passes the winter in a half-grown condition thrust down between the seeds in the ball. Only one borer seems specifically confined to this tree, but *Chalcophora campestris* is found burrowing into dead limbs and trunks, and may hasten the death of an otherwise diseased tree. Consult Packard, *Insects Injurious to Forest Trees* (Washington, 1890).

SYCOSIS (Neo-Lat., from Gk. *σύκωσις*, *sykōsis*, fig-like excrescence on the flesh, from *σῦκον*, *sykon*, fig). A skin disease characterized by an eruption of pustules or papules, each one pierced by a hair, generally limited to the bearded face. It is, in common with *impetigo faciei* and *tinea barbæ*, called 'barber's itch.' It is caused by the entrance into the hair follicles of a variety of staphylococcus, either albus, aureus, or citreus. Acne or eczema may be mistaken for it. Zinc, oil of cade, carbolic acid, ichthyol, sulphur, and betanaphthol are all recommended for its relief.

SYDENHAM, sĭd'en-*am*. A residential section and Parliamentary sub-district of Lewisham Borough, metropolitan London, 8 miles southeast of Saint Paul's Cathedral (Map: London and vicinity, F 8). It is of world-wide celebrity in connection with the Crystal Palace (q.v.), which was reërected here in 1854. Population, in 1891, 34,100; in 1901, 43,630.

SYDENHAM, THOMAS (1624-89). A great English physician, born at Winford Eagle, educated at Magdalen Hall, Oxford, at All Souls' College, and at Montpellier, France. He received his degree in medicine from Cambridge, and in 1600 established himself in practice in London, and soon became the foremost physician of his time. Although his name is inseparably connected with our present knowledge of many diseases, he is especially to be remembered as the one who introduced cinchona in the treatment of malaria, and who first differentiated scarlatina, classified chorea, and expounded gout. A collection of his works was published in English (1785); and the Sydenham Society of London, founded for the purpose of printing meritorious medical works, put forth as its first issue his complete works in Latin in 1846, and in English in 1848. Consult Latham's *Memoir* (London, 1848).

SYD'NEY. The capital of New South Wales and the oldest city in Australia, on the southern shores of Port Jackson; latitude 33° 52′ S., longitude 151° 13′ E. (Map: New South Wales, F 3). It is situated about 8 miles from the sea, and the whole bay round which the city is built forms a fine harbor, where the largest vessels can safely anchor. Its bold and rocky shores present a succession of picturesque and beautiful landscapes. The narrow entrance is called the 'Heads,' and is marked by a lighthouse. The Fitzroy dry-dock, originally intended for vessels of the royal navy, can accommodate vessels of the largest size. The city is defended by modern forts and batteries, and is the chief station of the Australian navy. The neighborhood of Sydney is surrounded by park-like grounds, and gardens of orange trees, bananas, and numberless semi-tropical plants. The suburbs include 41 municipalities, the chief of which are Balmain in the west; Newton, Redfern, Marrickville, and Waterlow in the south; Paddington, Randwick, Woolhara and Waverley in the east.

The climate of Sydney is, upon the whole, temperate and healthful. The sandstone rock upon which the city is built affords a valuable material for building. The streets in the older parts of the town are narrow and irregular; in the newer portions they are modern, and the size and style of the buildings are not behind those of the principal towns of Europe. The University of Sydney stands on a commanding height. There are two suffragan colleges in connection with the university—that of Saint Paul's, belonging to the Church of England, and Saint John's, erected under the auspices of the Roman Catholic community. The metropolitan Cathedral of Saint Andrew is a handsome building in the later Perpendicular style of architecture, and the Roman Catholic Cathedral of Saint Mary is also a fine structure. Noteworthy are the residence of the Governor, the museum, the National Art Gallery, the exchange, the custom-house, the town hall, the new post-office, the public grammar school, and the theatres. Sydney has several mechanics' institutes.

There are fine botanical gardens, and a number of public parks, of which Hyde Park is the chief. Water is brought from a point on the Nepean River, 63 miles distant, and stored in a large reservoir at Parramatta. The water-works, abattoirs, and street railways are municipal property. The manufactures comprise wagons, glass, pottery, boots and shoes, carriages, stoves, and tobacco, and there are car-shops, distilleries, and breweries. At various points within a radius of from 30 to 100 miles large quantities of coal are mined for colonial consumption as well as for export. Its central position makes Sydney the permanent emporium of the British dependencies in the Southern Hemisphere. It maintains its position as the exclusive outlet for the productions and commerce of extensive pastoral and mineral districts on the northwest, west, and southwest.

The first party of British settlers (convicts) that reached Australia were landed at Botany Bay on January 20, 1788. The spot which had been selected being found unsuitable, it was abandoned a few days afterwards, and the infant settlement was transferred to a point about 7 miles farther to the north, the place where Sydney now stands. The choice of the new locality was chiefly determined by the circumstance of a stream of fresh water found there, flowing into the deep inlet known as Sydney Cove, one of the numerous bays into which the basin of Port Jackson is divided. After the abolition of convict transportation the growth of Sydney was rapid. The installation here, on January 1, 1901, of Earl Hopetoun as first Governor-General of the Australian Commonwealth consummated the federation of Australia. The population of municipal Sydney in 1901 was 111,801; of the city with its suburbs, 488,968.

SYDNEY, Algernon. An English statesman. See Sidney, Algernon.

SYDOW, zē'dō, Emil von (1812-73). A distinguished German cartographer, born at Freiberg, Saxony. He entered the Prussian army in 1829, taught geography, and in 1838 began to publish his excellent school-room maps. Detailed to Berlin in 1843 as a member of the Military Examination Committee, he was subsequently intrusted with the geographical lectures at the Military Academy, which he resumed in 1860, having in the meanwhile lived retired at Gotha since 1855. Attached to the great general staff, he was made director of the geographic-statistical department in 1867 and colonel in 1870. His cartographic work, nearly all translated also into foreign languages, comprises: *Methodischer Handatlas für das wissenschaftliche Studium der Erdkunde*, 30 maps (4th ed. 1870); *Schulatlas in 42 Blättern* (32d ed. 1880); new ed. by Wagner, entitled *Sydow-Wagner, Methodischer Schulatlas*, 63 main and 50 accessory maps (10th ed. 1902); *Oro-hydrographischer Atlas*, 25 maps; and others. He also contributed many articles to various periodicals, notably the reports "Ueber den kartographischen Standpunkt Europas," to *Petermanns Mitteilungen* (1857-72), and created the valuable book of reference *Registrande der geographisch-statistischen Abteilung des Grossen Generalstabs* (Berlin, 1870-83).

SYENE, sī-ē'nē. The ancient name of Assuan (q.v.), a town of Egypt.

SYENITE (Lat. *syenites*, from *Syene*, from Gk. Συήνη, a locality in Upper Egypt). An igneous rock of granitic texture, composed essentially of alkali feldspar and mica, hornblende, or augite (mica seyenite, hornblende syenite, augite syenite). Its average composition is: silica, 59 per cent.; alumina, 17 per cent.; oxides of iron, 7 per cent.; magnesia, 37 per cent.; oxide of lime, 5 per cent.; oxide of sodium, 4 per cent.; oxide of potassium, 5 per cent. From granite, syenite differs in containing little or no free silica (quartz).

SYKES, sīks, GEORGE (1822-80). An American soldier, born at Dover, Del. He graduated at West Point in 1842, served in the Seminole and Mexican wars, and was brevetted captain for gallant conduct at Cerro Gordo. He fought in the first battle of Bull Run, as a major in the Federal army; was commissioned brigadier-general of volunteers in September, 1861, took part in the Peninsular, in the second Bull Run, and in the Antietam campaigns; was commissioned major-general of volunteers in November, 1862; fought at Fredericksburg and Chancellorsville; and commanded the Fifth Corps at Gettysburg. In March, 1865, he was brevetted brigadier-general in the Regular Army for his services in the battle of Gettysburg and major-general in the Regular Army for his services during the war. He was mustered out of the volunteer army in January, 1866, but remained in the Regular Army first as lieutenant-colonel and then as colonel until his death in 1880. A monument has been erected in his honor at West Point.

SYKES, OLIVE (LOGAN) (1841—). An American actress and author, born in New York. In 1864 she appeared at Wallack's Theatre, New York, in *Eveleen*, a play of her own composition; but retired from the stage in 1868, and devoted herself principally to lecturing and writing in behalf of the woman's rights movement. Her later publications include *Women and Theatres* (1869); *Before the Footlights and Behind the Scenes* (1870); and the comedy *Surf, or Life at Long Branch*.

SYL'LABUS ERRO'RUM (Lat., catalogue of errors). A document published by Pius IX. in 1864, appended to the encyclical *Quanta cura*, condemning eighty doctrines which it calls "the principal errors of our times." They are classed under various heads: pantheism, naturalism, and absolute rationalism; moderate rationalism; indifferentism and latitudinarianism; socialism, communism, secret societies, Bible societies (considered from the point of view as Protestant proselytizing organizations), and clericoliberal societies; errors concerning the Church and her rights; concerning civil society; concerning natural and Christian ethics; concerning Christian marriage; concerning the temporal power of the Pope; and errors connected with modern liberalism. The text of the document and an English translation are given in Schaff, *Creeds of Christendom* (New York, 1877-78). The Syllabus gave rise in England to a famous controversy between Gladstone and Newman. Consult Gladstone, *Vaticanism* (London, 1875); Newman, *Letters to the Duke of Norfolk* (ib., 1875).

SYLLOGISM (Lat. *syllogismus*, from Gk. *συλλογισμός*, reasoning. conclusion, from *συλλογίζεσθαι*, *syllogizesthai*, to infer, conclude, from *σύν*, *syn*, together + *λογίζεσθαι*, *logizesthai*, to reason, from *λόγος*, *logos*, word. reason). The name of a logical operation when expressed in a certain form in accordance with the principles of formal logic. When we reason, or get at truth by means of inference, we are said to proceed either inductively (see INDUCTION) or deductively. Deductive reasoning, when fully and methodically expressed, takes the form called the syllogism. 'This thing will sink in water, for it is a stone,' is a deductive argument, but not fully stated; this is called an enthymeme (q.v.). The complete form is, "Stones sink in water; this is a stone; therefore, this sinks in water'—which form is called a syllogism.

To a perfect syllogism it is necessary (1) that there should be three, and no more than three, propositions (see PROPOSITION); these are the conclusion, or the matter to be proved, and two others that are the means of proving it, called the premises. It is also necessary (2) that there should be three, and no more than three, *terms*, namely, the subject and the predicate of the conclusion, and one, called the middle term, which must occur in both premises, being the connecting link for bringing the two other terms together in the conclusion. The *predicate* of the conclusion is called the major term, because it is in its extension (q.v.) the largest of the three; the *subject* of the conclusion is the minor term, as being the smallest in extension. The major and minor terms are called extremes. The three terms appear in the premises in this manner: the major term and the middle term appear in one premise, called the major premise; the middle term and the minor term in the minor premise. In the syllogism above stated, the terms are '(a thing that will) sink in water' (major), 'this thing' (minor), 'stone' (middle); the premises are, 'stones sink in water' (major), 'this thing is a stone' (minor); the conclusion is, 'this thing sinks in water'; (3) one premise at least must be affirmative; (4) if one premise be negative, the conclusion must be negative; (5) the middle term must be distributed (= taken in the whole of its extension) in at least one premise; (6) an extreme, if undistributed in a premise, may not be distributed in the conclusion. Any syllogism which violates any one or more of these six syllogistic rules is invalid. There are two other rules which are derivative: (7) one premise at least must be universal; (8) if one premise be particular, the conclusion must be particular also. Any syllogism which violates either of these rules violates also one or more of the first six rules given above. For the discussion of the question as to the evidence of these canons, see LOGIC.

Categorical syllogistic forms are divided into *figures*, and each figure into *moods*, which are the distinct syllogistic forms, the principle of division being as follows: The figure is determined by the function of the middle term, in the two premises; it may be the *subject* of the major premise, and the *predicate* of the minor (1st figure); the *predicate* in both (2d figure), the *subject* in both (3d figure), the *predicate* of the major and the *subject* of the minor (4th figure). The 4th figure did not belong to the original scheme of Aristotle, and it is usually considered as both unnatural and unnecessary, being only an awkward inversion of the first. The syllogisms of each figure are said to differ in *mood*, or according to the *quality* and the *quantity* of the propositions—that is, according as these are affirmative or negative (quality), universal or particular (quantity).

A conditional syllogism whose conditional major premise presents some sort of alternative is called a *dilemma*. We may have these cases: Either (*a*) alternative consequences may be asserted to follow upon a single condition (or combination of conditions) or (*b*) alternative conditions may be asserted to determine a single consequence (or combination of consequences); or (*c*) an alternative may be presented between a condition with its consequence and another condition with its separate consequence. If alternative consequences are asserted to follow upon a single condition, then it is possible to have a valid conditional syllogism either when a minor premise affirms the condition, warranting as conclusion the affirmation of the alternative consequence; or when a minor premise denies conjunctively ('neither—nor') the alternative consequences, warranting as conclusion the denial of the antecedent. If alternative conditions are asserted to determine a single consequence, it is possible to have a valid syllogism when a minor premise either categorically affirms one of the conditions or disjunctively affirms both conditions, in either case justifying as conclusion the affirmation of the consequent; or when the minor premise categorically denies the consequent, justifying as conclusion the conjunctive denial of the conditions. If the major premise presents an alternative between a condition with its consequence and another condition with its separate consequence, a valid syllogism obtains when the minor premise either disjunctively affirms the two conditions, justifying the disjunctive affirmation of the two consequences, or when the minor premise conjunctively or disjunctively denies both consequences, justifying a conjunctive or disjunctive denial respectively of the two antecedents. For bibliography, see books mentioned under Logic. See also Fallacy; Dilemma; Conversion; Obversion.

SYLPHS (Neo-Lat. *sylpha*, probably from Gk. *σίλφη*, *silphē*, sort of beetle; so called as being a spirit flying in the air). In the fantastic system of the Paracelsists, the elemental spirits of the air, who, like the other elemental spirits, hold an intermediate place between immaterial and material beings. They eat, drink, speak, move about, beget children, and are subject to infirmities like men; but, on the other hand, they resemble spirits in being more nimble and swift in their motions, while their bodies are more diaphanous than those of the human race. They also surpass the latter in their knowledge, both of the present and the future, but have no soul; and when they die, nothing is left.

In common usage, the term 'sylph' has a feminine signification, and is applied to a graceful maiden. How this curious change of meaning occurred is not quite certain; but it is possibly owing to the popularity of Pope's *Rape of the Lock*, which introduced the term into the world of fashion and literature. Consult: Paracelsus's *Liber de Nymphis, Sylphis, Pygmæis et Salamandris et Cæteris Spiritibus* (Basel ed. of Paracelsus's works, 1590).

SYLVANITE. See Tellurium.

SYLVES'TER. The name of two popes. Sylvester I., Pope 314-35. His reign was the first in the new period of Church freedom under Constantine. In his pontificate the Council of Nicæa was held, which he did not himself attend, but sent two legates to represent him. Numerous unhistorical legends, especally concerning his relations to Constantine, have clustered about him; concerning them, consult Döllinger, *Fables Respecting the Popes in the Middle Ages* (Eng. trans., New York, 1872); and see Donation of Constantine. His works are in Migne, *Patrologia Latina*, viii.—Sylvester II., Pope 999-1003, Gerbert by name. He was born at Aurillac, in Auvergne, about 935, and at an early age went to Spain, where he made remarkable progress in scientific studies. He became head of the cathedral school at Rheims, which grew to eminence under his direction. In 982 he was made Abbot of Bobbio on the nomination of Otho II., but returned to Rheims, of which, by Hugh Capet's wish, he was chosen Archbishop in 991. Four years later, the deposition of his predecessor having been declared invalid, he went to Magdeburg on Otho III.'s invitation, and accompanied him to Italy, where he remained, becoming Archbishop of Ravenna in 998, and reaching the Papal throne in the following year. He was a strict reformer, and acquired the reputation of the most learned man of his age; he was an adept in mathematics, and in practical mechanics and astronomy, in which his attainments were so amazing to his contemporaries as to arouse a suspicion that he was in league with the devil. The Gubar numerals, the ancestors of our modern numerals and due to the Western Arabs, owe much of their prominence, if not their introduction into Europe, to Sylvester. His writings are reprinted in Migne, *Patrologia Latina*, cxxxix.; also by Olleris (Paris, 1867); his letters, which throw much light upon an obscure period, have been translated into French (Riom, 1847). Consult studies of his life and times by Hock (Vienna, 1837), Axinger (Paris, 1842), Tappe (Berlin, 1869), and Schultess (Hamburg, 1891); also Schultess, *Die Sagen über Silvester II.* (ib., 1893), and the book of Döllinger referred to above.—The name was also borne by two antipopes, Sylvester III., who contested the Papal throne with Benedict IX. in 1044, and Sylvester IV., who was put up by the Imperial party to oppose Paschal II. in 1105.

SYLVESTER, James Joseph (1814-97). One of the foremost English mathematicians of the nineteenth century. He was born in London, of Jewish parents, and received his early education in a Jewish school. He then attended the Royal Institution school in Liverpool, and thence proceeded to Saint John's, Cambridge (1831). As a Jew he was barred from taking a degree, and it was not until the passing of the Tests Act that he obtained his B.A. at Cambridge (1872). He studied at Inner Temple after leaving Cambridge, and was called to the bar in 1850. Sylvester was appointed professor of natural philosophy at University College, London, in 1837, and was elected fellow of the Royal Society in 1839. In 1841 he was appointed professor of mathematics in the University of Virginia, but soon after (1845) returned to England, where he took up the work of an actuary. In 1855 he became professor of mathematics at the Royal Military Academy at Woolwich, where he remained for 15 years. In 1877 he became the first professor of mathematics at Johns Hopkins University, which position he held for seven years, returning to England to accept the Savilian professorship of geometry at Oxford. He founded the *American Journal of Mathematics* and was for some years its editor.

Sylvester's contributions were almost exclusively in the form of memoirs, scattered through various scientific journals and the proceedings of various societies. They are devoted chiefly to the theories of algebraic forms (see FORMS), in which he was the recognized leader of the mathematical world. He and Cayley (q.v.) contributed more than any of their contemporaries to the theory of invariants, and he may be said to have practically created the vocabulary of the subject. He also published a work on *Laws of Verse* (1870), a subject in which he always showed an interest. Consult obituary notices in various scientific journals in 1897; and Franklin, *Address Commemorative of Sylvester* (Baltimore, 1897).

SYLVESTER, JOSHUA (1563-1618). An English poet, born in the north of Kent. His life was divided between poetry and trade. He is mainly known for a translation, or rather paraphrase, of the *Semaines* (Weeks), a sacred epic written by the French poet Du Bartas (q.v.). The translation had considerable influence upon Milton. Of Sylvester's original verse, all is forgotten except the beautiful sonnet beginning "Were I as base as is the lowly plaine" (in Palgrave's *Golden Treasury*). Consult his *Works*, ed. A. B. Grosart, "Chertsey Worthies Library" (2 vols., London, 1878).

SYLVESTER DAGGERWOOD. A one-act play by George Colman the younger, produced in 1795, a shorter form of *New Hay at the Old Market*, brought out in the same year. There were only two characters in it, the strolling player whose name is the title, and Fustian, a playwright.

SYLVICULTURE. See FORESTRY.

SYL'VIUS. The Latinized name of Jacques Dubois (1478-1555), a French anatomist, born near Amiens. He studied in Paris, and afterwards was a lecturer on anatomy there. His anatomical discoveries and his invention of injection for use in dissection cause him to be remembered. The Sylvian fissure, the Sylvian aqueduct, and the Sylvian artery were named in his honor. His *Opera Medica* were published at Geneva in 1630.

SYMBIOSIS (Neo-Lat., from Gk. *συμβίωσις*, life together, from *σύν*, *syn*, together + *βίος*, *bios*, life.) That condition in which two or more dissimilar organisms live together in an intimate life relation. Various types of symbiosis depend upon the type of relation existing between the organisms, the so-called symbionts.

(1) Mutualistic symbiosis, or mutualism, is that condition in which each party to the symbiosis seems to derive advantage therefrom. This relation has perhaps not been proved to exist in plants, though it seems likely that mutualism exists between the legumes and the bacteria of their root tubercles. Many believe that lichens show true mutualism, the fungus symbiont supplying nitrogenous substances or other materials absorbed from the substratum, and the alga symbiont the carbohydrates.

(2) Antagonistic symbiosis, or parasitism, is that condition where one symbiont gains at the expense of the other. There are many illustrations of this in nature. For example, the parasitic fungi and seed plants may be regarded as securing food from their host plants, but not giving an equivalent in return, as is the case in perfect mutualism.

(3) A somewhat intermediate condition is illustrated by contingent symbiosis, or helotism (q.v.). Some writers hold that lichens illustrate this type, the idea being that there is not a mutual exchange between the alga and the fungus symbiont. The fungus is supposed to gain, but the alga is supposed neither to lose nor gain.

Symbiosis may be more or less intimate. In conjunctive symbiosis the symbionts are blended together so as to form a single body, as best illustrated by the lichens. In disjunctive symbiosis the symbiosis is more temporary, or the symbionts are less completely blended, as illustrated by ectotropic mycorrhizas.

Relations which are, perhaps, not to be regarded as symbiosis, but which nevertheless bear a close similarity to it, are frequently found. Saprophytism differs from parasitism only in that the host plant, so to speak, is dead. Recently a new life relation has been recognized, such as is found in the Indian pipe (Monotropa); in which case there is a root fungus which derives its food materials saprophytically from the soil. Monotropa, not being a green plant, gets nearly all of its food material from the fungus. Hence the relation of the two organisms taken together is saprophytism. The mutual relation of the pair is, however, symbiosis, and the whole relation may be called symbiotic saprophytism. This term may be applied to all of the mycorrhiza plants. By some authors lianas and epiphytes have been regarded as having symbiotic relations with the supporting plants, but the relation is not at all intimate, since they probably get only mechanical support. Kerner held a still broader view of symbiosis, applying this term, for instance, to the herbaceous shade plants of the woods, which are unable to grow unless shaded by the trees.

Among animals forms of symbiosis are to be found. An example of social symbiosis is the case of a polyp (Epizoanthus) or a sea-anemone (Adamsia), which grows on the shell inhabited by a hermit-crab. Klebs states that when the crab changes its shell it seizes the anemone and carries it off to its new home. The term *physiological symbiosis* may be applied to cases among the lowest organisms where certain algæ (Zoöxanthellæ) often live in Radiolaria (q.v.), while similar green and yellow plants inhabit the stomach epithelium of many actinians, corals, and worms. As Hertwig says, the Zoöxanthellæ are nourished by the carbon dioxide which is formed by the animal tissues, and breathe out oxygen, which in turn serves as food for the animal. They also form starch and other carbohydrates, and there is nothing to prevent any surplus thus formed from becoming food for the animal. A remarkable case of symbiosis, involving a structural modification, is that of a carpenter bee (of the Oriental genus Koptorthosoma) and a certain mite. A special chamber, with a small orifice for entry, exists in the abdomen of the bee, in which the Acari are lodged. Here it is a little difficult to draw the line between symbiosis and the parasitism, for instance, of the itch mite which burrows under the skin between the fingers.

SOCIAL SYMBIOSIS. Wheeler applies this term to the relations between ants and the various beetles, crickets, cockroaches, etc., which live at their expense. Of those beetles (Claviger, Paussus, etc.) that live in ant and termite nests certain ones seem to be tolerated or ignored by the ants. So completely agreeable to the ants is the presence of certain of the Staphylinidæ that the ants regurgitate food which they give to the beetles, and the beetles in the same manner share their supply with hungry ants. The ants feed the larval beetles with as much care as they do their own larvæ. They even clean the young beetles by licking them. See ANT; BEE; COMMENSALISM; EPIPHYTE; INSECT; LICHEN; MUTUALISM; PARASITE; ROVE-BEETLE; TERMITE.

Consult: O. Hertwig, *Die Symbiosis* (Jena, 1883); Geddes, *Nature*, vol. xxv. (1882); Brandt, *Archiv für Anatomie und Physiologie* (1882), and *Mittheilungen der zoologischen Station, Naples*, iv. (1883); Lankester, *Nature*, vol. xxvii. (1882). For symbiosis in insects, see the papers of Forel, Wasmann, Wheeler, etc.

SYMBOLISM (from *symbol*, from Lat. *symbolus*, *symbolum*, from Gk. σύμβολος, σύμβολον, mark, token, signal, sign, confession of faith, from συμβάλλειν, *symballein*, to compare, put together, from σύν, *syn*, together + βάλλειν, *ballein*, to throw). In its broadest sense, the representation of one thing by another, as of a sound by a letter, of a word or a concrete idea by a hieroglyph. Symbolism is most important in the history of art, especially of Christian art. Obviously no doctrine of religion can take form in outward act without some kind of symbolism; and accordingly every detail of the ancient Roman Catholic or Eastern rites is so planned as to suggest to the worshiper one or another aspect of abstract truth. In the plan and construction of the older churches the same idea is carried out as in their cruciform shape. Early Christian art represented Jesus under numerous symbols, among the commonest being the lamb, the fish, and the Greek letters Alpha and Omega (the beginning and the end). Similarly, the Holy Ghost was represented by a dove; and the olive branch denoted peace; the palm, triumph; and the anchor, faith or hope. In later art each one of the saints depicted may be recognized by some appropriate symbol, e.g. Saint Andrew by a cross in the shape of an X, or Saint Dominic by the lily and the star above his forehead. Consult: Clement, *Handbook of Legendary and Mythological Art* (2d ed., Boston, 1881); Knight, *The Symbolic Language of Ancient Art and Mythology* (2d ed., New York, 1876). See DÉCADENTS.

SYMBOLISTS. The name of a class of writers which sprang up after 1880 notably in France and in connection with verse. The symbolists regard symbolism as the expression of an idea by the introduction of a being or an object merely for the purposes of such expression. The characteristic means are the allegory, transposition, and allusion. The symbolists were in effect reactionists against realism. They concern themselves with general truths in contrast with actualities. They court erudition, adore the metaphysical and mysterious, and especially exalt the magic power and charm of music. Identified with the influence of Wagner, they seek music in language and accordingly the sonorousness of words; they suggest but do not name. Dreams, visions, and mythological tales are their proper subjects, and lyricism their favorite form of poetic expression. In their aim to unify and blend the arts and the functions of the senses, the extremists among them, like Arthur Rimbaud, associated the vowels with colors, etc. The metrical reforms of the French Symbolists have resulted in making French verse more free and large in its possibilities of effect, more subtle, intimate, and musical. The Symbolists, despite the vagaries which attend all new schools of literature and art, have left a permanent and desirable mark. Their general influence has been for the exclusive, the refined, the delicate, and the mystic beauties of the supranatural. Their verse has represented idealism, religious sentiment, a return to the ancient, and an inherent preference for solemn or fatalistic themes. Verlaine, Mallarmé, and Maeterlinck are the most noteworthy of the French and Belgian Symbolists. Among Symbolist plays those of De Curel may be noted. Symbolism reaches also into the domain of contemporary painting. For a statement of certain particular phases or developments of Symbolism, see DÉCADENTS.

SYMBOLS, MATHEMATICAL. The various signs and abbreviations used to facilitate mathematical expression. They are of the following kinds:

Of value.
Hindu and other numerals. See NUMERALS.
Of operation.
Addition, $+$, Σ.
Subtraction, $-$.
Multiplication, as in $a \times b$, $a \cdot b$, $(a + b)$, $\underline{|a}$ or $a!$
Division, as in $a \div b$, $a:b$, $^a/_b$, x^{-n} $\left(= \frac{1}{x^n}\right)$,
% (as in $6\% = \frac{6}{100}$).
Involution, as in x^n.
Evolution, as in $x^{\frac{1}{n}}$ or $\sqrt[n]{x}$.
Differentation, d, δ, D.
Integration, $\int$.
Of function.
$f(x)$, $F(x)$, for f — function of x, F — function of x; $\phi\ (x, y, \ldots)$, for phi-function of $x, y, \ldots$.
Of quality.
Positive number, $+a$.
Negative number, $-a$.
Absolute value, $|a|$.
Imaginary, ai for $a\sqrt{-1}$.
Decimal, as in 3.2.
Of relation.
Equality, $=$, $::$.
Indentity, $\equiv$.
Inequality as in $a < b$ (a less than b), $a > b$ (a greater than b), $a \nless b$ (a not less than b), $a \ngtr b$ (a not greater than b), $a \neq b$ (a not equal to b).
Of continuation.
....., as in $a, a^2, a^3, \ldots\ldots$

Of deduction.
∵ (since).
∴ (therefore).
Of aggregation.
( ), [ ], { }, ——
Of denominate numbers, as in \$10, 3° 4′ 15″ (degrees, minutes, seconds), £20 3s. 2d. (pounds, shillings, pence), cwt. (100 lbs.), and various abbreviations.
Of geometry.
∠, ∠• (angle, angles).
⊥ (perpendicular to).
‖ (parallel to).
≅ (congruent to).
∽ (similar to).
≐ (approaches as a limit).
△, ◬ (triangle, triangles).
⊙, ◉ (circle, circles).
□, ⊡ (square, squares).
▭, ▣ (rectangle, rectangles).
▱, ▣ (parallelogram, parallelograms).
⌒ (arc).
α (radians).

The question of the origin and development of mathematical symbols is a large one, and science has not yet given satisfactory answers at many points. The probable origin of the remarkable digits 1 . . 9, is discussed in the article on NUMERALS. The origin of zero is unknown, there being no authentic record of its history before A.D. 400. The extension of the position system below unity is attributed to Stevin (1585), who called tenths, hundredths, thousandths, . . . *primes*, *sekondes*, *terzes*, and wrote subscripts to denote the orders, thus 4.628 was written $4(_0)\ 6(_1)\ 2(_2)\ 8(_3)$. But Rudolff (1525) and Kepler (1571-1630) used the comma to set off the decimal orders, and Bürgi (1552-1632) and Pitiscus (1612) in their tables used the decimal fraction in the form 0.32, 3.2. Although the early Egyptians had symbols for addition and equality, and the Greeks, Hindus, and Arabs symbols for equality and for the unknown quantity, from earliest times mathematical processes were cumbersome for lack of proper symbols of operation. The expressions for such processes were either written out in full or denoted by word abbreviations. The later Greeks, the Hindus, and Jordanus indicated addition by juxtaposition; the Italians usually denoted it by the letter P or p with a line drawn through it to distinguish it as an operation, but their symbols were not uniform. Pacioli, for example, sometimes used p and sometimes e, and Tartaglia commonly expressed the operation by φ. The German and English algebraists introduced the sign +, but spoke of it as *signum additorum* and first employed it only to indicate excess. Subtraction was indicated by Diophantus by the symbol ⋔. The Hindus used a dot, while the Italian algebraists denoted it by M or m with a line drawn through the letter. The symbols m̄ and *de* were, however, used by Pacioli. The German and English algebraists were the first to use the present symbol and described it as *signum subtractorum*. The symbols + and — appeared first in print in an arithmetic of Widmann (1489). The symbol × for 'times' is due to Oughtred (1631). To Rahn (1659) is due the present sign ÷ for division; Harriot (1631) used a period to indicate multiplication, and Descartes (1637) used juxtaposition. Leibnitz in 1688 employed the sign ⌒ to denote multiplication and ⌣ to denote division. Division among the Arabs was designated variously by $a - b$, a/b, $\frac{a}{b}$, but Clairaut (1760) made familiar the form $a : b$. Descartes made popular the notation a^n for involution and Wallis defined the negative exponent. The symbol of equality, =, is due to Recorde (1557), and the symbols >, <, for greater than and less than, originated with Harriot (1631). Viĕta (1591) and Girard (1629) introduced various symbols of aggregation. The symbol ∞ for infinity was first employed by Wallis in 1655. The symbols of differentiation dx and of integration $\int$ as used in calculus, are due to Leibnitz, as is also the symbol ∽ for similarity, as used in geometry. The symbolism ϕ, f, F, as used in theory of functions, is due to Abel.

Consult Cantor, *Vorlesungen über Geschichte der Mathematik* (2d ed., Leipzig, 1900).

SYME, sīm, JAMES (1799-1870). A noted Scotch surgeon, born in Fife, and educated at the University of Edinburgh. He was lecturer (1823-32) and professor (1833-48) of surgery at his alma mater, after having served as demonstrator under Liston. He was the inventor of the mackintosh waterproof cloth. He was clinical professor from 1829 to 1833 in Minto House Hospital, which he founded at his own expense. He was one of the ablest teachers and operative surgeons of the age. He devised resection of the joints, Syme's amputation of the foot, and excision of the lower jaw. He was the author of many valuable works, including *The Excision of Diseased Joints* (1831); *Principles of Surgery* (1832); the same, to which is added *Diseases of the Rectum* (1866); *Pathology and Practice of Surgery* (1848); *Stricture of the Urethra and Fistula in Perineo* (1849). Consult Paterson, *Memoir* (Edinburgh, 1874).

SYMINGTON, sĭm′ĭng-ton, WILLIAM (1763-1831). A British inventor, born at Leadhills. In 1786 he constructed a working model of a steam road-carriage, and afterwards patented a steam-engine in which he obtained rotary motion by chains and ratchet wheels. In 1788 he and Patrick Miller used an engine constructed on the lines of this patent to propel a small pleasure boat on Dalswinton Loch. In the following year they experimented on a larger scale on the Forth and Clyde Canal and succeeded in attaining a speed of seven miles an hour. As the type of engine used was imperfect, however, Symington in 1801 patented another in which a piston rod guided by rollers was connected by a rod to a crank attached to the paddle-wheel shaft. In the following year he fitted out a boat called the *Charlotte Dundas*, which proved able to tow two barges a distance of 19½ miles in six hours. The Duke of Bridgewater, Symington's patron, was so well pleased with the boat that he ordered eight others to be constructed. Unfortunately for the inventor, however, the Duke died shortly afterwards, the order was canceled, and Symington was unable to find another patron.

SYMMACHUS, sĭm′må-kŭs. Pope, 498-514. He was born in Sardinia, and was chosen to fill the vacancy left by the death of Anastasius II. A minority, however, of the Byzantine faction, set up as a rival the archipresbyter Laurentius. As a result of the schism, bloody encounters took place, and the Ostrogothic King Theodoric, although an Arian, was appealed to, and gave his voice for Symmachus. Theodoric, being again appealed to, caused the Bishop of Altinum to administer the affairs of the Church for a time, and left the decision to a synod. In its fourth session the synod (502) finally decided in favor of Symmachus. In vindication of the action of the synod the deacon Ennodius, afterwards Bishop of Ticinium (Pavia), gave clear expression to the principle that the Pope (Ennodius is among the first to limit this title to the Bishop of Rome) is above every human tribunal and is responsible only to God himself. Later councils during Symmachus's pontificate condemned all interference of laymen in the election of popes and regulated the disposition of goods belonging to the Church.

SYMMACHUS, GREEK VERSION OF. See BIBLE, section on *Versions.*

SYMMACHUS, QUINTUS AURELIUS. A distinguished Roman orator, scholar, and statesman, who was born probably not long after A.D. 340, was educated in Gaul, and after holding several lesser offices, became prefect of Rome (A.D. 384). Seven years later he was raised to the consulship. The date of his death is unknown, but we know that he was alive in A.D. 404. A sincere pagan in an age when classic paganism was almost extinct, he proved in his own person a pattern of its choicest virtues, and manfully, if in vain, strove to regain for it a place of honor in the State. Symmachus's extant writings consist of ten books of letters (*Epistolarum Libri X.*) and the fragments of nine orations. The best editions of Symmachus's entire works are by Seeck (Berlin, 1883) and Kroll (Leipzig, 1893). Consult: Morin, *Etude sur la vie et les écrits de Symmaque, préfet de Rome* (Paris, 1847); Dill, *Roman Society in the Last Century of the Western Empire* (London, 1899).

SYMMES, sĭmz, JOHN CLEVES (c.1780-1829). An American soldier and author, born in Sussex County, N. J. He entered the United States Army as ensign in 1802, became captain January 20, 1813, and served through the War of 1812, distinguishing himself particularly at Niagara and in the sortie from Fort Erie. He subsequently lived in Newport, Ky., and gave his entire time to developing and advocating his theory that the earth and all the other planetary bodies are composed of a number of hollow concentric spheres, open at their poles. He believed the inside of the earth to be habitable, and in 1822 and again in 1823 petitioned Congress to fit out an expedition to test the theory. In support of his contention he published many pamphlets and a volume entitled *Theory of Concentric Spheres* (1826). Consult an article on "Symmes's Theory of the Earth," in the *Atlantic Monthly* for April, 1873.

SYMMETRY (Lat. *symmetria,* from Gk. *συμμετρία*, from *σύμμετρος*, *symmetros,* having a common measure, from *σύν*, *syn,* together + *μέτρον*, *metron,* measure, from *μετρεῖν*, *metrein,* to measure). A term used in geometry to express a characteristic property of two congruent or quasi-congruent figures which have a certain relation with respect to a point, line, or plane. Two systems of points, A_1, B_1, C_1, ..., A_2, B_2, C_2, ..., are said to be symmetric with respect to an axis when all lines A_1 A_2, B_1 B_2, ... are bisected at right angles by that axis. Two figures are said to be symmetric with respect to an axis when their systems of points are symmetric with respect to that axis. A figure is said to be symmetric with respect to an axis when the axis divides it into two symmetric figures. Two systems of points A_1, B_1, C_1, ..., and A_2, B_2, C_2, ..., are said to be *symmetric with respect to a centre O* when all lines A_1 A_2, B_1 B_2, C_1 C_2, ..., are bisected by O.

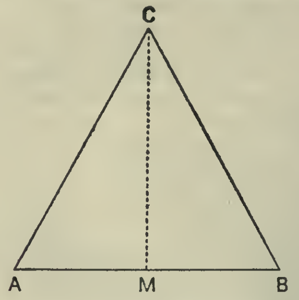
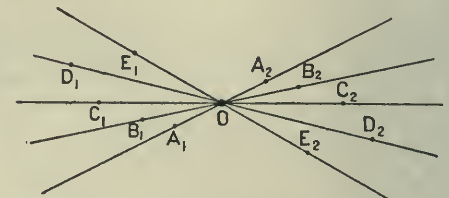
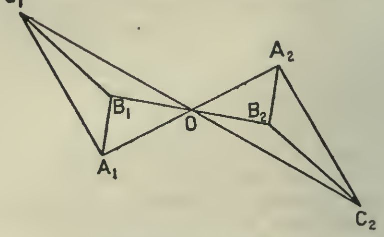


FIGURE SYMMETRIC WITH RESPECT TO AN AXIS.



POINTS SYMMETRIC WITH RESPECT TO A CENTRE.

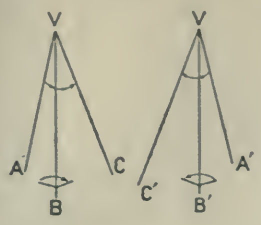


SYMMETRICAL TRIANGLES.

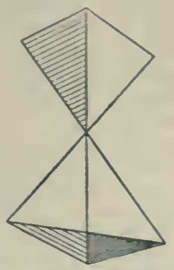
Two figures are said to be symmetric with respect to a centre when their systems of points are symmetric with respect to that centre. E.g. in the figure triangles A_1 B_1 C_1, A_2 B_2 C_2 are symmetric with respect to O.

Figures of three dimensions besides being symmetric with respect to an axis or a centre may be symmetric with respect to a plane. E.g. the sphere is symmetric with respect to its centre, with respect to any diameter as axis, and with respect to any diametrical plane as a plane of symmetry. Symmetric polyhedral angles may be considered as quasi-congruent, and are such as have their dihedral angles equal, and the plane angles of their faces also equal, but arranged in reverse order.

Thus, in the following figure, V and V′ are symmetric trihedral angles, the letters showing the reserve arrangement. Opposite polyhedral angles are such that each is formed by producing the edges and faces of the other through the vertex, and are symmetric. The theory of symmetric figures is closely related to that of similarity (q.v.).



SYMMETRIC POLYHEDRAL ANGLES.



OPPOSITE POLYHEDRAL ANGLES.

In algebra, an algebraic function is said to be *symmetric* with respect to certain letters when these letters can be interchanged without changing the form of the expression. E.g. $x^2 + 2xy + y^2$ is symmetric as to x and y, because if x and y are interchanged it becomes $y^2 + 2yx + x^2$, which is the same as the original expression.

A knowledge of symmetry and homogeneity (q.v.) is of great value in factoring. E.g. to factor $f(x,y,z) = x(y^3-z^3) + y(z^3-x^3) + z(x^3-y^3)$. The expression vanishes for $x = y$, hence $x - y$ is a factor by the remainder theorem (q.v.). But $f(x,y,z)$ is symmetric with respect to x,y,z, therefore $y - z$, $z - x$, are also factors. And $f(x, y, z)$ being homogeneous of the fourth degree, it must contain another factor of the first degree; but such a homogeneous symmetric factor can be $x + y + z$ only. Whence the literal factors are $x - y$, $y - z$, $z - x$, $x + y + z$. On algebraic symmetry consult Beman and Smith, *Elements of Algebra* (Boston, 1900).

SYMMETRY. The general tendency in animals toward a symmetrical arrangement of parts. Thus man is bilaterally symmetrical, i.e. the external parts or limbs are arranged in pairs on each side of his body. So with the annelid worms, the lobster, centipede, and scorpion. On the other hand, this symmetry is wanting in some of the internal organs—those which are single. Haeckel has elaborated a scheme of fundamental forms of which the following is a summary.

(1) *Anaxial or symmetrical* forms, with no fixed central point or definite axis (many Protozoa and most sponges).

(2) *Homaxial or spherical* animals have the fundamental shape of a sphere, the parts of the body being arranged concentrically around a fixed central point (a few spherical Protozoa, chiefly Radiolaria).

(3) *Monaxial or Radial Symmetry.* In polyps, owing to their becoming fixed in larval life, the digestive canal opens upward, the parts being arranged around the single or main axis, radiating from it. In cross-section the radial symmetry is seen to be very marked. The parts are like reëntering wedges and were called by Agassiz spheromeres (cœlenterates and echinoderms).

(4) *Bilateral Symmetry.* Here the parts are symmetrically arranged on each side of the main or sagittal axis (annelid worms, arthropods, vertebrates).

INTERNAL AND EXTERNAL SEGMENTATION. This is due to the division of the body into segments, indicated externally by infoldings of the integument (annelids, tapeworms, arthropods). The external signs of segmentation may be effaced or wanting. Thus in man the body is segmented only internally; in the lancelet the muscles are arranged segmentally and can be seen on the outside of the body. In the annelid worms (earthworm, etc.) not only is the body segmented externally, bearing setæ or parapodia on each segment, but the nerve-ganglia, nephridia or segmental organs, the vascular arches or transverse arteries, and the septa of the body, i.e. the partitions between the segments, are repeated metamerically.

HOMONOMOUS AND HETEROMEROUS SEGMENTATION. The earthworm, the galley-worm (Julus), and the centipedes afford examples where the trunk-segments are for the most part alike in size and appearance, and bear similar locomotive setæ or jointed appendages. In most crustacea and insects, as well as in the higher vertebrates, 'heteronomy' prevails. Homonomy is characteristic of the more primitive forms, heteronomy of later more specialized types. Thus the transfer of parts headwards in crabs (cephalization), due to the excessive development of certain of the head segments and the atrophy of those behind, brings about a decided irregularity in the size and shape of the segments. Heteronomy is thus accompanied by a division of physiological labor due to the specialization of the segments and their appendages. It is owing to the hypertrophy of certain segments and partial or total reduction and even in some cases loss of segments or portions of segments, with their appendages, that the varied forms of arthropods are produced. Consult Haeckel, *Generelle Morphologie* (Berlin, 1866).

SYMONDS, sĭm′ondz *or* sī′mondz, JOHN ADDINGTON (1840-93). An English critic and literary historian, born at Bristol. From Harrow he passed to Balliol College, Oxford, where he graduated with distinction, winning the Newdigate prize, with a poem on *The Escorial* (1860), and a fellowship at Magdalen College (1862). He began the study of law, which ill health compelled him to abandon. He settled at Clifton and began literary work in earnest. Subsequently he passed much time on the Continent, and for several years lived at Davos, in Switzerland. *Our Life in the Swiss Highlands* (1891) tells charmingly of his mountain home. He died in Rome. Symonds's reputation rests mainly on *The History of the Italian Renaissance* (7 vols., 1875-86), and the excellent translations of the *Vita di Benvenuto Cellini* (1887) and the *Sonnets of Michelangelo and Campanella* (1878). Other striking books are the *Introduction to the Study of Dante* (1872), *Essays, Speculative and Suggestive* (1890), *In the Key of Blue* (1893), and *Walt Whitman* (1893). Symonds also contributed to the "English Men of Letters" good lives of Shelley (1878) and of Sir Philip Sidney (1886). Besides all these and much other miscellaneous work, he composed a considerable body of verse, admirable in technique, but wanting in inspiration. This includes *Many Moods* (1878); *New and Old* (1880); *Animi Figura* (1882); and *Vagabunduli Libellus* (1884). Both his verse and his prose show the thorough interpenetration of his nature by the culture and the ideals of the Renaissance period with which he was so familiar. He was celebrated as a fascinating conversationalist; Stevenson, who passed some time at Davos with him, has commemorated him in the essay on "Talk and Talkers" in *Memories and Portraits,* under the name of Opalstein. Consult also the biography by Brown (London, 1895).

SYMONS, sĭm′onz, Arthur (1865—). An English essayist and verse writer, born in Wales. He attended several private schools and traveled in France and in Italy. He has written for the *Athenæum* and the *Saturday Review,* and was editor of the short-lived *Savoy* (1896). As a literary critic, Symons is seen at his best in *Studies in Two Literatures* (1897), dealing with contemporary English and French writers. These essays possess a charm and finish recalling Walter Pater. Symons has published *An Introduction to the Study of Browning* (1886) and *The Symbolist Movement in Literature* (1899). He has produced a body of graceful and tender verse in *Days and Nights* (1889); *Silhouettes* (1892); *London Nights* (1895); *Amoris Victima* (1897); and *Images of Good and Evil* (1900), all showing a marked influence of the recent school of French Symbolists. Two volumes of poems (1902) contain, with some new verses, all he wished to preserve from earlier volumes.

SYMPATHY (Lat. *sympathia,* from Gk. συμπάθεια, *sympatheia,* fellow-feeling, sympathy, from συμπαθής, *sympathēs,* having like feeling, sympathetic, from σύν, *syn,* together + πάθος, *pathos,* feeling). In its broadest sense, the reproduction in one's self of a particular condition (physiological, psychophysical, or psychological) presented by other living creatures in one's perceptual or ideal environment. In genetic psychology, sympathy is a form of ejective or social consciousness, based ultimately upon a group of organic sensations (q.v.). The motor attitude assumed by gregarious animals in defense of their kind is different from the attitude adopted under the influence of personal fear. When consciousness becomes representative, and free ideas are formed (see Idea), the sense-basis of the former attitude is associated with ideas of others' suffering and rescue, that of the latter with ideas of one's own danger, safety, escape, etc. This is the stage of sympathetic consciousness proper. In general psychology, sympathy is one of the great emotional types, covering such different individual emotions as love, anger, contempt, aversion, chagrin, resentment, etc. (See Emotion; Anger.) For the ethical importance of sympathy, see Altruism, and the references there given. See also Antipathy.

SYMPETALÆ. One of the two great groups of dicotyledons (q.v.).

SYMPHONY (Lat. *symphonia,* from Gk. συμφωνία, unison of sound, harmony, from σύμφωνος, *symphōnos,* agreeing in sound, harmonious, from σύν, *syn,* together + φωνή, *phōnē,* sound, voice). In music, a word used in two different senses: (1) The instrumental introduction and termination of a vocal composition, sometimes called *ritornello;* (2) a composition for a full orchestra, consisting generally of four movements. The most usual though not unvarying order of movements is a brilliant allegro, ushered in by a slow introduction, an adagio or andante, a scherzo with its trio, and the finale, again an allegro. For the origin of the modern symphony we must go back to the beginnings of opera early in the seventeenth century, when the name *Sinfonia* was given to the short instrumental prelude which preceded the opera. The early history of the symphony is, therefore, that of the overture (q.v.). About the middle of the eighteenth century composers began to write separate *sinfonie* exclusively for concert performance. The three parts of the older overture, which had then only a loose connection, were entirely detached and became separate movements. Haydn introduced a fourth movement, the minuet (q.v.), which he inserted before the finale. He also adopted for the first movement the sonata form (q.v.). By individualizing the separate instruments and grouping them in families Haydn also established the symphony orchestra and thus made the symphony what it is to-day. Beethoven extended the form considerably, particularly the development section of the first movement, and also replaced the minuet by the more elaborate scherzo (q.v.). Beethoven also increased the orchestra considerably. (See Orchestra.)

SYMPLEGADES, sĭm-plĕg′ȧ-dēz (Lat., from Gk. Συμπληγάδες, that strike together, from συμπλήσσειν, *symplēssein,* to strike together, from σύν, *syn,* together + πλήσσειν, *plēssein,* to strike). Two mythical floating islands in the Pontus Euxinus, which dashed against each other until they became fixed when the Argo made its way between them. See Argonauts.

SYMPOSIUM (Lat., from Gk. Συμπόσιον, banquet). (1) A philosophical treatise by Xenophon, discussing the nature of love and friendship, and depicting the character of Socrates, who is one of the speakers. The meeting place is the house of the Athenian Callias. The work conveys a good idea of the conduct of an Athenian drinking party. (2) A dialogue by Plato, intended probably as a corrective of the similar work of Xenophon. Its subject is the nature of love. Its scene is the house of the poet Agathon, and Socrates and Alcibiades are among the speakers.

SYMPTOM (from Gk. σύμπτωμα, *symptōma,* chance, mischance, symptom, from συυπίπτειν *sympiptein,* to fall in with, happen, coincide, from σύν, *syn,* together + πίπτειν, *piptein,* to fall). A medical term denoting a phenomenon by which a physician judges of the presence of disease. A group, or syndrome, of symptoms enables the physician to judge directly of the nature of and to identify the disease, or to decide upon the lesions or morbid tissue changes, and then determine what disease is present. This decision is called a diagnosis. (See Pathology.) Symptoms are *objective,* including those perceived by the physician and found upon examination, such as heart murmurs, rise of temperature, etc.; or *subjective,* including those perceived only by the patient, as pain, ringing in the ears, etc. Symptoms are termed *pathognomonic* when they are sure signs of a certain disease; e.g. the syndrome of occipital headache, severe pain in the orbits, acute nasal catarrh, rheumatoid pains in joints and muscles, and great prostration is almost always pathognomonic of the grippe.

SYNAGOGUE (Gk. *συναγωγή*, *synagogē*, assembly, collection, from *συνάγειν*, *synagein*, to bring together, from *σύν*, *syn*, together + *ἄγειν*, *agein*, to lead; translation of Heb. *bēth-hakkeneseth*, the house of assembly). The name applied to the place of assembly used by Jewish communities primarily for public worship. The origin of this institution is probably to be traced to the period of the Babylonian captivity, when religious needs in the absence of an official cult could only be satisfied by private assemblies for religious communion. The example set during the Babylonian Exile led to the establishment of synagogues in Palestine after the days of Ezra, and with the impetus then given to the study of the law a further factor was introduced which encouraged the institution of assembly-houses for prayer and study. Although express notices of the synagogues are not found in the literature till the last century B.C., all indications point to their existence in the towns and even villages of Palestine at the time of the Maccabees.

Synagogues were erected from the common funds or free gifts of the community and supported by taxes and donations. Regarding their architecture it would appear that in Palestine the Græco-Roman model of public buildings was followed, though with some essential modifications. Abundant ornamentation was a feature both of the exterior and interior. The larger synagogues were divided by rows of pillars into several aisles and some had porticoes in front. In later times in Europe the Romanesque style was adopted, and in more modern times Moorish architecture is frequently chosen as a model. Little is known of any special law respecting the construction of these buildings, save that the faces of the worshipers should be directed toward Jerusalem; that, in accordance with the verse in the Psalms, there should be a slight descent of a step or two on entering the edifice; that the building should stand, if feasible, on a slightly elevated ground, or be somehow or other made visible from afar. Within at the extreme eastern end was the holy ark, or chest (*tēbāh*) containing several copies of the Pentateuch, from which the periodical readings were chanted. In front of this was the stand of the public reader of the prayers, not far from which was suspended the everlasting lamp. On a raised platform in the middle of the synagogue was the place of the reader or preacher. The women, who were not counted as members of the congregation, sat separated from the men.

The affairs of the synagogue were administered by a board of 'ancients' or 'elders,' at whose head stood a chief or principal (*Rōsh hakkeneseth*, *archisynagogos*). The 'chief' was not a scribe, though taking rank immediately after the scribes. The officiating minister, whose office it was to recite the prayers aloud, was called *shĕlîach-ṣibbūr*, messenger of the community. The *chazzān* had general charge of the sacred place and its books and implements. He had to present the scroll to the reader, received it back after the reading was finished, rolled up the scroll and deposited it in the chest, and it was he who announced the advent of the Sabbath or of a holy day from the roof of the synagogue with a thrice repeated trumpet-blast. During the week-days he had to teach the children of the town or village. He had to be initiated by a solemn imposition of hands. The name of *chazzān*, however, at a later period, came to designate the officiating minister, and it has retained that meaning until this day. Almoners or deacons, who collected or distributed the alms, possibly the same as the *baṭlanīm* or 'idle men,' whose office in relation to the synagogue cannot be exactly determined now, but who had always to be ready for the purpose of making up the requisite number of ten worshipers, were further attached to the general body of officials. The third, sixth, and ninth hours of the day were the times appointed for daily worship; the more special days were Monday and Thursday, when the judges sat, and the villagers came to town, and Saturday, on which the forms of some of the prayers were altered according to the occasion.

The reading from the Scriptures, though in Hebrew, was coupled in the synagogues of Palestine and Babylonia with a translation or paraphrase in the current Aramaic idiom, and presumably in the synagogues of Egypt a Greek translation was employed, but the chief prayers were always pronounced in Hebrew, though the Talmud admits the use of other languages in worship. Besides the prayers and the readings, a feature of early synagogue worship was the exposition of the law or of the lesson of the day by a competent person. In course of time a more elaborate liturgy developed. The oldest complete ritual, known as *siddur* ('arrangement'), dates from the year A.D. 880, and was compiled by a Rabbi Amram. In the liturgy as finally evolved two distinct elements are discernible: the *Shema'* ('Hear, O Israel,' etc.), being a collection of the three passages, Deuteronomy vi. 4-9, xi. 13-21, and numbers xv. 37-41, expressive of the unity of God and of His government over Israel, put together without any extraneous addition; and the *Tĕphillāh* or prayer, consisting of a certain number of supplications, with a hymnal introduction and conclusion, followed by the priestly blessing. The single portions of this prayer gradually increased to eighteen and the prayer itself received the name of *Shĕmōnāh 'eshēh* (eighteen). For a long time the prayers were recited only by the reader, the people joining in silent responses and amens. These readers by degrees—chiefly from the tenth century—introduced occasional prayers of their own, and ultimately religious doctrine, history, saga, angelology, and mysticism, interspersed with biblical verses, are found put together in a mosaic of the most original and fantastic, often grand and brilliant, often obscure and feeble kind. The ritual differed in different countries. At the beginning of the nineteenth century a movement began in Germany for the reform of the ritual and gradually spread to other countries. At first the changes consisted in the shortening of certain prayers, the omission of others and the introduction of German, English, or French by the side of the Hebrew.

The synagogues contributed more than anything else to the steadfast adherence of the people to their religion and liberty as long as there was any possibility of keeping both intact. At the same time they gradually undermined the priestly and aristocratic element that gathered around the temple, its gorgeous worship and kingly revenues. Their importance as a place of instruction as well as a place of worship was of profound influence on the development of Judaism. Both primary and advanced instruction in the Scriptures and subsequently in Talmudic literature was given in the synagogue, and in the early centuries of the Christian Era legal decisions were likewise announced there. The synagogue could also be used as the place of mourning for prominent members of the community, and there are instances on record of the use of synagogues for political gatherings. In Babylonia travelers were accommodated in the synagogue and ate their Sabbath meals there. In view of these various uses to which the synagogue was put, it is not surprising that it became in the Middle Ages the centre of the religious and intellectual life of the Jews and in a measure of their social life as well. The 'reform' movement within Judaism as well as the extension of the intellectual interests of the Jews has resulted in narrowing the influence and scope of the synagogue to purely religious affairs, though in orthodox Jewish communities in Eastern Europe and in the Orient the former status of the synagogue is still in large measure maintained.

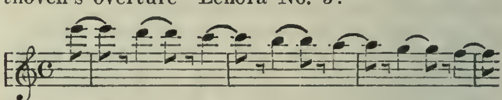
Bibliography. Schürer, *History of the Jewish People in the Time of Jesus Christ* (Eng. trans., London, 1886-90); Abrahams, *Jewish Life in the Middle Ages* (Philadelphia, 1896); Grätz, *History of the Jews*, vol. i. (Eng. trans., ib., 1893). For the ritual, Leopold Löw, *Der synagogale Ritus* (*Gesammelte Schriften*, vol. iv., Szegedin, 1889); Dembitz, *Jewish Services in Synagogue and Home* (Philadelphia, 1899); Zunz, *Der Ritus synagogalen Gottesdienstes, geschichtlich entwickelt* (Berlin, 1855-59); a complete English translation of the Portuguese ritual may be found in Lesser's Prayer-book (Philadelphia, 1845); and a translation of the German ritual in Sachs's *Machsar* (Berlin, 1866).

SYNAGOGUE, The Great (Heb. *hakkeneseth haggĕdōlāh*). An alleged assembly or synod, said to have been founded and presided over by Ezra and to have controlled the national and religious fortunes of the Jews after the return from Babylon, c.450-200 B.C. Its membership is generally given as 120, but sometimes as 80. The palpable chronological discrepancies that occur in the early accounts about this synod, together with other doubtful points, have led modern scholars to deny its existence. It is not mentioned by Josephus or the Apocrypha and is only twice referred to in the Mishna (*Pirke Aboth* I., 1 and 2). Even according to the Talmudical notices the 'great synagogue' continued only for a single generation. According to these notices the men of the great synagogue secured the acceptance of certain books of the Old Testament (Proverbs, Canticles, Ecclesiastes); they promoted the work of copying the Torah, devoted themselves to the perfection of a daily ritual, and introduced certain changes into the Old Testament text in order to avoid misunderstandings. The notion that they collected the books of the Old Testament and fixed the canon had no authority in the Talmud, and indeed does not arise till the sixteenth century. Kuenen has traced the origin of the name to the 'great assembly' which is described in Nehemiah viii.-x. This assembly was of a popular character, and no doubt marked an epoch in the history of post-exilic Judaism. An uncritical age made of this 'assembly' a permanent institution and attributed to it the various steps taken in the natural unfolding of that phase of Rabbinical Judaism which came to a temporary close when the canon of the Old Testament was definitely established. While some scholars (notably D. Hoffmann of Berlin) still cling to the traditional view, Kuenen's results have been accepted by the great majority. Consult his essay in *Gesammelte Abhandlungen*, pp. 125-160 (Freiburg, 1894); Hoffmann's reply will be found in the *Magazin für die Wissenschaft des Judenthums*, vol. x. (1883), pp. 45-63. See also L. Krauss, "The Great Synod," in the *Jewish Quarterly Review*, vol. x. (1898), pp. 347-377.

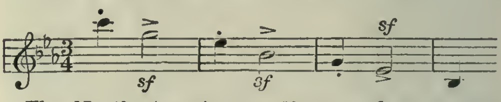
SYNCHRONOUS MOTORS. See Dynamic Electric Machinery.

SYNCLINE (from Gk. *συνκλίνειν*, *synklinein*, to lean together, from *σύν*, *syn*, together + *κλίνειν*, *klinein*, to lean). A term used in geology for the structure formed by the bending of strata into a basin of downward fold, the limbs of the fold dipping toward each other and meeting at a line called the synclinal axis. Where the strata dip downward from all sides a peculiar type of syncline arises, known as a geologic basin; in this case the synclinal axis is reduced to a point. The syncline, structurally, is the complement of the anticline (q.v.). See Geology.

SYNCOPATION (from Lat. *syncopatus*, p.p. of *syncopare*, to syncopate, from *syncope*, from Gk. *συγκοπή*, *synkopē*, a cutting short, from *συγκόπτειν*, *synkoptein*, to abridge, from *σύν*, *syn*, together + *κόπτειν*, *koptein*, to cut). In music, the joining together of two similar notes by means of a tie, so that the accent intended to fall on the second (strong beat) comes on the first (weak beat). The effect produced is that of contra-tempo. The following example is from Beethoven's overture "Lenora No. 3:"



The effect of syncopation can also be produced by merely shifting the accent by means of *sf* marks (*Eroica Symphony*, Scherzo):



The North American Indians made extensive use of syncopation, and in this were followed by the Southern negroes. In fact, the music of nearly every savage or semi-civilized nation shows traces of syncopated rhythm.

SYNCOPE. See Fainting.

SYNCRETISM (from Gk. *συγκρητισμός*, *synkrētismos*, combination against a common enemy, from *συγκρητίζειν*, *synkrētizein*, to combine against a common enemy, apparently from *σύν*, *syn*, together + *κρητίζειν*, *krētizein*, to act like a Cretan, from *Κρής*, *Krēs*, Cretan). A term used: (1) in ancient times, politically, to designate the Cretan custom of disregarding all internal dissensions whenever a controversy with a foreign country occurred; (2) in the sixteenth century, philosophically, to denote the efforts made to reconcile opposing systems; (3) in the seventeenth century theologically, first by Percus in his *Irenicon*, and afterwards to describe the views of Calixtus and his followers, who sought to heal the schism in the Church by making the traditions of the first five centuries of equal authority with the Bible, and by adopting the Apostles' Creed as the common basis of all Christian denominations and a sufficient definition of true Christianity.

SYNDIC (from Lat. *syndicus*, from Gk. *σύνδικος*, *syndikos*, advocate, public officer, from *σύν*, *syn*, together + *δίκη*, *dikē*, justice, law, right). A name which has at different times and in different countries been given to various municipal and other officers. In Geneva the chief magistrate was formerly called the syndic. The syndics of cities in France, under the old régime, were officers delegated by the municipality as agents or mandatories; the various trading companies in Paris and the university had also their syndics; and in the University of Cambridge the same name is applied to members of special committees of members of the senate appointed by grace from time to time for specific duties. In Italy the mayors of towns are called syndics.

SYNERGISM (from Gk. *συνεργία*, *synergia*, coöperation, from *συνεργός*, *synergos*, coöperative, from *σύν*, *syn*, together + *ἔργον*, *ergon*, work). The name given to a doctrine of theology which teaches that in the work of conversion the will of man is not wholly passive, but can coöperate, through consent, with the Divine Spirit. In the time of the Reformation Melanchthon and his school were inclined to this view, while the strict Lutherans opposed it and charged its advocates with favoring Pelagianism (q.v.). In 1557 and later the question was hotly discussed, Pfeffinger and Strigel taking the lead on the Synergistic side, Flacius and Amsdorf (qq.v.) on the opposite. The Wittenberg divines in general favored the doctrine, the Mansfield divines opposed it. Finally it was condemned in 1580 in the third article of the Formula of Concord. See CONCORD, BOOK OF.

SYNE'SIUS (Lat., from Gk. *Συνέσιος*) (c.370-?). A Neo-Platonic philosopher and Christian bishop. He studied philosophy in Alexandria, under Hypatia, to whom he was ever warmly devoted, and his life well illustrates the combination of Neo-Platonism and Christianity so characteristic of the fourth century. For three years (397-400) he served as envoy at the court of Arcadius, in Constantinople, where he won popularity and influence. His famous speech *On Kingship* was delivered in the Emperor's presence, and was a bold discussion of the duties and frailties of monarchs. Synesius was made Bishop of Ptolemais in 410, against his own desire, and with the apparent stipulation that he should not be obliged to give up his wife or his philosophy. He administered his see with conscientious fidelity, notwithstanding the fact that his personal tastes were far from ecclesiastical. Neither the time nor the place of his death is known. Synesius's writings include about 150 letters; *Egyptian Tales, or on Providence*, a sort of historical allegory defending the idea of a providential government of the world; a defense of the philosophic life, entitled *Dio* (after Dio Chrysostom); a humorous work, called *Praise of Baldness*, suggested by Dio's *Praise of Hair;* and ten *Hymns*, which are partly pagan and partly Christian. His general theological point of view and his distinctive characteristics are well brought out in Charles Kingsley's novel, *Hypatia*, in which Synesius figures. For his works, consult: Migne, *Patrologia Græca*, lxvi. In general, consult: Glover, *Life and Letters in the Fourth Century* (Cambridge, 1901); Druon, *Etudes sur la vie et les œuvres de Synésius* (Paris, 1859); Volkmann, *Synesius von Cyrene* (Berlin, 1869).

SYNOD (Lat. *synodus*, from Gk. *σύνοδος*, assembly, meeting, coming together, from *σύν*, *syn*, together + *ὁδός*, *hodos*, way, road). A term applied almost exclusively to ecclesiastical assemblies convoked for the discussion and decision of ecclesiastical affairs. Synods or church councils are of five kinds: Ecumenical, general, national, provincial, and diocesan or local. By the law of the Roman Catholic Church the decrees of a national or provincial synod must be submitted to the Pope, and unless confirmed by him, or at least suffered to pass for two years without condemnation, are not held to be valid. The term synod has been preserved to describe courts in the Presbyterian system of church government which rank above the presbytery and the synod either is subordinate to a General Assembly or is itself the supreme court of the Church. The courts above the classes in the Dutch and German Reformed churches are called synods. In the organization of the Lutheran churches the synod is the highest representative body. Two of the Eastern churches have preserved the synod. The Holy Governing Synod of All the Russias is the highest ecclesiastical authority for the established Church of the Russian Empire. It consists of several metropolitans and other prelates and officials—the Chief Procurator of the synod representing the Czar. It was instituted by Peter the Great in 1721, to take over the jurisdiction formerly exercised by the Patriarch of Moscow. The orthodox national Church of the Kingdom of Greece is also governed by a synod of archbishops and bishops independent of the jurisdiction of any patriarch. For other conciliar organizations, see COUNCIL.

SYNODIC (Lat. *synodicus*, from Gk. *συνοδικός*, *synodikos*, relating to a conjunction, from *σύνοδος*, *synodos*, assembly, meeting, coming together). In astronomy, the epithet applied to the period of time which elapses between two successive conjunctions (q.v.) of a planet with the sun, as seen from the earth. In the case of the moon, the synodic period is therefore the time elapsing between two successive new moons. See MOON.

SYNONYM (Lat. *synonymum*, from Gk. *συνώνυμον*, *synōnymon*, neu. sg. of *συνώνυμος*, *synōnymos*, having the same name or meaning, from *σύν*, *syn*, together + *ὄνομα*, *onoma*, name). A word which nearly coincides in meaning with another, as clear, transparent; bright, limpid; fair, cloudless; serene, plain; lucid, perspicuous; patent, obvious; visible, evident. There is, however, in nearly every case a slight individual shade of meaning in each synonym. The development of synonyms is one first of convergence and then of divergence. That is, the meanings are originally quite distinct.

In the course of semasiological evolution, however (see SEMASIOLOGY), the particular words which tend to become synonymous overlap in meaning. This process may then continue till the words become identical in meaning. In this case the result is suppression of one of the terms, either complete, or, less usually, partial. The latter process gives the so-called suppletive or composite inflection, illustrated in such English verbs as *am, be, was*, or *go, went*, in which verb-roots originally distinct have coalesced. If, on the other hand, synonyms do not become identical, they tend to become so specialized in meaning with respect to each other that they not only retain for the most part their original distinctions, but frequently develop others. The main stylistic use of synonyms is to give variety and accuracy of diction. One of the criteria of excellence of a language is its synonyms, and herein English ranks as one of the foremost tongues. Consult, for English synonyms: Roget, *Thesaurus of English Words* (new ed., London, 1883); Soule, *Dictionary of English Synonyms* (new ed., Philadelphia, 1895); Crabbe, *English Synonyms* (new ed., New York, 1891); Smith, *Synonyms Discriminated* (4th ed., London, 1890).

SYNOVIAL MEMBRANE and **FLUID** (from Neo-Lat. *synovialis*, from *synovia*, lubricating fluid secreted by a synovial membrane, so called because it resembles the white of an egg, from Gk. *σύν, syn*, together + Lat. *ovum*, egg). In every joint in which a considerable range of motion is required, the osseous segments (or contiguous extremities of bones) are separated by a space, which is called the cavity of the joint. The end of each of the bones entering into the composition of the joint is incrusted by a layer of articular cartilage adapted to its form, and the entire cavity of the joint is lined by a delicate membrane, which is termed the *synovial membrane*, which secretes a peculiar viscid matter, termed *synovia*, or *synovial fluid*, for the purpose of lubricating the inner surface. Being a serous membrane, a synovial membrane is always a closed bag, like the pleura, for example, with an attached and a free surface, the latter being smooth and moist. The minute structure of a synovial membrane is much the same as that of serous membranes elsewhere. (See HISTOLOGY.) A very simple form of synovial membrane—anatomically known as a *bursa*—is employed to facilitate the gliding of a tendon of a muscle or of the integument over a projection of bone. It consists of a bag connected by areolar tissue with the neighboring parts, and secreting a fluid in its interior. These bags are sometimes prolonged into *synovial sheaths*, which surround long tendons, such as those of the flexor and extensor muscles of the fingers and toes. In felon (q.v.), when inflammation extends to one of the sheaths, and gives rise to the formation of adhesions, the motion of the inclosed tendon is destroyed, and a permanently stiff finger is the result. See SYNOVITIS.

The *synovial fluid*, or *synovia*, consists of water holding in solution mucin, albumen, fat, and inorganic salts. Excessive movement diminishes its amount, makes it more inspissated, and increases the mucin, but diminishes the salts.

SYNOVITIS (Neo-Lat., from *synovia*, lubricating fluid secreted by a synovial membrane). Inflammation of a synovial membrane. Although inflammatory processes involving joints frequently start in an inflammation of the synovial membrane, they rarely confine themselves to this membrane, but spread to and involve the surrounding tissues. It is for this reason that, especially in discussing the pathology of joints, the term synovitis, which properly means inflammation of the synovial membrane only, has been displaced by the term arthritis, which signifies inflammation of the joint in general, including the synovial membrane.

ACUTE ARTHRITIS is usually an exudative inflammation and may be serous, sero-fibrinous, or suppurative in character. In serous arthritis there is congestion of the synovial membrane with a serous exudate into the joint cavity. With the subsidence of the inflammation the serum may be absorbed and the joint return to its normal condition, or, becoming infected, may pass on to suppuration. The acuteness of the condition may pass off and the joint go on to a chronic inflammation. In sero-fibrinous arthritis there is in addition to the serum more or less fibrin in the joint cavity. Suppurative arthritis is an infectious condition due to the presence of bacteria. The exudate is purulent, while the synovial membrane is usually thickened, dull, and infiltrated with pus cells. Suppurative arthritis is apt to accompany or follow some one of the infectious diseases, as e.g. pyæmia, puerperal fever, pneumonia, gonorrhœa, diphtheria, and scarlet fever. Acute rheumatic arthritis or acute articular rheumatism is usually an exudative inflammation in which the exudate is serous in character and in which there is a successive involvement of different joints.

CHRONIC ARTHRITIS. The most important forms of chronic arthritis are simple chronic arthritis, arthritis deformans, rheumatic arthritis, gouty arthritis, and tubercular arthritis. In simple chronic arthritis there is a serous exudation into the joint cavity; the synovial membrane is thickened, pale, and rough. The exudate may be clear, thin, and watery, or may be cloudy and thick from the presence of minute particles of fibrin, or of lymphoid or endothelial cells. The amount of fluid is sometimes large and may result in rupture of the joint capsule or in so separating the joint surfaces that dislocations occur. In that peculiar form of chronic inflammation of the joints known as arthritis deformans there is a combination of destruction of parts of the joint with new bone formation which leads to extensive deformities. The joints most commonly involved are those of the fingers, hips, knees, and feet. In gouty arthritis there is a deposit of urates in and about the joints. These deposits take place in the cartilages and in the connective tissue and in the ligaments around the joints or even in the subcutaneous tissue. The deposit may be in the form of crystals or of whitish concretions. In tubercular arthritis the lesion is that of a tubercular inflammation modified by the nature of the tissues in which the inflammation occurs. The process may originate in the joint, but more frequently represents an extension to the joint of tubercular inflammation of the bones. Tubercular arthritis is always characterized by the growth of tubercle tissue in and about the joint. Like tubercle tissue in other parts of the body, this tissue may vary in character; and, dependent upon these variations, several types of tubercular arthritis are recognized.

In some cases the most marked feature of the tubercular process is the degeneration of the tubercle tissue and of the adjacent joint structures with the formation of ulcers. This is known as the ulcerative form of the disease. In other cases the growth of granulation tissue is very extensive and the name 'fungous' is applied to this form of the disease. In still others extensive suppuration occurs, pus being present in the joint cavity and in the surrounding tissues. This is designated suppurative tubercular arthritis. The tubercular process frequently spreads to and involves the bone, resulting in extensive changes in the bones themselves. Tubercular arthritis is usually slow in its progress. The large joints are most frequently affected. The amount of stiffness is dependent upon the extent of the process. Tubercular arthritis may occur as part of a general tubercular infection, as secondary to other tubercular lesions, or, not infrequently, is confined to a single joint with no evidence of any tubercular condition in other parts of the body.

Treatment of synovitis or arthritis depends upon the cause. In the acute serous or serofibrinous varieties, rest, alternate hot and cold affusion, extension of the limb so as to separate the surfaces, and exercise with the joint immovable, may be all that is necessary. In some cases passive motion is desirable, to break up adhesions, after prolonged rest in a splint. In some exudative, especially in suppurative cases, the joint is aspirated and the fluid drawn off. Rheumatic and gouty arthritis yields to the salicylates, alkalies, lithia salts, or other internal medicine used in rheumatism or gout. In tubercular cases the joint is opened and the tubercular nidus scooped out, or the joint is resected in some instances. Deforming arthritis usually leaves permanent deformities. Sometimes operative procedures, undertaken after the inflammation has ceased, will correct these deformities in part. Consult Marsh, *Diseases of the Joints and Spine* (London, 1895); "Joints, Diseases of," in *Encyclopædia Medica*, vol. vi. (Edinburgh, 1900).

SYNTAX. A division of philology (q.v.).

SYNTAX, FIGURES OF. Intentional deviations from the ordinary construction of words. The principal figures of syntax are as follows: Anaphora is the repetition of the same word or grammatical form at the beginning of several successive clauses, as '*without* tumult, *without* arms, *without* harm or injury the insurrection was quelled.' Anastrophe consists of a transposition of words, as *rolled the thunder* for *the thunder rolled*, or 'he travels earth *around*.' Asyndeton is the elipsis of a conjunction or connecting particle, as *veni, vidi, vici*, 'I came, I saw, I conquered.' Brachylogy is the use of a concise or pregnant mode of expression, as 'the eye of a horse is bigger than an elephant,' i.e. than (the eye of) an elephant. Chiasmus is a cross-wise arrangement of words, where the words of a second and corresponding set are stated in inverse order to those of the first set, as 'Begot by butchers, but by bishops bred.' Ellipsis is the omission of a word or words necessary for the construction of the sentence, but not essential to its meaning. By means of ellipsis conciseness and impressiveness are gained, and accordingly it prevails in proverbs, as 'More haste, less speed,' or *Ex pede Herculem*. Asyndeton is a special form of ellipsis. Enallage is the substitution of one part of speech, or of one inflectional form of a word, for another, as 'they fall *successive* and *successive* rise.' Epanastrophe is the repetition of the end of a clause at the beginning of the next, as 'The mouse ran up *the clock, the clock* struck one.' Epiphora is the repetition of a word or words at the end of successive clauses and hence is the reverse of anaphora, as *Lælius navus erat, doctus erat*. Epizeuxis is the emphatic repetition of a word, as

"*Alone, alone*, all, all *alone*,
Alone on a *wide, wide* sea."

Hendiadys or hendiadyoin is the use of two coordinate words or phrases instead of an expression in which one qualifies the other grammatically, or, in other words, it is the presentation of one idea by means of two coördinate words or phrases, as a 'couch strewn with *purple and tapestry*,' i.e. with purple tapestry, or *armis virisque*, 'with arms and men' (i.e. armed men). Hypallage is the use of one case for another, the transference of an epithet from its proper subject to another, as *Tyrrhenus tubæ clangor*, 'the Tyrrhenian clang of the trumpet,' for *Tyrrhenæ tubæ clangor*, 'the clang of the Tyrrhenian trumpet.' Hyperbaton is the transposition of words or clauses. An example of hyperbaton of clauses is *valet atque vivit*, 'he is well and alive,' for *vivit atque valet*, 'he is alive and well.' Pleonasm is the use of superfluous words, sometimes, however, arising from a desire to secure strength, as in the excessive use of the negative in conversation, especially by uneducated persons or by children. Polysyndeton is pleonasm in the use of conjunctions and is the reverse of asyndeton. Prolepsis consists in introducing a word in advance of its proper place, as 'I know *thee*, who thou art.' Prolepsis also denotes the use of an epithet before it is logically applicable, as *Scuta latentia condum*, 'they conceal their hiding (or hidden) shields.' Syllepsis is the agreement of an adjective or verb with only one of two or more subjects with which it is linked, as *rex et regina beati*. Synesis is a construction of words according to the sense conveyed by them rather than by the strict requirements of grammatical rules, as 'Philip went down to Samaria and preached Christ unto *them*.' Tmesis is the separation of the parts of a word, as in Ennius's famous line, *saxo cere comminuit brum*, or, in 'the love of God *to* us *ward*.' Zeugma is the use of a word in two or more connections, though, strictly speaking, it is appliable to only one of them.

SYNTHESIS (Lat. *synthesis*, from Gk. σύνθεσις, composition, combination, a putting together, from συντιθέναι, *syntithenai*, to combine, put together, from σύν, *syn*, together + τιθέναι, *tithenai*, to put, place). In philosophy, a term applied to the organic unity of different elements, or to the process whereby such a unity is constituted. See ANALYSIS.

SYNTHESIS, CHEMICAL. The building up of compounds from their elements. The synthetic methods of chemistry are of the greatest importance in several respects. First, they may serve to test the correctness of analyses, or even, in certain cases, replace analytical methods altogether. For example, if there were any doubt as to water being composed of eight parts of oxygen and one of hydrogen, or if water could not be analyzed at all, its exact composition could be demonstrated by causing oxygen and hydrogen to combine. In fact, it was the synthesis of water by Cavendish that first indicated its chemical nature and exact composition. (See CHEMISTRY, historical section.) Secondly, synthetic methods may, and very often do, serve to reveal the complex chemical constitution of compounds of carbon. It is explained under CARBON COMPOUNDS (q.v.) that one of the basal principles employed in determining the constitution of compounds is the assumption, itself well founded on facts, that when a given compound undergoes a moderate chemical change, the greater part of each of its molecules remains unaffected: an atom, or a group of atoms, may be replaced by another, but the linking of the remaining atoms is not changed. Thus, by the action of chlorine on acetic acid, the latter may be gradually transformed into mono-chloracetic acid, di-chloracetic acid, and tri-chloracetic acid, one, two, or three atoms of hydrogen in the molecule of acetic acid being replaced by one, two, or three atoms of chlorine; but the remaining atoms (carbon, hydrogen, and oxygen) are linked in the chloracetic acids in the same manner as in acetic acid itself. On this principle, the constitution of a compound becomes known if it is produced by synthesis from compounds of known constitution. In this connection it may be well to observe that the definition of the term synthesis must not be taken to mean the production of compounds from their elements directly. Thus, when it is said that ordinary alcohol can be produced synthetically, it does not mean that alcohol can be made by the direct union of carbon, hydrogen, and oxygen. The synthesis of alcohol consists of the following steps: carbon and hydrogen are caused to unite into acetylene (q.v.); acetylene is caused to unite with hydrogen into ethylene; ethylene is caused to unite with sulphuric acid to form ethyl-sulphuric acid; and the latter by reaction with water yields alcohol. The two compounds employed, viz. water and sulphuric acid, can also be made by starting with their elements; and so it may be said that ordinary alcohol can be made with nothing to start with but elementary substances, and this is what is meant by 'the synthesis of alcohol from its elements.' Finally, many synthetic processes have acquired great importance industrially. In 1868 Graebe and Liebermann built up by synthetical processes the substance called alizarin (q.v.), which occurs naturally in madder root, and which gives the latter its chief value as a dye-stuff. This artificial alizarin is now made on an enormous scale and has almost entirely displaced madder in dyeing and calico-printing. In 1880 Adolf Baeyer accomplished the synthesis of indigo. In 1887 Ladenburg succeeded in the synthesis of coniine, $C_8H_{17}N$, the poisonous alkaloid found in hemlock. Vanillin, the aromatic flavoring principle of the vanilla bean, has been made artificially by several chemists. Antipyrin, a substance much used in medicine, and saccharin, a substance several hundred times sweeter than sugar, are entirely the products of synthesis.

Yet while most of the known carbon compounds can be produced synthetically, some of the most important organic substances, including the proteins and many carbohydrates, still remain unsynthesized, and hence but imperfectly understood, and must still be obtained ready-made from nature. The synthetic methods employed in the preparation of a large number of carbon compounds are mentioned under the special names of those compounds. For further information, consult: Berthelot, *La synthèse chimique* (Paris, 1876; Ger, trans., Leipzig, 1877); Louise, *Synthèse d'hydrocarbures, d'acétones, d'acides, d'alcools, d'éthers et de quinones dans la série aromatique* (Paris, 1885); Lellmann, *Principien der organischen Synthese* (Berlin, 1887); and especially the excellent work of Elbs, *Die synthetischen Darstellungsmethoden der Kohlenstoff-Verbindungen* (Leipzig, 1889-91). See CHEMISTRY (historical section) and CARBON COMPOUNDS.

SYNTHETIC GEOMETRY. See GEOMETRY.

SYNTONIN (from Gk. *σύντονος*, *syntonos*, stretched tight, from *συντείνειν*, *synteinein*, to stretch tight, from *σύν*, *syn*, together + *τείνειν*, *teinein*, to stretch). A protein substance prepared by the action of dilute acids on the myosin of the muscles. The acid solution thus obtained is neutralized with alkali and the precipitated syntonin is washed with a small quantity of water. Syntonin may be converted into a globulin probably identical with myosin, by dissolving in lime-water, adding ammonium chloride, then neutralizing with acetic acid; from the solution thus obtained the globulin may be precipitated by adding the solution slowly to a large amount of distilled water. Syntonin is soluble in lime-water and in dilute solutions of sodium carbonate, but not in acid sodium phosphate. It may be classed with the so-called acid albumins, and it is distinguished from other substances of the same class of proteids by its insolubility in acid sodium phosphate solution.

SYPHAX, sī′făks (Lat., from Gk. *Σύφαξ*). A Numidian prince, who played a part in the Second Punic War, an enemy of Masinissa (q.v.).

SYPHILIS (from *Syphilus*, in the Latin poem entitled *Syphilus, sive Morbi Gallici libri tres*, by the Italian physician and poet Hieronimo Fracastoria (1483-1553), a shepherd who was afflicted with the disease by Apollo as a punishment for offering homage to his king instead of to the god; of uncertain etymology, popularly explained as from Gk. *σῦς*, *sys*, hog + *φίλος*, *philos*, loving, or, less plausibly, from *σύν*, *syn*, with + *φίλος*, *philos*, loving), or LUES, or THE POX. A specific contagious disease peculiar to the human species, chronic in its course, and generally acquired during sexual congress. It is always due to contact with a syphilitic individual or with his secretions or discharges. Descriptions of syphilis are found in the earliest writings, and traces of it are discovered in the bones of prehistoric people. Chinese accounts of it date back to the writings of Hoan-Ti, who lived about 2637 B.C. The earliest Indian record is found in the Ajwe Veda of Suśrutas, A.D. 400. The Japanese historians described the disease several thousand years ago. The Hebrews were familiar with it and it is probable that many cases called leprosy were really syphilis. Hippocrates and his successors describe it as it existed among the ancient Greeks, and Celsus speaks of it among the Romans. Although the malady is known to have existed in Europe at least as early as A.D. 1250, when Theodoric, a Dominican monk, wrote of the *malum mortuum* and recommended inunctions of mercury for its cure, its authentic and general recognition dates from a severe outbreak of the disease in the army of Charles VIII. of France during the siege of Naples. It was known as 'the Neapolitan disease' and as the *morbus Gallicus*. The disease spread with frightful rapidity and virulence, and during the following years was so widely disseminated as to be considered a form of plague. The armies of the various countries were nearly decimated, and no class of society escaped its ravages.

It was not at first recognized as a venereal disease. Its true nature appears to have been unsuspected at this time, as it was again a little previous to the time of John Hunter (q.v.), after whom was named the Hunterian or hard venereal sore. Hunter, although the greatest surgical philosopher of the eighteenth century, believed that there was but one venereal disease; that gonorrhœa, chancroid, and syphilitic chancre were merely variations of the same constitutional affection. Nearly half a century later (1831) Ricord established the identity of gonorrhœa, but failed to distinguish between chancroid and chancre. This was left to one of his pupils, Bassereau, to accomplish in 1856. The severe epidemics of the fifteenth century have never been repeated, although syphilis has since prevailed with continually decreasing virulence. This is due in part to improved personal hygiene, better understanding of the disease, and rational treatment, but also doubtless to the fact that successive generations have transmitted a certain degree of immunity to their descendants. See IMMUNITY.

The nature of the morbific principle—the *materies morbi*—of syphilis has not been determined. No specific microörganism has been discovered. Syphilis is peculiar to man. Attempts to inoculate the lower animals, with the possible exception of the monkey, have been uniformly unsuccessful. A disease somewhat resembling syphilis is observed in the horse. This is known as *maladie du coit* or equine syphilis. The negro race is believed to be more susceptible to syphilis and to have it in a severer form than the Caucasian. This may be explainable on the ground that the disease is a comparatively new one to the darker race, which has not had time to acquire immunity.

Syphilis requires for its transmission contact of the specific poison existent in the secretions or discharges of a syphilitic patient with an abraded surface of skin or with a mucous membrane. The blood is also capable of transmitting syphilis. Although the disease is as a rule acquired through sexual intercourse, *syphilis insontium*, or syphilis of the innocent, is of frequent occurrence. Physicians may become inoculated by contact with syphilitic patients, and innocent patients, on the other hand, may be infected, though rarely, by surgical and dental instruments. The saliva of syphilitic individuals contains the specific virus, and in this way inoculation may occur by kissing, and the use of pipes, spoons, cups, pencils, sticks of candy, plugs of tobacco, etc. Great care is necessary when one member of a family is affected to prevent transmission of the disease to others, since in the familiar intercourse of relations great danger exists.

After the poison of syphilis has been absorbed a certain time elapses before its effects become manifest. The abrasion heals over and there are no visible signs of danger. This is the period of incubation and lasts on the average three weeks, but may vary from ten to seventy days. At the end of this period a hard thickening appears at the site of inoculation, and this soon breaks down into a discharging sore or ulcer, the discharge from which is extremely contagious. This ulcer is situated on an indurated base and is surrounded by dense tissue, and from this fact is known as the 'hard' chancre. It is the characteristic initial lesion of syphilis, and is usually single. Another period of apparent quiescence now ensues, during which the patient is conscious of no trouble besides the sore. This is the so-called secondary incubation period, lasting from four to six weeks or perhaps longer. A characteristic set of symptoms now appears. The poison has been absorbed by the lymphatics, and upon examination the glands of the groin, axilla, neck, and in fact of the entire body will be found enlarged and indurated. A rash, somewhat resembling that of measles, breaks out upon the chest and abdomen, spreading thence to the face, extremities, and back. The rash may vary widely in character, presenting in different cases macules, papules, nodules, scabs, vesicles, or pustules. The eruption is usually superficial and fades gradually without scarring, differing in this respect from the tertiary rashes or 'late syphilides.' The rash marks the secondary stage of syphilis, and is attended with constitutional disturbances. There is slight fever, with severe nocturnal headache, pains in the bones, and general malaise. The tonsils, soft palate, and lymphatic tissues of the pharynx become swollen, and together with the gums, tongue, and inner side of the cheeks are the seat of 'mucous patches.' These are small grayish or whitish papules or shallow ulcers which discharge a most infectious material. It is through them that by far the greater number of cases of 'innocent' syphilis occur. Mucous patches are also apt to appear on the inner surface of the nose, the eyelids, about the genitals and arms. The throat is sometimes so sore and painful that eating solid food becomes impossible. Coincident with these changes in the skin and mucous membranes, several other tissues are affected. The periosteum covering the tibiæ, skull, clavicles, or sternum becomes the seat of inflammatory thickenings or nodules (see NODES), tender to the touch, but soon disappearing. The joints may swell. The hair may come off in considerable quantities, either in patches, or as a general thinning. The finger-nails are dry, brittle, and lustreless. The lymph glands continue swollen during the secondary period of the disease. They may be felt in chains along the neck and groins. A small gland just above the inside of the elbow, the epitrochlear, is almost invariably affected in syphilis and rarely in other diseases, and is therefore a valuable aid in the diagnosis of doubtful cases. Syphilitic iritis is apt to occur during this stage. It usually affects one eye at a time, and is manifested by photophobia, irregularity of the pupil from adhesions of the iris, swelling, and congestion. Later in the disease other eye tissues—the choroid and retina—may suffer seriously. Deafness may result from infiltration of the labyrinth of the ear.

The period of the active manifestations of syphilis, embracing the primary and secondary stages, extends over a year or more. In many cases all symptoms disappear, and no further evidence of the disease is felt. Patients rarely die during the second stage. After an interval of months or years, in a certain proportion of cases, the so-called 'tertiary' or third stage of syphilis sets in. Insidious degenerative changes may have been going on during the interval and now become manifest, suddenly or gradually. The characteristic lesion of this stage is the gumma, which consists of a soft elastic tumor composed of cells and fibrous tissue. Gummata may develop in any situation, skin, bones, liver, testes, kidneys, lungs, or brain, and vary in size from a hemp-seed to a walnut. They are very prone to break down and ulcerate, often resulting in great loss of tissue and hideous scars and deformities. The bony framework of the nose is frequently destroyed in this manner. The skin is apt to be the seat of a variety of deposits which tend to form sluggish ulcerations, slow in healing, and leaving scars surrounded by deeply pigmented skin. Several disorders of the nervous system are referable to syphilis; some, like hemiplegia, due to syphilitic degeneration of the arterial walls; others, like localized paralysis and convulsions, to gummata on the surface of the brain or the roots of the nerves; others again, like locomotor ataxia, are only indirectly traceable to syphilis.

Congenital syphilis shows itself in many and curious ways. Children born of parents suffering from syphilis in the first or second stage may be infected with the disease. The infection may be derived from the father alone, the mother being healthy; or from the mother alone, the father being healthy; or from both father and mother. Or the mother may acquire syphilis after conception and convey it to the child *in utero*. A curious law, to which there seems to be no exception, is that if a child inherits syphilis from its father, the mother being originally healthy, the infant may infect a wet nurse, but not its own mother, who is in some way protected against infection although she may have shown no evidences of the disease. As a rule the effect of syphilis in the parents is to cut pregnancy short, with resulting miscarriages, premature or still birth. Children may be born alive, presenting lesions of any stage of the disease. In many cases the child is at birth apparently healthy, fat and plump, but in a few weeks develops a characteristic catarrh, vulgarly termed the 'snuffles,' shows a rash, with ulcerations about the lips, genitals, and anus, and gradually wastes away until the face acquires a typical withered, shrunken, and aged appearance. Most of these children die in infancy.

The treatment and prophylaxis of syphilis is a matter of great importance, since there is no disease so widespread in its dissemination nor so potent in its influence upon the human species. Prevention depends on education in matters of sexual hygiene on the part of the public, elevation of the moral tone of the individual, and in segregation and inspection of prostitutes. The latter is practiced with good results in many cities of the Old World, and attempts are constantly making toward the same end in the United States. Great ignorance prevails among the laity as to the nature, effects, and treatment of syphilis. The only remedies of any value are mercury and iodides; but these must be given with care and under close observation, and should be combined with tonic remedies, according to the needs of the particular case. Lay medication is apt to be ineffectual, if not dangerous. Mercury may be given by inunction, fumigation, hypodermically or by the mouth. Excessive doses of mercury are likely to produce a series of very unpleasant symptoms (see MERCURY; SALIVATION), and its unwise use in the hands of the ancient practitioners has resulted in a popular distrust of the drug. As a rule mercury is of greatest value in the first stages of syphilis, a combination of iodine and mercury in the second stage, and iodine alone, usually in the form of potassium iodide, in the tertiary period. When these drugs are given skillfully and for proper periods of time, there is every reasonable prospect of a permanent cure. The time of treatment should extend over at least two and one-half years after all visible signs of the disease have disappeared and marriage should be prohibited during this interval. The general health must be watched, and exercise in the open air, full diet, and appropriate tonics administered. In the syphilis of infants mercury is best given by inunction. Children somewhat older may take mercury in the form of gray powder in small doses. The two other drugs that seem to exert almost a specific effect in children are cod-liver oil and the iodide of iron. For a fuller description of this disease, consult: Lydston, *A Textbook on the Genito-Urinary, Venereal, and Sexual Diseases* (Philadelphia, 1900); Fournier, *Syphilis and Marriage* (trans. by Morrow, New York, 1881); id., *Danger social de la Syphilis* (Paris, 1901).

SY'RA (Lat. *Syrus*, from Gk. Σῦρος). An island in the Ægean Sea, belonging to the Cyclades, and situated nearly in the centre of the group, 10 miles southwest of Tinos. Area, 31 square miles (Map: Greece, F 4). It is for the most part barren and rocky, and its natural products are insufficient to support its population. Its importance is due to its being the site of Hermopolis (q.v.), the capital of the nomarchy of the Cyclades and one of the chief commercial ports of Greece. Population of the island in 1896, 26,856.

SYR'ACUSE (Lat. *Syracusæ*, from Gk. Συράκουσαι, *Surakousai*). Anciently the most famous and powerful city of Sicily, situated on the southeastern coast of the island, 33 miles south-southeast of Catania. It was founded by a body of Corinthian settlers under Archias, one of the Bacchiadæ, near the end of the eighth century B.C. The traditional date, B.C. 734, rests on uncertain evidence. The original colonists seem at first to have occupied nothing more than the little isle of Ortygia, about one mile long and half a mile broad, which lies near the shore, but with the growth of the city the population soon passed over to the mainland. This settlement was on Achradina, at the eastern end of a high triangular plateau, which lies north of the island. To the north of the island lay the small harbor, while to the west was the great harbor, one of the best in Sicily. Later the greater part of the city was on the mainland, with which Ortygia was connected by bridges or a causeway. It consisted of Achradina, occupying the eastern end of the tableland and the adjacent coast, Tyche and Neapolis to the west of Achradina and of Epipolæ, still farther west, with the strong fort of Euryalus at the apex of the triangle. The colony rapidly rose to prosperity, and was enabled to establish sub-colonies of its own, Acræ (B.C. 664), Casmenæ (B.C. 644), and Camarina (B.C. 599). Nothing definite is known of the early political state of Syracuse, but the government seems to have been in the hands of the descendants of the Dorian colonists, who were land-owners employing a large body of serfs, seemingly Sicels. The commerce of the city brought, however, a large 'Demos' of Greeks, who about B.C. 486 expelled the 'Gamori,' or ruling oligarchy, and established a democracy. The 'Gamori' were brought back in the following year by Gelon (q.v.), tyrant of Gela, who at the same time made himself master of Syracuse. He was a great ruler, and under him the city increased in size and wealth. He was succeeded by his brother, Hiero I. (q.v.) (B.C. 478-467), whose court became a literary centre. In B.C. 465 the democracy expelled his brother and successor Thrasybulus, and for sixty years a free and popular government was enjoyed under which Syracuse prospered greatly. The Sicels were reduced, and war was waged with neighboring States, till the island attracted Athenian intervention, only closed by the Peace of Hermocrates (B.C. 424). Renewed hostilities with Segesta led to the great struggle with Athens (B.C. 415-413), in which Syracuse, aided by the Spartan Gylippus, annihilated the invading army, and contributed not a little to the outcome of the Peloponnesian War. But a new power appeared on the stage—the Carthaginian, whose conquests in Sicily toward the close of the fifth century threatened the existence of Syracuse. The successful leadership of Dionysius the Elder (q.v.) enabled him to become tyrant of the city and make it the chief power of Magna Græcia and Sicily. It was he who constructed the docks in the greater and lesser harbors, and surrounded the city with fortifications. His fierce and victorious war with Carthage (B.C. 397) raised the renown of Syracuse still higher. The reigns of Dionysius the Younger (q.v.) and of Dion (q.v.) were unsettled; but after the restoration of public liberty by Timoleon (B.C. 343) a brief season of tranquillity ensued, during which the prosperity of the city rapidly revived. Under Agathocles (q.v.), however, the despotic form of government was again established (B.C. 317). This reign was marked by a war with Carthage, including an invasion of Africa, conducted with very doubtful success. In B.C. 275 Hiero II. (q.v.) was chosen general, and about B.C. 270 he assumed the title of King. He adopted the policy of loyal alliance with Rome, and preserved the independence of the State until his death in B.C. 216. His grandson, Hieronymus, joined the Carthaginians, and in consequence the city suffered a long siege, rendered famous by the devices of Archimedes, and was finally stormed and plundered in B.C. 212 by Marcellus.

Under the Romans Syracuse slowly but steadily declined, though it always continued to be the capital and first city of Sicily, and was made a colony by Augustus. Captured, pillaged, and burned by the Saracens (878), it sank into complete decay, and is at present confined to its original limits, Ortygia, which, however, is no longer an island, but a peninsula. The population of Syracuse, which is the capital of a province of the same name, was about 32,000 in 1900. The mainland contains the chief remains of antiquity, which include a fine rock-cut theatre, a Roman amphitheatre, the great altar of Hiero II., the remains of the ancient fortifications, and the great Latomiæ or quarries. The cathedral on Ortygia has been built around an ancient Doric temple, and the columns of the temple form part of the church. The museum contains many interesting remains of the pre-Hellenic population, found in graves and caves in the neighborhood. In the southern part of the town is the famous fountain of Arethusa. Consult: Freeman, *History of Sicily* (Oxford, 1891-94); Holm, *Geschichte Siciliens* (Leipzig, 1870-98); Cavallari and Holm, *Topografia archeologica di Siracusa* (Polermo, 1883), and *Appendice* (1891).

SYRACUSE. The fourth city in population of the State of New York, and the county-seat of Onondaga County, 148 miles west of Albany and 149 miles east of Buffalo (Map: New York, D 2). It is situated at the mouth of Onondaga Valley, 35 miles south of Lake Ontario, in an amphitheatre of hills.

Syracuse has superior facilities for transportation, steam railroads entering the city from ten directions, and canals from three. The Erie Canal, which pierces the heart of the city, gives water communication with Lake Erie and the Hudson River, and thence with tidewater, and the Oswego Canal with Lake Ontario and the Saint Lawrence. All the steam railroad lines centring here are of two systems, the New York Central and Hudson River and the Lackawanna. The street railway system comprises 65 miles of track, and reaches all sections of the city. It is practically under one management.

The chief residential streets are profusely shaded, presenting a park-like appearance. Syracuse has forty-five public parks, ranging from small plots at street intersections to Burnet Park, on a hillside to the west, with more than 100 acres. Lincoln Park, a wooded height of 20 acres on the eastern border, commands the most extensive and picturesque view of the city and its surroundings. The State Fair, under the auspices of the State Agricultural Society, is permanently located in Syracuse. The State annually appropriates a large sum for the support of the fair.

The buildings of Syracuse University (q.v.) crown a commanding elevation and are among the most imposing edifices in the city. Other prominent public buildings are the city hall, the new high school, costing $400,000, the Carnegie Library, the county court-house, the Federal Government building, the State Asylum for Feeble-Minded Children, the County Orphan Asylum, the Old Ladies' Home, and the four hospitals. The Carnegie (public) Library contains 60,000 volumes, and the Court of Appeals Law Library, belonging to the State, 10,000 volumes. The city also maintains a Museum of Fine Arts. The Onondaga Historical Society is (1904) to erect a building for its own use.

Industrially, Syracuse is fourth among the cities of the State, its establishments in the census year 1900 having $31,358,000 invested capital, and a production valued at $31,948,000.

The leading manufactures are men's clothing, foundry and machine shop products, iron and steel, malt liquors, iron and steel pipe, typewriters and supplies, boots and shoes, agricultural implements, flouring and grist mill products, and furniture. The city is noted for the manufacture of typewriters. The Onondaga Salt Springs, belonging to the State, are on the borders of Onondaga Lake. The manufacture of salt, from the brine pumped out of the springs, was formerly the main industry, and is still of importance. The Solvay Process Works, manufacturing soda ash and other products, and employing some 3000 men, are just outside of the city limits on the west. With its many and varied manufactures, the city has a large wholesale and export trade.

The government is vested in a mayor and common council, elected every two years. The comptroller and treasurer are chosen at the same time. The mayor appoints the heads of departments, including the city engineer, corporation counsel, and commissioners of public works, public safety, and charities. The schools are under the control of a board of education elected on a general ticket. In maintenance and operation the city annually expends about $2,000,000, the principal items being: schools, $350,000; police department, $140,000; fire department, $180,000; and lighting, $122,000. There are 45 miles of paved streets, principally of asphalt; 100 miles of sewers; and 161 miles of water mains. The water system is under municipal ownership and control. The water is obtained from Skaneateles Lake, 18 miles distant, and is conveyed by gravity to the city through 36-inch pipes. The plant cost $5,000,000. The water department in 1902 netted the city a profit of $40,000.

Population, in 1850, 22,271; in 1860, 28,119; in 1870, 43,051; in 1880, 51,792; in 1890, 88,143; in 1900, 108,374.

The territory in which Syracuse is situated originally belonged to the Onondaga Indians. It was visited by the Jesuit missionary Father Isaac Jogues as early as 1642. By treaties in 1778 and 1795 the State bought a large tract containing the salt springs and formed from it the 'Onondaga Salt Springs Reservation,' parts of which were subsequently sold to individuals. Syracuse proper was first settled about 1805 and was of little importance until after the completion of the Erie Canal, its population in 1820 being only 250. Until named Syracuse in 1819 it was known successively as South Salina, Bogardus's Corners, Cassitt's Corners, and Milan. It was incorporated as a village in 1825, and in 1847 absorbed Salina and was chartered as a city. It was prominent for its abolitionist sentiment preceding the Civil War, and was one of the chief stations on the 'Underground Railroad' (q.v.). Here on October 1, 1849, occurred the famous 'Jerry Rescue,' which did much to crystallize abolitionist sentiment in the North and arouse the animosity of the Southern planters. In 1887 the villages of Geddes and Danforth became a part of Syracuse, and in 1892 some further additions were authorized by the Legislature. Consult Bruce, *Memorial History of Syracuse* (Syracuse, 1891).

SYRACUSE UNIVERSITY. A coeducational institution of higher learning at Syracuse, N. Y., founded in 1870. In its academic department it is a continuation of Genesee College, which was conducted at Lima, N. Y., from 1849 to 1871, and in its medical department of the Geneva Medical College (1835-72), which was in part successor of the Fairfield Medical College (1812-39). The university at present comprises five colleges: (1) the College of Liberal Arts with classical, philosophical, scientific, and library courses, leading to the degrees of B.A., Ph.B., and B.S.; (2) the College of Fine Arts, with courses in architecture, belles lettres, music, painting, art, and decorative design, as well as normal courses, leading to the bachelor's degree in architecture, letters, music, and painting; (3) the College of Medicine, with a four years' course and leading to the degree of M.D.; (4) the College of Law, with a three years' course leading to the degree of LL.B.; and (5) the College of Applied Science with courses in civil, electrical, and mining engineering, leading to the corresponding engineer's degrees. In the graduate department the master's and doctor's degrees are conferred. In addition to the regular departments, the university maintains a summer session of six weeks, and a table at the Marine Biological Laboratory at Wood's Hole, Mass. In 1902 an observing station of the United States Weather Bureau was established, in connection with which lectures are given on meteorology and climatology. The attendance in 1903, allowing for duplications, was 2009, distributed as follows: Liberal Arts, 905; Fine Arts, 706; Medicine, 140; Law, 123; Applied Science, 183; Summer School, 39. The endowment was $1,625,600, the income $765,936, and the estimated value of the college property $3,169,361, the grounds and buildings being valued at $1,169,500. The general library contained 50,842 volumes and 21,500 pamphlets.

SYR-DARYA, sēr där′yȧ, or **SIR-DARIA** (ancient *Jaxartes*). A large river of Russian Turkestan, Central Asia (Map: Asia, F 4). It rises on the north slope of the Tian Shan on the boundary of Chinese Turkestan, and flows in a general northwest direction till it enters the northeastern part of the Aral Sea after a course of over 1700 miles. Its upper course, known as the Narin, descends through a series of romantic gorges as a tumultuous mountain torrent, the fall being more than 3000 feet in less than 50 miles. It receives here numerous tributaries, but after making a long detour to the southwest around the highlands north of Ferghana, it enters upon the great arid lowland steppes, in which it receives no more affluents, but decreases in volume by evaporation. Its course becomes here very sluggish. In the rainy season it overflows the surrounding country, and its low banks are in some places lined with extensive marshes. In these lowland regions, also, a considerable amount of water is drawn from the river through numerous irrigation canals, and the discharge into the Aral Sea is less than half of the volume of the river in its middle course. The delta is marshy and shifting, and the depth on the bar is generally not more than three feet. From its lower middle course the river sends an arm across the desert to the southeastern end of the Aral Sea. This channel is now nearly dry, but probably indicates the former bed of the main river. The river is practically unnavigable in its lower course, though small Russian gunboats have crossed the bar. It is now little used as an avenue of commerce.

SYR-DARYA, or **SIR-DARIA.** A territory in the northwest of Russian Turkestan. Area, about 195,000 square miles (Map: Asia, F 4). The larger part consists of extensive steppes and deserts. The southeastern part belongs to the region of the Tian-Shan Mountains and rises in some of its snow-covered peaks to an altitude of over 15,000 feet. The flat part of the territory is very scantily watered by the Syr-Darya and Amu-Darya (qq.v.). The lakes are mostly salty. The settlements are found largely at the foot of the mountains, where the streams are utilized for irrigation. Wheat, barley, rice, and cotton are the principal products, the cotton crop being valued at over $3,500,000 in 1900. The nomadic inhabitants have extensive herds of cattle and sheep, and utilize the wool for the manufacturing of woolen products, besides exporting large quantities of the raw material to Russia and other parts of Europe. The Central Asiatic Railway is the principal means of transportation. Population, in 1897, 1,479,848, consisting principally of Kirghizes and Sarts, the Russians forming only about 4 per cent. of the total. Capital, Tashkend (q.v.).

SYR'IA. Traditionally, the region lying between the Euphrates River and the Syrian Desert on the east and the Mediterranean on the west, and between the Alma Dagh (the ancient Amanus) in the north and Egypt in the south. This region now forms a part of Asiatic Turkey (Map: Turkey in Asia, G 6). Mesopotamia, or at least a portion of it, is frequently designated as East Syria. Syria proper is now a distinct part of the Turkish Empire and is divided into six provinces—Jerusalem, Lebanon, Beirut, Aleppo, Syria, and Zor. It occupies approximately the area within the above boundaries. It, therefore, includes Palestine. Its area is 109,500 square miles.

Syria proper is traversed from north to south by a system of mountains connected with the Taurus in the north and in the south with Mount Sinai as well as with the important mountain chain of Western Arabia. The loftiest section is the Lebanon district, comprising the range of the Lebanon proper, skirting the middle part of the Mediterranean coast, and the parallel Anti-Libanus, with the valley of Cœle-Syria, between them. The Lebanon reaches an elevation of about 10,000 feet, the highest peak of the Anti-Libanus, Mount Hermon, being about 9000 feet. Syria is in general a plateau of chalk and Tertiary formation, with sandstone in evidence, and varied in places by eruptive stone. The plateau dips steeply to the Mediterranean. It is traversed north and south by the important and remarkable inter-mountain depression which, beginning at the Gulf of Akabah (of the Red Sea) in the south, extends under the name of Wadi el-Araba to the Dead Sea, thence north through the region of the Jordan to its sources, and beyond this through the Lebanon region, becoming narrower but widening again farther north, and finally reaches the sea at Antioch. This depression is over 400 miles long, and generally averages about 12 miles in width. It divides Syria (except in the north and northeast) into two long comparatively narrow stretches of tableland—the eastern and western. For the full description of the western, adjacent to the Mediterranean, see PALESTINE. The eastern strip merges into the Syrian desert, and is sandy and bare, its elevated levels being dominated by the basaltic Jebel Hauran (6000 feet) situated east of Lake Tiberias. The Nahr-el-Asi (ancient Orontes), the Litany (Leontes), and many short streams flow into the sea on the west. The Jordan is the main feeder of the Dead Sea, whose surface is nearly 1300 feet below that of the ocean. The principal affluents of the Jordan are the Yarmuk and Jabbok. In the east are a number of streams that die in the sands of the desert. There are several lakes besides the Dead Sea, the best known being Lake Tiberias (Gennesaret). The climate is that of the Mediterranean basin. At Beirut the mean annual temperature is 68° F.; at Jerusalem, 62.6° F. The rainfall is scanty, being heaviest in the north and west. The springs are short, the summers long, dry, and hot. Snow falls in winter and there is often almost severe cold. The flora is that of the Mediterranean region, the olive being prominent. Forests of conifers clothe portions of the western slope of the Lebanon. But small remnants survive of the famous cedars of Lebanon. In the east and south, however, the plant growth partakes of the scanty desert species. In the extreme north the date palm thrives. Of the wild fauna the lion has nearly disappeared, hyenas exist in some mountainous regions, and jackals abound. Gazelles are still met with. There are several species of venomous serpents, including the cobra. Formerly a land rich and highly productive, Syria is in modern times of very inferior agricultural and industrial significance. Fruits, grain, and vegetables are grown. The principal ports are Beirut and Jaffa. The Syrian Railroad has afforded an impetus to trade since 1895. The population in 1900 was 3,317,600. It is mainly Semitic in race. Mohammedans predominate, and Arabic is generally spoken. Bedouins and Arabs roam in the south and east. The Turks are few. The Christian population is considerable, the Maronites of the Lebanon region alone numbering over 100,000. There are many Jews, especially in Palestine, where they form agricultural communities. The Mohammedan sect of the Druses (in the Lebanon region and the Hauran) has been prominent through its fierce hatred of the Maronites. The chief towns are Damascus, Aleppo, Beirut, and Jerusalem.

HISTORY. About B.C. 1500 the kings of Egypt brought the greater part of Syria under their dominion. Their advance was opposed by the Hittites (q.v.), who were long dominant in northern Syria, and who spread also into the southern part of the country. The non-Semitic people were gradually amalgamated with the Semites among whom they dwelt, their speech becoming Semitic. About B.C. 1000 the Phœnicians were at the height of their power and prosperity and the Hebrew kingdom was firmly established. By this time the Hittites, whose State had become disintegrated into a number of principalities, had begun to feel the power of Assyria. Under David and Solomon the Israelites extended their sway over a great part of Syria, subduing the southern Hittites, the Amorites, and other peoples and subjecting Damascus and other important cities. On the southern part of the coast the Philistine cities were united in a powerful confederacy. After the disruption of the Hebrew realm Damascus became the seat of a powerful independent kingdom. This was destroyed in the second half of the eighth century B.C. by the Assyrians, who imposed their yoke upon the Philistine cities, and put an end to the kingdom of Israel, while the Phœnician cities paid them tribute. About this time the last of the Hittite principalities were swallowed up by the same enemy. At the beginning of the sixth century B.C. Syria came under the rule of Babylon, which was succeeded in B.C. 538 by that of Persia. In B.C. 333-332 Alexander of Macedon established his sway. At the close of the century Upper Syria was appropriated by Seleucus, one of Alexander's generals, who founded Antioch as the seat of his kingdom. The Ptolemies and the Seleucidæ (q.v.) contended for the possession of the rest of the country, which finally passed to the latter, whose realm, which embraced a large part of Western Asia, came to be known as the Kingdom of Syria. A number of Greek cities were founded by this dynasty. In B.C. 167-141 Palestine threw off the yoke of the Seleucidæ. In B.C. 64 Syria was made a Roman province and in the following year Judea was made tributary to the Romans.

In the third century A.D. the Kingdom of Palmyra, on the eastern borders of Syria, enjoyed a short-lived splendor. After the close of the fourth century Syria formed part of the Byzantine Empire, from which it was wrested in 634-36 by the Saracens. In 661 Damascus became the seat of the caliphs, but about a century later it was supplanted by Bagdad. In the second half of the eleventh century the Seljuks occupied the country. In 1099 the Crusaders took Jerusalem, which was made the capital of a kingdom. At the same time was founded the Principality of Antioch. In the middle of the next century the Christian power in Syra was shattered by the assaults of Sultan Nureddin, whose seat was at Aleppo. In 1174-87 Saladin, Sultan of Egypt, wrested Syria from the successors of Nureddin and overthrew the Kingdom of Jerusalem. In the thirteenth century Khwaresmians and Mongols swept over Syria. In 1291 Acre, the last stronghold of the Christians on the Syrian coast, was taken by the Mameluke ruler of Egypt and Syria. In 1516 Syria was conquered by the Ottoman Turks. In 1831-32 Mehemet Ali of Egypt made himself master of the country, but was forced to relinquish it to the Sultan in 1841. In 1860 there were massacres of the Maronites by the Druses and a frightful slaughter of Christians at Damascus.

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SYRIAC LANGUAGE AND LITERATURE. The Aramaic dialect anciently spoken in Edessa and Western Mesopotamia (see ARAMAIC), in which many literary productions have been preserved. This name is derived from the Greek Συρία, which is either an abbreviation of 'Ασσυρία, or a survival of the old designation *Suri* found in cuneiform inscriptions. Before the introduction of Christianity the natives of Mesopotamia called themselves Aramæans. Subsequently this term was used especially for the pagans, while the Christians were designated by Greeks and Persians as 'Syrians' and seem to some extent to have adopted the name themselves. The Syriac language shows in its earliest documents a remarkably fixed type, and must therefore have been long spoken in Mesopotamia. Characteristic of this dialect are the *n* of the preformative in the imperfect of the verb and the loss of the determinative force of the emphatic ending *a* in the noun.

There was probably an extensive pagan literature both in Edessa and in Harran; but no specimen of it has yet been recovered. The earliest document in this language is the translation of the Old Testament, which was probably made by Jews. It may belong to the first Christian century, though it was subsequently revised in some books with the aid of the Greek version. Two recensions of the oldest translation of the New Testament have been preserved in part in a Sinaitic manuscript of the Gospels and a Nitrian manuscript published by Cureton, containing fragments of the Gospels. This latter version may have been made in the middle of the second century. A compilation of the four Gospels, called the *Diatessaron,* was made by Tatian (q.v.), or translated by him from a Greek work of the same kind about 180. This *Diatessaron* is lost and is known chiefly through Ephraem Syrus (q.v.); the Arabic translation of this work published by Ciasca seems to belong to the eleventh century, and has manifestly been made conformable to the standard text. This compilation of the Gospels, after being long in use in the Mesopotamian churches, was finally supplanted by the Syriac Vulgate or *Peshitto* (see BIBLE, heading *Versions*), apparently in the fifth century. The shorter Catholic Epistles (II. Peter, II. and III. John, Jude) and the Apocalypse, which were not found in the old Syriac Bible, were later supplied from the versions of Philoxenus (508) and Thomas of Heraclea (616). In addition to the canonical books, Ecclesiasticus (q.v.) was also translated from the Hebrew and the other Apocrypha, including IV. Maccabees and a part of Josephus's Jewish War called V. Maccabees, were translated from the Greek, as well as several Pseudepigrapha, such as the Apocalypses of Baruch and Ezra. A translation of the Greek text adopted by Origen called the Syro-Hexaplaric version was made by Paul of Tella in 617; and a revision of the New Testament was made by Jacob of Edessa at the end of the seventeenth century.

As early as any of the New Testament translations are the works of Bardesanes, the Gnostic (q.v.), who flourished in the second century and was a poet, philosopher, astronomer, and historian. His *Dialogue on Destiny* is extant; his 150 hymns are lost. A number of Gnostic hymns have, however, been preserved in the *Acts of Thomas*, written in the third century. In the fourth century Aphraates (q.v.) wrote his homilies, and the famous Ephraem (died 373) his commentaries on the Bible and on Tatian's *Diatessaron*, his exegetical discourses, and his hymns. Among the disciples of Ephraem were such writers as Aba. Zenobius, Balai, and Cyrillona. The most flourishing period of Syriac literature extended from c.400 to the Arabic conquest. In the course of the fifth century the great schism occurred which divided the Mesopotamian Church between Nestorians and Monophysites (qq.v.) and severed both from the Catholic Church. Much of the early Nestorian literature is lost; but some works of Hamana (died 607), Babai (died 610), and Elias of Merv remain. Among the Monophysites, Philoxenus of Mabug, Jacob of Serug (died 521), Jacob Baradæus, after whom the party was called 'Jacobites,' and Jacob of Edessa (died 708) were perhaps the most influential writers. In addition to the strictly theological works, there grew up an historical literature, including the *Chronicle of Edessa*, the very excellent chronicle of Dionysius of Tell Mahre, many histories dealing exclusively with the Church, such as that of John of Ephesus (sixth century), martyrologies and legends such as those of King Abgar and the Apostle Addai. Not only theological works, such as the *Clementine Recognitions*, the Apology of Aristides, the ecclesiastical history of Eusebius, and the commenatries of Theodore of Mopsuestia, were translated from the Greek, but also secular works like those of Homer, Æsop, Aristotle, Galen, and Hippocrates. Mana, Moses, Probus, Sergius, and Jacob of Edessa were especially active as translators. After the Moslem conquest the Arabic language gradually gained on the vernacular. But Syriac still continued to be spoken in many localities and to be cultivated as a learned language. The use of two languages led to philological studies, and many works on grammar and lexicography were written. Among these may be mentioned the grammar of Elias of Tirhan and the lexicons composed by Bar Ali Honain (died 873) and Bar Bahlul (963). Many books were translated from the Arabic in the tenth century, such as the *Kalilah wa Dimnah*, *Sindbad*, and Pseudo-Callisthenes's life of Alexander. Classical Syriac was written with great elegance by the Sabian Thabit ben Korrah (died 901) and his sons. (See SABIANS.) With the decline of the caliphate, the Syriac gained a more vigorous life, and numerous theological writers used it. The most important of these are Abulfaraj Gregory, called Bar Ebhraya or Bar-Hebræus (1226-86), who wrote a grammar, a commentary on the Bible, a history of the world, a commentary on Galen, translations from the Greek, essays on ethics and religion, astronomy, and other physical sciences (see BAR-HEBRÆUS); and Abhdisho (died 1318), a learned Nestorian who wrote the history of Syriac literature and many other works. After the fourteenth century there were no noteworthy writers.

The system of writing used by the Edessene Christians before the fifth century was a modification of the Aramaic script then in use in Syria, resembling most the Palmyrene. From the tenth century this writing was known as *Estrangelo* or 'the writing of the gospel.' The Nestorians continued to use it, while the Jacobites adopted for distinction a cursive form. At first vowels were not indicated at all. Subsequently vowel-letters were used. But in the seventh century the Nestorians began to employ vowel points, and about 700 the Jacobites adopted some of the Greek vowels, which they wrote above or below the consonants to show the proper pronunciation.

The modern Syriac spoken with dialectical differences by the Nestorians in the West, those of Lake Urumiah, in the Kurdish mountains, and on the plain of Mosul, and by the Jacobites of Tur Abdin, exhibits, in addition to numerous Turkish, Kurdish, and Arabic loan-words, certain peculiarities rendering it probable that it is a descendant of the Aramaic, once spoken in Assyria, rather than of the classical Edessene. In the dialect of Urumiah a considerable literature has been developed by American missionaries.

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SYRIAC VERSIONS. See BIBLE.

SYRINGA (Neo-Lat., from Gk. *σῦριγξ*, *syrinx*, pipe, tube; name first given to the mock-orange, because its stems, after removal of the pith, were used as pipes). A genus of plants of the natural order Oleaceæ. The English name of the genus is lilac (q.v.). Syringa is also a name very commonly applied to the mock-orange or Philadelphus.

SYRINGOMYE'LIA (Neo-Lat., from Gk. *σῦριγξ*, *syrinx*, a pipe + *μυελός*, *myelos*, marrow). A disease of the spinal cord characterized by the formation of cavities and the growth of new tissue resembling glioma in its central parts. Its cause is not accurately known, though it may depend upon anomalous embryonic development and it apparently follows infectious diseases as well as wounds upon the hands. It is not caused by alcohol or syphilis, nor is it hereditary. It often appears after childbirth. It is rare, as probably less than 300 cases have been reported. The disease appears between the eleventh and the thirtieth year, and is more frequent in males than in females, in the proportion of 2.2 to 1. The symptoms are pains in neck and arms with reduced sensation in the hands, atrophy of the muscles of the hands, arms, and shoulders, with twitchings, followed by the same wasting in muscles of back, thighs, and legs. The hands become clawed, the feet deformed; and the spine becomes curved, in extreme cases. Loss of sensation to temperature and pain, while not to touch, occurs, and is considered pathognomonic. Eruptions and ulcerations appear on hands and face, and many other changes occur. The disease runs for from five to twenty years, and the prognosis for checking it is not good. It is incurable. Rest and general tonic treatment, hydrotherapy, and massage, as well as silver and arsenic are among the therapeutic measures tried. Consult: Dana, *Text-book of Nervous Diseases* (New York, 1902).

SYR'INGOP'ORA (Neo-Lat. nom. pl., from Gk. σῦριγξ, *syrinx*, pipe, tube + πόρος, *poros*, passage, pore). A genus of fossil tabulate corals in which the coral mass consists of a bundle of slender cylindrical tubes that rise from a common base and that are connected at intervals by slender hollow horizontal processes or plates. The genus contains many species, and ranges through the Upper Silurian, Devonian, and Lower Carboniferous formations.

SYRINX (Neo-Lat., from Gk. σῦριγξ, pipe, tube). A simple instrument of reeds, probably the most ancient of all musical instruments. It is thought to be identical with the Hebrew *Ugab*, mentioned in the Bible. It is made in China with twelve tubes of bamboo, and in Peru it is made of cane or soapstone. It is seen in ancient manuscripts and bas-reliefs. The Greeks supposed it to have been made by the god Pan out of reeds, and hence its secondary name, Pandean pipes. It was formed of seven, eight, or nine short hollow reeds cut in graduated lengths, so as to produce a musical scale, and then fixed together by wax. The lower ends of the reeds were closed and the upper ones open and on a level, so that the lips could easily pass from one pipe to another.

SYRLIN, zēr'lēn, JÖRG, the Elder (?-1491). A famous German wood-carver and sculptor, active at Ulm from about 1458, one of the most remarkable masters of his time. The three-seated stool of 1468 at the entrance of the choir in the cathedral, and his chief production, the stately double row of "Choir Stalls" (1469-74) there, the first of their kind in richness and artistic merit, exhibit a plastic beauty not even remotely equaled by any contemporary effort. His earliest known work is a "Singing Desk" (1458) in the Museum of Antiquities, and as an isolated production in stone is to be mentioned the fountain in the market square, known as the "Fischkasten" (1482). His son and pupil, JÖRG, the Younger (1455-c.1521), was a worthy inheritor of his art and executed the "Choir Stalls" (1493) and the "Celebrants' Stool" (1496), in the church at Blaubeuren, also a similar stool (1505) in the Neithardt Chapel of Ulm Cathedral, and in the latter the sounding-board of the pulpit (1510), more important architecturally than as a work of sculpture.

SYRPHUS FLY (Neo-Lat., from Gk. σύρφος, *syrphos*, σέρφος, *serphos*, gnat). A fly of the family Syrphidæ, many species of which are of much economic importance. More than 300 species occur in the United States. They are stout-bodied flies and vary greatly in color. Many species closely resemble bees and wasps. Nearly all of them are flower flies, and carry pollen from one plant to another. Very many syrphus flies in the larval state feed upon plant-lice and other soft-bodied insects. Others live in decaying wood or in manure or soft mud, in the sap of trees or in the stems of plants, or in fungi, or as guests of ants and bumblebees. The rat-tailed maggot (q.v.) is an example of the forms found in soft mud or in manure. Those which live in ants' nests belong to the genus Microdon and are among the strangest insect larvæ known. Those which live in the nests of bumblebees belong to the genus Volucella, and the adult flies resemble bumblebees. Consult Williston, *Synopsis of the North American Syrphidae*, Bulletin 31, United States National Museum (Washington, 1886).

SYR'TIS MA'JOR and **SYR'TIS MI'NOR.** The ancient names of two gulfs on the north coast of Africa. See SIDRA, GULF OF; and CABES, GULF OF.

SYSTOLE. See HEART.

SYSTYLE. An arrangement of classic columns in which the intercolumniation is very narrow, being equal to only twice the diameter of the column.

SYZRAN, sĭz-rän'y'. A river port in the Government of Simbirsk, Russia, on the River Syzran, near the right bank of the Volga (Map: Russia, G 4). It lies in a low district, submerged during the annual rise of the Volga. The town is known as a grain exporting centre and also manufactures leather, flour, etc. Population, in 1897, 32,377.

SZABADKA, sŏ'bŏt-kō. A town of Hungary. See THERESIOPEL.

SZABÓ, sŏ'bō, JÓZSEF (1822-94). An Hungarian geologist, born in Kalocsa, near Pesth, and educated in Pesth, where he studied law, and at the School of Mines in Schemnitz. He became professor in the higher industrial school at Pesth in 1855, and in 1860 was appointed professor of mineralogy and geology in the university. Szabo wrote, mostly in Hungarian, on geology, and in 1883 published a valuable textbook of that science, with especial stress on petrography.

SZARVAS, sŏr'vŏsh. A town of Hungary, in the county of Békés, 85 miles southeast of Budapest, on the left bank of the Körös (Map: Hungary, G 3). Population, in 1900, 25,773.

SZATMÁR-NÉMETI, sŏt'mär-nā'mĕ-tē. A town in the County of Szatmár, Hungary, 63 miles northeast of Debreczin, on the right bank of the Szamos (Map: Hungary, H 3). It contains a beautiful cathedral. There are manufactures of pottery, linen, and plum brandy. Szatmár-Németi was founded by the Germans in the eleventh century. Its population in 1890 was 21,218; in 1900, 26,881, chiefly Magyars.

SZÉCHÉNYI, sā'chā-nyē, BÉLA, Count (1837—). An Hungarian traveler and explorer, born in Budapest. He traveled in North America in 1863 and in Algeria in 1865, and described the former trip in *Amerikai útam* (1865). In 1877-80 he explored the East Indies, Japan, China, Java, Borneo, Western Mongolia, and the frontiers of Tibet. An Hungarian description of this expedition was published in 1890 and a German version, *Die wissenschaftlichen Ergebnisse der*

Reise des Grafen Béla Széchenyi in Ostasien, in 1893.

SZÉCHÉNYI, ISTVÁN (Stephen), Count (1792-1860). An Hungarian statesman, born in Vienna. As a youth he served in the Austrian Army in the wars with Napoleon, and afterwards traveled through Europe. In 1825 he took his seat in the Upper House of the Hungarian Parliament. As a leader of the National Party he endowed the Hungarian Academy of Science, a conservatory of music, and a theatre, and founded a society for effecting improvements in horse-breeding. To his exertions were due the erection of the great suspension bridge between Pesth and Buda, the removal of obstacles to navigation at the Iron Gate, the regulation of the Theiss, and the introduction of steamboats on the Danube. In 1847-48 he at first opposed the extreme measures of Kossuth, but later fell in with the popular movement and became a member of the Ministry under Batthyányi and Kossuth in 1848. Becoming insane soon after, he was taken to the asylum at Döbling, near Vienna, where, though he partly regained his health, he spent his remaining years. In March, 1860, his papers were searched by the police, and in a fit of excitement he shot himself. Consult Lónyay, *Graf Stephan Széchenyi und seine hinterassenen Schriften* (Pesth, 1875).

SZE-CHUEN, or **SZE-CHUAN,** sĕ′chwän′ (Chin., Four Rivers). The largest of the eighteen provinces of China. It is bounded on the north by Kan-su and Shen-si, on the east by Hu-peh, on the south by Kwei-chow and Yun-nan, and on the west by Tibet (Map: China, B 5). Area, 220,000 square miles. With the exception of the elevated plain of Ching-tu (q.v.), 2400 square miles in area, and 1800 feet above the level of the sea, the province is entirely covered with mountains, many of them rising above the snow line. The eastern portion, east of the Min River, may be regarded as Sze-chuen proper, the western and more inaccessible part being inhabited chiefly by non-Chinese tribes—Man-tse, Si-fan, and Lolos (q.v.). The province is well watered by the Yang-tse and its numerous tributaries—the Yalung, the Min, the T'o, and the Kia-ling from the north, and the Ta-kwan, the Nan-kwang, the Yung-ning, the Chih-shui, the K'i-kiang, and the Kung-t'an from the south. Nearly all of these are obstructed in parts by rapids, but they nevertheless form most valuable avenues of communication in an otherwise difficult country. The climate is not extreme, but changes are sudden. From October to February the country is generally enveloped in deep fogs and the sun is seldom seen. The rainy season begins in May and is at its height in July.

Sze-chuen is rich in minerals, especially in coal and iron, which occur together. Coal is found everywhere, but the seams are thin and the quality does not compare with the coal of Kan-su, Shan-si, Ho-nan, or even Hu-nan. It has not as yet been mined by modern methods. Copper, silver, gold, and lead occur in small quantities. Notwithstanding the mountainous character of the country, agriculture has been brought to a high state of perfection, and the province produces everything needed for home consumption except cotton and wool. The hillsides in many places have been terraced with much industry and skill. Wheat is a winter crop, but it has been largely encroached on by poppy culture, which is more remunerative. Rice, the staple article of diet, is very extensively grown. Other crops are barley, maize, millet, buckwheat, pulse, potatoes, tobacco of very fine quality, tea, sugar, indigo, and sesamum, rape and other oil-producing plants. Hemp is the only textile plant grown, except that used in the manufacture of grass-cloth.

Other important products are silk, white wax, vegetable tallow, tung-oil, rhubarb, medicines, musk, and hides. Wool is imported from Shen-si, Tibet, Kokonor, and other regions. Cotton, both raw and manufactured, comes chiefly from Hu-peh. Cotton spinning and weaving are important home industries, and the cloth is exported to Tibet and Yun-nan, along with tea and silk. Iron manufacture from the ores of the province is one of the most extensive industries. Enormous quantities of salt are obtained from brine-springs from 500 to 2000 or more feet in depth, the brine being evaporated by natural gas or coal. It is a Government monopoly, and brings in a large revenue to both the provincial and the Imperial governments. Large numbers of people are also employed in paper-making and the production of fans, umbrellas, crape, gauze, and beautiful silk embroideries, etc.

Sze-chuen can be entered from the east by only two routes: either overland through Shan-si and Shen-si, along difficult mountain paths infested by robbers, or up the Yang-tse by steam to I-chang (q.v.) and thence by native, specially constructed, junks which are hauled slowly and at great expense and risk up formidable rapids and through deep gorges. Within the province itself there are many pack-roads paved with flags, and with steps cut in the rocks at very steep places. For travelers sedans and ponies are used, and for goods coolie carriers. Capital, Ching-tu (q.v.), where resides the Governor-General, who also has charge of East Tibet (q.v.). The only port opened to foreign trade is Ch'ung-k'ing (q.v.). Population, about 70,000,000. The province buys more foreign goods than any other. See Baber, *Travels and Researches in Western China* (London, 1882); Hosie, *Three Years in Western China* (London and New York, 1890); and Bishop, *The Yang-tse Valley and Beyond* (London and New York, 1901).

SZEGEDIN, sĕg′ĕd-ĕn (Hung. *Szeged*). A royal free city of Hungary, next in size to Budapest, in the County of Csongrád, on the right bank of the Theiss a little below the confluence of the Maros, 96 miles southeast of Budapest (Map: Hungary, G 3). The town has been largely and handsomely rebuilt since the terrible inundation of 1879, when 2000 persons lost their lives. A high dike has been constructed to protect the city from another such disaster. The modern streets are wide and there are several attractive squares. Szegedin has a fine rococo town hall, a Gothic cathedral, a handsome theatre, and other stately edifices. The Franciscan monastery contains an excellent library (80,000 volumes) and a museum of antiquities. There are also a Minorite and a Piarist monastery. The principal manufactures are paper, salt, cloth, and the famous Szegedin soap. As the commercial centre of the great Hungarian Alföld it has a brisk trade in grain, wool, tobacco, lumber, etc., both by rail and river, the Theiss being lined with quays. Boat-building is extensively carried on. New Szegedin lies on the opposite bank. Szegedin was fortified by the Turks, who held it from 1526 for 160 years. Population, in 1890, 87,410; in 1900, 102,991, mostly Catholic Magyars.

SZEGSZÁRD, sĕk′särd. A town of Hungary, capital of the County of Tolna, on the right bank of the Danube, 84 miles south of Budapest (Map: Hungary, F 3). The town produces an exceptionally fine red wine. Population, in 1900, 13,895, mostly Catholic Magyars.

SZEKLERS. See TRANSYLVANIA.

SZÉLL, sāl, KOLOMAN (1843—). An Hungarian statesman, born in Gosstony, and educated at Budapest and Vienna. Entering local politics in 1867 and Parliament the next year, he so distinguished himself by his financial interpellations that in 1875 he was offered the portfolio of finance by Wenckheim. He retained it until 1878, when he retired because of his disapproval of the Bosnian occupation. He then became president of a great financial institution in Budapest, refusing every inducement to reënter the Cabinet until the fall of Bánffy in 1899, when he rose to the head of the Government as Minister of the Interior and president of the Council. He retired in June, 1903.

SZE-MA KWANG, sĕ′mä′kwäng′, or **SSŬ-MA KUANG** (1019-86). A distinguished Chinese statesman and historian, born in Hia, a district of Ho-nan. At nineteen he entered the public service, rose rapidly, became president of the Hanlin Yuan (q.v.), and a Minister of State. He is specially noted for the persistency and the vigor of his opposition to Wang An-shih (q.v.), 'the innovator.' Failing to induce the Emperor to dismiss Wang and repeal his reform, Sze-ma retired to private life, and devoted himself to literature and especially to the preparation of his *History of China* (B.C. 403 to A.D. 960), in 294 books, called the *Comprehensive Mirror for the Aid of Those Who Govern.* In 1085, on the death of the Emperor, he was taken into favor by the Empress Regent, was reinstated in office, and at once set about the repeal of the reforms of Wang, but he died in the following year. Besides the *Comprehensive Mirror,* he was the author of the *Ki-ku-lu,* or Investigations into Antiquity, in 20 books, which extends to A.D. 1067, an etymological dictionary, and many miscellaneous essays. See Rémusat, *Nouveaux mélanges Asiatiques* (2 vols., Paris, 1829), and Giles, *Chinese Literature* (New York, 1901).

SZE-MAO, sĕ′mou′. A town in the southwestern part of the Province of Yun-nan, China, situated 185 miles southwest by west of Yun-nan-fu. The trade of Sze-mao is almost entirely with Burma and Tibet. The town was opened to foreign residence and trade in 1897. Population, estimated at 14,000.

SZE-MA TS'IEN, sĕ′mä′ chĕn′, or **SSŬ-MA CH'IEN** (c.145-c.85 B.C.). The first great historian of China. He was born in Lung-mŭn, in Ho-nan, made great progress in learning while still a child, and at twenty began a great tour of the Empire. On his return he entered the public service, and was commissioned to inspect and report upon the regions now known as Sze-chuen and Yun-nan, then recently conquered. On the death of his father in B.C. 110 he succeeded him as historiographer, and entered upon the task of completing the great historical work which had been begun by his father. This he accomplished B.C. 91, but the work did not appear until some years after his death. It is entitled *Shih Ki,* or "Historical Records," and in 130 books gives the history of the country from B.C. 2697 to B.C. 104. For specimens of his style, see Giles, *Chinese Literature* (New York, 1901).

SZENTES, sĕn′tĕsh. A market-town of the County of Csongrád, Hungary, on a tributary of the Theiss, 28 miles north by east of Szegedin (Map: Hungary, G 3). The town formerly suffered from inundations, but is now protected by a number of large dikes. Agriculture and fishing are the principal pursuits, and wine is exported. Population, in 1890, 30,797; in 1900, 31,308, mostly Lutheran Magyars.

SZIGLIGETI, sĭg′lĭ-gȧ′tĭ, EDUARD (1814-78). An Hungarian dramatist, whose real name was Joseph Szatmáry. Born at Grosswardein, he studied engineering, but in 1834 went on the stage at Buda and in 1837 became secretary and stage manager of the newly erected national theatre at Pest. Of his numerous dramas several were crowned with prizes by the Academy, among them *Rózsa, Vándor szinészek* (Itinerant Actors), *Béldi Pál, Laczfi Imre,* and *Béla IV.*, but the greatest success attended his popular plays drawn from national life, many of which found their way also to the German stage, notably *The Deserter, Two Pistols, The Csikós, The Foundling,* and others. Besides his excellent *A dráma és válfajai* (The Drama and its Species, 1874), he published biographies of Hungarian actors (1878). He was a member of the Academy and of the Kisfaludy Society, and, since 1874, director of the National Theatre.

SZILÁGYI, sė̂′läd-yė̂, SÁNDOR (1827-99). An Hungarian historian, born at Klausenburg, and educated there and at Marosyásárhely. In 1867 he was appointed secretary in the Ministry of Public Instruction, and in 1879 was made librarian of the University Library at Budapest. He founded the Hungarian Historical Society, of which he was secretary until his death, and of whose organ, *Századok* ("The Centuries"), he was editor. He was the moving spirit in the revival of historical interest which took place in Hungary after 1849, published many monographs himself, and edited or projected works of importance. Of these may be mentioned the *Monumenta Comitialia Regni Transylvaniæ,* in twenty-one volumes; a collection of papers from Hungaro-Turkish sources in nine volumes; and a national history in ten volumes (1895-98).

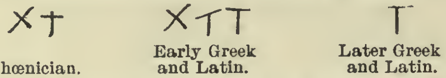
SZOLNOK, sôl′nôk. A town of Hungary, the capital of the County of Jazygia—Great Cumania—Szolnok, 57 miles southeast of Budapest, on the right bank of the Theiss, at the mouth of the Zagyva (Map: Hungary, G 3). On March 5, 1849, the Austrian General Karger was defeated here by the Hungarians. Population, in 1890, 21,094; in 1900, 25,379, mostly Catholic Magyars.

SZUJSKI, shwĭs′kĭ, JÓZEF (1835-83). A Polish historian and dramatist, born at Tarnov, Galicia. He studied in Cracow and Vienna, became associated with Tarnovski in the establishment and redaction of the *Przeglad Polski* in

1867 and was appointed professor of Polish history at the University of Cracow in 1869, subsequently also secretary-general of the Academy of Sciences. In 1881 he was called to a seat in the Austrian House of Lords. He published many mediæval documents and chronicles bearing upon Polish history and in his excellent *Dzieje Polski* (1862-66; new ed. 1896) presented a history of Poland based upon the most recent researches. In German he wrote *Die Polen und Ruthenen in Galizien* (1882). Besides poems and tales he produced a number of historical dramas, remarkable for spirited characterization, such as *Halszka z Ostroga* (1858); *Jerzy Lubomirski* (1863); *Maryna Mniszchovna* (1876); *Jadviga*, *Kopernikus*, and others.

T

T The twentieth letter of the English alphabet. Its Semitic original *tau* the last letter of the Phœnician alphabet, meant cross, and was so called on account of the early shape of the character. The various forms which it has assumed are as follows:



As a phonetic character *t* is the voiceless alveolar explosive. To form this sound the tongue-tip is brought into contact with the sockets of the upper front teeth, and the breath is made to escape explosively.

English *t* represents in general an original Indo-Germanic *d*, as Sanskrit *dam*, 'to tame,' Greek *δαμάω*, Latin *domare*, English *tame*. It may also represent an original Indo-Germanic *t*, as in Sanskrit *stigh*, 'to step,' Greek *στείχω*, Anglo-Saxon *stīgan*, English *stile*. An excrescent *t* occurs especially between *s* and *r*, as a glide-sound between the median and lateral positions of the tongue, as in English *stream*, compared with Sanskrit *sravas*. An inorganic *t* has also been developed in some modern English words after a final *s*, as *amidst* from *amiddes*, *amongst* from *amonges*, *whilst* from *whiles*, and in the dialectic *oncet*, *twicet*.

The digraph *th* represents both the voiced and the voiceless spirant, as *then*, *thorough*. It may be pronounced *t*, as *Thames*, *thyme*, as may also the *-ed* of the preterite and perfect participle, as *dressed*. In several words *t* is silent, as in *chasten*, *moisten*, *christen*, *castle*, *gristle*, *hustle*. In *action*, *nation*, *portion*, *ti* has the sound of *-sh*.

As a mediæval numeral T = 160; $\bar{\bar{\text{T}}}$ = 160,000. In music *t* = tenor, tempo.

TAAFFE, tä'fe, Eduard, Count (1833-95). An Austrian statesman of Irish extraction. He was born at Prague, and was educated in companionship with the Emperor Francis Joseph. He entered the public service in 1857 and was appointed Governor of Salzburg in 1863. He was Minister of the Interior in 1867 and Minister of National Defense in 1868, becoming president of the Council after Prince Auersperg's retirement in September, 1868. He resigned in January, 1870, but three months later became again Minister of the Interior and remained in office until February, 1871, when he was made Governor of Tyrol and Vorarlberg. In February, 1879, Taaffe was once more appointed Minister of the Interior and in August he formed a new Cabinet, over which he presided until 1893. The distinguishing feature of his administration was the greater weight given to the Slav nationalities, especially the Czechs and the Poles, as well as to the clericals, in the public affairs of the Empire and his vain effort to conciliate the divergent nationalities comprised in the Empire. He finally attempted to sustain his Government by a radical electoral reform measure, which displeased all parties, and was compelled to retire in November, 1893. He died November 29, 1895.

TAAL, täl. A town of Luzon, Philippines, in the Province of Batangas. It is on the Transipit River near its fall into the Gulf of Balayán, and is connected by a bridge with Lemeri on the opposite bank (Map: Luzon, E 11). It carries on a large trade in coffee, sugar, and cotton goods in addition to the local industries of agriculture, fishing, and stock-raising. The old town of Taal was situated on the bank of the lake of the same name near the volcano Taal (q.v.), and was destroyed in 1754. Population, in 1897, 22,000, now estimated at about 33,400, of whom a considerable number are of Chinese origin.

TAAL, or **BOMBÓN**. A volcano in Central Luzon, Philippines. It forms a small island in the middle of Lake Taal, which lies 10 miles southwest of the Bay Lagoon. Its height is only a little over 1000 feet, but it has a crater over a mile in diameter. A number of eruptions have been recorded since the discovery of the islands, the last occurring in 1873.

TAALIBI, tä-lē'bē̇ (Ar. *Abū Manṣūr Abd al-Malik ibn Muḥammad ibn Ismā'īl al-Ṭa'ālibī*) (961-1038). A prolific writer upon philological and literary subjects. He was a native of Persia, his birthplace being Nisabur, and he represented the Persian-Arabic school of literature. Arabic philology was now passing from the ancient schools of Basra and Kufa to Persian soil. Portions of Taalibi's works have been edited in Europe and translated, for example: Seligman, *Proœmium et Specimen Lexici Synonymici Arabici Atthalibi* (Upsala, 1863); Cool, *Selecta ex Thaalebii Libro Facetiarum* (Leyden, 1835); Valeton, *Talibii Syntagma Dictorum Brevium et Acutorum* (Leyden, 1844). Consult Brockelmann, *Geschichte der arabischen Litteratur* (Weimar, 1898).

TABAGO, tȧ-bä′gō̇. An island of the West Indies. See TOBAGO.

TABANIDÆ (Neo-Lat. nom. pl., from Lat. *tabanus*, gad-fly). A numerous family of dipterous insects which live by sucking the blood of horses, cattle, and other animals, and are popularly known as gad-flies, horse-flies, or deer-flies. See GAD-FLY.

TABARD, THE. A famous inn of old London. It was situated on High Street, Southwark, near Kent Road, and must have been in existence as early as the fourteenth century, for Chaucer starts his pilgrims from it on their journey to the shrine of Thomas Becket. Its sign was a tabard or sleeveless jacket. At the end of the sixteenth century it was in high repute. In the seventeenth century it was damaged by the Great Fire, and in the process of restoration the sign was changed to a 'Talbot.' It was condemned in 1866 and its site is at present occupied by the freight depot of the Midland Railway.

TABARI, tȧ-bä′rē̇ (Ar. *Abū Ja 'far Muhammad ibn Jarīr al-Tabarī*) (838-923). Author of the first universal history in Arabic. A Persian, born in Tabaristan, he studied at Bagdad and visited the other schools in Syria and Egypt. He settled at last in Bagdad, and gave himself to teaching and incessant literary labors. His great historical work is the *Annals*, a history of the world from the creation to A.H. 302. This has been published at Leyden by de Goeje (1879 sqq.). Nöldeke's *Geschichte der Perser und Araber zur Zeit der Sassaniden* (Leyden, 1879) is a translation of portions of the *Annals*. His commentary on the Koran stands superior to all other commentaries. Consult Brockelmann, *Geschichte der arabischen Litteratur* (Weimar, 1898).

TABASCO, tȧ-BÄS′kō̇. A maritime State of Mexico, bounded by the Gulf of Mexico on the north, the State of Campeche and the Republic of Guatemala on the east, Chiapas on the south, and Vera Cruz on the west (Map: Mexico, M 8). Area, 10,072 square miles. Tabasco is well watered and some of its rivers, as the Usumacinta, are navigable to some extent. The climate is hot and unhealthful and the rainfall very abundant. The fertile soil yields good crops of cacao, sugar, coffee, tobacco, rice, and fruit. Stock-raising is of secondary importance. Population, in 1900, 158,107. Capital, San Juan Bautista.

TABASHEER (Hind. *ṭabāshīr*, Skt. *tavakṣīra*, *trakṣīra*, bamboo-manna). A substance sometimes found in the cavities or tubular parts of the stems of bamboos and other large grasses. It consists chiefly of silica, with a little lime and vegetable matter, or sometimes of silica and potash. It appears to be formed by extravasation of the juices of the plant, in consequence of some diseased condition of the nodes or joints. It is in high repute among the Hindus as a tonic, and is prepared by imperfect calcination and trituration. Tabasheer has a beautiful veined structure and is remarkable as having the lowest refracting power of any known substance.

TABB, JOHN BANISTER (1845—). An American poet, born in Virginia. He was a Roman Catholic priest and professor of English literature at Saint Charles College, Ellicott City, Md. The verse of Father Tabb is scant, comprising *Poems* (1883), *An Octave to Mary* (1893), *Lyrics* (1897), *Poems Grave and Gay* (1899), and *Two Lyrics* (1900), but it is distinguished for its sympathy with whatever subjects it treats from nature, literature, or religion, for the delicacy and refinement of its sentiment, and for the precision of its verse. *The Sisters*, *To Shelley*, *Clover*, *Indian Summer*, *The Child*, and *The Druid* are examples of his exquisite lyric quality, and of his choice of subject. His thought is generally compressed into a few stánzas, often a quatrain.

TABERNACLE (Lat. *tabernaculum*, diminutive of *taberna*, hut, booth; connected with *tabula*, plank, board, table, tablet, Umbrian *tafle*, on a table). A portable sanctuary which, according to the traditional view, was carried about by the Israelites in the wilderness. The command to build this structure is found in Exodus xxv. 10-xxvii. 19, and the account of its construction in almost identical terms in Exodus xxxvi. 8-xxxviii. 31. While it is called a tent, it was in reality a house, having upright walls made of thick boards on three sides, and a curtain on the fourth. The wooden framework had four coverings, one of linen, one of black goats' hair, one of rams' skins dyed red, and one of the skins of wethers. In front the curtain was fastened to pillars made of acacia wood, with copper bases and capitals covered with gold. This structure was divided into two parts, separated by an inner curtain, supported by four pillars with bases of silver and wholly overlaid with gold. The outer and larger apartment was 'the Holy Place,' accessible to priests only; the inner, 'the Holy of Holies,' was entered only once a year by the high priest. Around the sanctuary was a court inclosed by curtains supported by sixty pillars of wood with bases of bronze and capitals overlaid with silver. In the Holy of Holies stood the Ark of the Covenant; in the Holy Place the table of shewbread, the golden candlestick, and the altar of incense; in the court stood the brazen altar of burnt-offering and around it were ash-pans, shovels, bowls, forks, and fire-pans of brass, while in the middle was the great brazen laver. The tabernacle is described as being of extraordinary splendor and of the costliest materials. It stood in the centre of the camp, and was carried by a large retinue of men when the camp moved. Modern scholars generally regard the description as wholly imaginary and devoid of historical value. It is considered as having been drawn on the basis of Solomon's temple and projected into the Mosaic period. This is indicated not only by the impossibility of such a house being constructed and carried about in the wilderness, but also by the fact that the earlier records know nothing of a tabernacle of this kind, while an Ephraemitish narrative has preserved the picture of a much simpler tent where Yahweh revealed himself to Moses (Ex. xxxiii. 7 et seq.; Num. xi. 25; xii. 5; xiv. 10). This 'tent of meeting' (*'ōhel mōēd*) stood outside the camp and was only a small tent with a single custodian, and Yahweh revealed Himself there in a cloud at the door. It is not impossible that the memory of such a portable shrine, common to many nations, carried about while they were still nomads, survived among some of the tribes that afterwards formed the people of Israel. Apparently the ark has its own history, and was not originally connected with this tent. The tent plays no part in the early history of Israel in Canaan, while the ark is of great importance.

In the Roman Catholic Church tabernacle is the name given to the receptacle in which the consecrated elements of the Eucharist are retained. By the present discipline, the tabernacle is commonly a small structure of marble, metal, or wood, placed above the altar, and of costly material and workmanship. Even when the exterior structure is of marble or metal, there is commonly an inner receptacle of wood (properly cedar), lined with silk. The tabernacle is appropriated exclusively to the reservation of the Eucharist, and it is prohibited to keep within it any other object. A red lamp is kept constantly burning before the tabernacle.

Consult: Colenso, *The Pentateuch and the Book of Joshua Critically Examined* (London, 1862-79); Kuenen, *De Godsdienst van Israël* (Haarlem, 1869); Wellhausen, *Prolegomena zur Geschichte Israels* (4th ed., Berlin, 1895); Carpenter and Battersby, *The Hexateuch* (London, 1900); Kennedy, article "Tabernacle," in the Hastings *Bible Dictionary* (New York, 1902); Benzinger, article "Tabernacle," in *Encyclopædia Biblica* (London, 1903).

TABERNACLES, Feast of (Heb. *Khag hassukkōth*). The name given in the Old Testament codes to a festival which marked the close of the harvest of fruit, oil, and wine in Palestine. As a harvest festival it is also known as the Feast of Ingathering (Ex. xxiii. 16; xxxiv. 22) and can be traced back to the Canaanites. The festival was marked by general jubilation and by a visit to some sanctuary, accompanied by sacrifices for the purpose of testifying gratitude to the giver of fertility. Among the popular customs observed by the Canaanites was the erection of booths in the vineyards, in which the people dwelt during the vintage. Hence the name Festival of Booths (or Tabernacles) in the four passages besides those already mentioned in which the ritual is set forth (Deut. xvi. 13-15; xxxi. 10-13; Lev. xxiii. 34-36; 39-44; Num. xxix. 12-40). This Canaanitish agricultural festival was adopted by the Hebrews and in the Deuteronomic and Priestly codes was given an historical aspect by interpreting the custom of dwelling in booths as a reminiscence of the nomadic stage in the life of the people, and more particularly of the traditional forty years' sojourn in the wilderness when the tent formed the only habitation. The pristine importance of the festival may be gathered from the fact that it was called 'the festival' *par excellence* and that originally it was the single occasion in the year on which a pilgrimage to a sanctuary was prescribed. As finally shaped in the Hebrew ritual, it extended over the seven days from the fifteenth to the twenty-second day of Tishri (the seventh month), and in addition the eighth day was observed as a 'solemn assembly,' which in Rabbinical Judaism developed into the festival of 'Rejoicing of the Law.' Booths were erected on the roofs of houses or in the courts and streets, made of olive, pine, myrtle, and palm branches (cf. Neh. viii. 15). The sacrifices prescribed for this feast were more numerous than for any other, sin-offerings (one kid daily) and burnt-offerings (two rams and 14 lambs daily), being prescribed for each day besides 70 bullocks during the seven days (13 on the first day, 12 on the second, and so on in a diminishing scale). Besides these distinctly biblical enactments, we find in the days of the second temple daily processions around the temple altar, the priestly procession to Siloam to fetch water and its libation in connection with the morning sacrifice (cf. John vii. 37), the singing of the Hallel psalms (Ps. cxiii.-cxviii.), the lighting of the four great golden candelabra in the Court of the Women (John viii. 12), and the carrying of palm branches entwined with myrtle and willow together with a specimen of the *ethrog* (or citron) fruit by the worshipers into the synagogues. The erection of booths and the waving of the palm branches with the ethrog are customs still observed in orthodox Jewish communities. Consult the Hebrew archæologies of Nowack and Benzinger.

TABES DORSALIS, tā′bēz dôr-sā′lĭs. See Locomotor Ataxia.

TABLATURE (Fr. *tablature*, from Lat. *tabula*, plank, board, table, tablet). A method of musical notation used in the fifteenth and sixteenth centuries. At first it was chiefly employed for the lutes and viols. The lines and spaces of the staff did not represent the pitch of the notes, but the frets of the instrument. Either the lines or the spaces were used, but not both. These lines or spaces varied according to the number of the strings of each instrument. The French and English tablatures denoted the tones by letters, the Italian by numerals. But the German or organ tablatures employed a regular staff and musical notation for the melody or highest part, while the tones completing the harmony were written by letters vertically below each note of the melody. All tablatures had three points in common: (1) All letters or figures belonging to the same chord were written vertically one above the other; (2) all employed lines for the division of the separate bars or measures; (3) all made use of a uniform system to denote the time-value of notes and rests. These signs were written either above or below the numbers or letters. Rests were denoted by a horizontal line placed below the note sign.

TABLELAND. See Plateau.

TABLE MOUNTAIN, or **TAFELBERG**, tä′fel-bĕrg. A mountain of Cape Colony overlooking Cape Town and Table Bay. It is 3540 feet high and is named for its peculiar shape and level top. It is often covered with a white cloud, which is called the 'Tablecloth.'

TABLES, Lunar. Tabular lists of numerical data based on the elements (q.v). of the moon's orbit and used for calculating the moon's position on the sky. See Nautical Almanac.

TABLET OF ABYDOS. See Abydos.

TABLEWARE, Silver-Plated. The manufacture of silver-plated tableware originated in England, and the centre of its manufacture was at Sheffield and Birmingham. The industry now flourishes in Germany and also in the United States, where the Rogers Brothers were the first to apply the process of electroplating with silver to table utensils. This they did in 1846, and in 1851 a company was formed in Hartford, Conn., for the manufacture of electro-plated ware. At the close of the century the silver-plated and britannia ware industry had spread into seven States, in which were located about 50 factories. Connecticut, however, still led, about one-half the total number of factories being in that State, with an annual product valued at $9,538,397.

Before the introduction of electro-plating, all ware was plated by the application of a thin sheet of silver to the object. Bits of solder were placed here and there between the plating and the body material, and, on subjecting the object to moderate but continued heat, the solder was melted and firmly united the metals. In this process it was always difficult to finish the sharp edges so they had the appearance of a continuous silver surface. The art of fashioning materials by stamping them out with dies (see DIES AND DIE-SINKING) has greatly facilitated and cheapened the manufacture of plated ware. In the modern factory three methods are employed for shaping the body material before the plating is applied—spinning, stamping, and casting, and special parts are sometimes hammered into shape. (See REPOUSSÉ.) The body material used in a standard factory is the composite metal called German silver, which consists of 53 per cent. copper, 31¼ per cent. zinc, and 15¾ per cent. of nickel. Stamping is the method usually employed when a large number of objects after the same pattern are to be made. When only one or a few pieces are to be made according to a given design, they are usually spun. In this process the object is shaped over a rapidly revolving wooden mold, known as a chuck, frequent annealing being required to keep the metal flexible. Spinning requires considerable manual dexterity, while stamping is a purely mechanical process. But the preliminary making of the wooden mold is much easier and cheaper than that of the metal die. Of course only objects which are somewhat spherical in shape can be spun, and the flat metal which is thus molded into shape is stamped out of the sheet. Often the chucks are sectional and hinged, so that they can be removed from the finished object, when this object is narrower at the top than at other portions; but oftener a dish, whether stamped or spun, is fashioned in several sections, which are soldered together before plating. Ornamental borders and similar decorations are stamped separately and soldered on. The final preparation for plating is to remove all roughnesses and scratches from each article and render it perfectly smooth, which is done by sand-finishing.

In applying the process of electro-plating (q.v.) to produce silver-plated ware, the objects are first washed in caustic soda and then in a strong solution of nitric, sulphuric, and hydrochloric acids. The trade terms 'single,' 'triple,' and 'quadruple,' which are commonly applied to plated ware to denote its quality, are somewhat misleading, for the heaviness of the plate usually depends upon the length of time during which the object remains in the electric bath, and not on the number of times the dip is repeated. The ware is carefully weighed before and after immersion and is allowed to remain in the bath until the desired number of pennyweights of silver have been added to its weight, an operation which, in thoroughly-good ware, requires several hours, although the vessel is quite as attractive in appearance after a bath of a few minutes. It is sometimes stated that danger of poison is incurred in using certain forms of cheaply made plated ware, but in all but the poorest quality the silver is subjected to so many cleansing processes after it is plated that not a vestige of the deadly poison, cyanide of potassium, in which it has been immersed can remain upon its surface. Standard ware, after it is plated, is finished by a succession of processes of hand polishing and burnishing.

TABOO′ (Samoan *tapu*, Hawaiian *kapu*, forbidden). An object or act religiously interdicted, and the religious system based upon such interdiction. Under various names and in one form or another, the practice of taboo is found all over the earth; but it has nowhere else been so systematized as in Polynesia. Primarily, taboo is something forbidden because the tabooed object is regarded as potent to injure owing to its *mana*, or mysterious (spiritual) power, which may be either holy, as a priest's possession, or unclean, as a corpse. There is at first no moral significance in taboo, and in many cases the interdict is due merely to fear of spirits. Thus in New Zealand there are a *mana* taboo and an *atua* taboo, the latter arising from a belief in spirits, *atua*, or a more personal embodiment of *mana*, Even in rites of purification the object is simply to keep off evil spirits. Taboo in many cases reverts to another phase of primitive philosophy, which sees retained in blood, nails, hair, etc., though severed from the body, the spiritual power of the individual. But in some cases taboo is merely the expression of conservatism, which may be religious or social. An instance of the former is the taboo of iron in religious ceremonies. Thus in such ceremonies both the ancient Romans and the modern Pawnee Indians put a taboo on iron, since the gods dislike innovations. Even without the fear of divinities, the same religious conservatism prevents the Australians from using stone implements in circumcision, for which they employ the still more antique burnt-wood knife. But there is also a social conservatism resulting in taboo. Foreigners and new things generally are dangerous and are regularly tabooed by many wild tribes (as in Africa), though the taboo is easily removed except in the case of chiefs. In such cases the foreign person, thing, or act is tabooed because of the unknown and dreaded *mana*. But, on the other hand, there are taboos which are simply in the interest of old practices. Thus the Hindu laws give the bed-hours of kings, and it needs only the right environment of superstition and antiquity to make such laws seem to be the effect of taboo, as in Egypt, though there can be no question that this is not the case in India.

Taboo may be permanent or temporary, private or public. Especially stringent are all royal and priestly taboos, because kings and priests control the weal of the people and must, for the people's sake, be guarded against danger in food and the like. In some cases a king becomes a mere slave bound by the rules thus laid upon him. In others he makes taboos for his own interest. The king is guarded from tabooed acts and objects; but the people too must guard themselves from the mysterious divine *mana* of the king, and it is this latter aspect of taboo which king and priest alike find it for their interest to maintain.

What is not taboo is *noa*, common, and in this antithesis lies the germ of the conception of personal property as applied to many persons and things. Thus taboo became in many cases merely an assertion of proprietary rights, as may be seen from the fact that a lesser chief's taboo was disregarded in New Zealand by a stronger chief, but a stronger chief's taboo was feared and respected by one weaker. Isolation was the object of taboo and this was the first stage to ownership. Food-taboos are often totemistic or hygienic, and the taboo of knots, which is very common, is a temporary taboo imposed because of the belief in mimetic magic. But it is not necessary that the imitative act be due to a wish to injure. Thus in Africa, Greece, and elsewhere there is a taboo on knots, locks, crossed arms and legs; in short, on all that suggests an impediment. Another common taboo is the *hlonipa* or name-taboo of the Kafirs, with the woman-language found among the Kafirs (as also among the Semites and the Caribs), certain names and words being tabooed, for example, the names of fearful beasts in India, of kings in Africa, and of the dead in Australia and elsewhere, as well as words used only by women. Sex-taboo is very common. Thus the belief that a woman's blood is fatal to a man leads at stated periods to a temporary taboo of women even among civilized Hindus, and in many countries men may not eat with women. Other common examples of taboo are as follows: To be ill, or to touch a corpse or grave, a king or a priest, or anything divine (such as royal blood) renders one taboo. A priest's or a king's clothes are so filled with *mana* that it would kill any one else to wear them, and to enter a chief's house or even in some cases to look at a great chief would be destructive. A priest's house is taboo even to himself, so far as eating in it goes. The taboo of part of one's self is often recognized. Thus, when a person is under taboo he may not touch his own head and has to be fed by another or eat with chopsticks. Such a person may not touch a drinking vessel lest he render it also taboo and dangerous. For whatever comes in contact with a tabooed object becomes itself tabooed. The private or public taboo of places for certain practical reasons is also noteworthy. A river is tabooed by a king until the fishing-season is over; a wood, till the game is caught; a field, till the harvest is gathered. A public taboo is where, as in New Zealand, a whole community is made taboo while getting in their crops. This renders it impossible for any member of the tribe to do anything else till the taboo is removed, and prevents any stranger from approaching the tabooed ground. The removal of a public taboo is made by a priest who repeats a spell and performs certain rites over the tabooed people. If a chief wants anything for himself he taboos it by calling it part of himself. Women, if of high rank, may taboo an object as effectively as do chiefs of the tribe.

Taboo has been explained either as a priestly trick or as a religious observance, required by the chief for political reasons. But neither explanation will suffice, though many taboos may be referred to the arbitrary enactment of priest or king, and again some taboos are not religious at all. Others explain taboo as due to a categorical imperative, and deduce from it all moral laws as well as most of the practices of civilized communities, such as caste, the wearing of ornaments, the carrying of umbrellas, the washing of new-born babes, etc. On the other hand, oaths, the punishment of murderers and thieves, and marriage restrictions may be developed out of a taboo system, which recognizes no moral sin, only the danger of 'breaking taboo.' But in that case we have to do not with a categorical imperative, but with a belief in a mysterious spiritual potency and the fear of its effect. An extension of this belief results in its becoming purely formal. Taboo itself then may be divided into purely religious and formal taboo; while, if everything 'forbidden' is to be called taboo, there must be added a mass of detailed regulations arising from different sources, some of them having no connection with what is strictly called taboo; and it is evident that for such a combination of effects there can be no one explanation. Consult: Taylor, *Te Ika A Maui, or New Zealand and Its Inhabitants* (2d ed., London, 1870); Robertson Smith, *Religion of the Semites* (2d ed., ib., 1894); Jevons, *Introduction to the History of Religion* (ib., 1896); Frazer, *The Golden Bough* (2d ed., ib., 1900).

TABOR (Heb. *Thābōr*, lofty place). The most conspicuous and famous mountain in Galilee (Map: Palestine, C 2). Its summit is 1843 feet above sea level. As a typical mountain of the Holy Land it impressed itself upon the language of poetry. It seems to have been the natural site for a sanctuary, and upon it from early times lay a town of the same name. Here Barak assembled his forces to attack Sisera (Judges iv.); twice the Jews held it, though unsuccessfully, against the Romans (B.C. 53; A.D. 67). It is the traditional scene of the Transfiguration of Christ, although most unreasonably, and so it became the site of churches and monasteries, and was an object of pious pilgrimage. Consult: *The Palestine Exploration Fund Memoirs*, vol. i. (London, 1881); Robinson, *Biblical Researches* (Boston, 1841).

TABOR (OF. *tabour*, Fr. *tambour*, Sp. *tambor*, from Ar. *tambūr*, sort of lute with a long neck and six brass strings, drum). A small drum, played with one stick, generally in combination with a galoubet or three-holed fife.

TABOR COLLEGE. An undenominational institution of learning for both sexes at Tabor, Iowa, founded by a company of missionaries in 1857 as an academy, and incorporated as a college in 1866. The courses after the freshman year are arranged in the group system and include instruction in music and art. The attendance in 1903 was 181; the faculty numbered 15, and the library contained 12,000 volumes. The productive funds of the college in the same year amounted to $104,000.

TABORITES. The most radical party of the Hussites in Bohemia. They derived their name from their fortress of Tabor, near the river Lužnič. They asserted the right of individual judgment, rejected all ordinances of the Church not expressly appointed in the Bible, and had democratic tendencies. Their leaders were John Ziska (q.v.), Nicholas of Pistna (Husinec), Procopius the Great, and Procopius the Lesser. (See PROCOPIUS, ANDREW.) At first, in the face of common danger, all parties of the Hussites held together and inflicted repeated defeats upon the Imperial troops. After the Calixtines (q.v.) had made terms with Sigismund and the Church

(1433), the Taborites continued the war, but were overthrown in the battle of Böhmischbrod, May 30, 1434. The remnant of them was absorbed in the Bohemian Brethren (q.v.). See HUSSITES.

TABRIZ, tȧ-brēz′, TAVRIS, or TEBRIS. The second largest town of Persia, capital of the Province of Azerbaijan, situated in a wide valley, on the Aji, a tributary of Lake Urumiah, 35 miles east of the lake, in about latitude 38° 4′ N., longitude 46° 18′ E., over 4000 feet above the sea (Map: Persia, B 2). Owing to the many earthquakes, large sections of the town are in ruins. The place is healthful, although the weather is bitterly cold a third of the year. In spite of the altitude, the bare rocks rising on the northeast and east and the peak of Sahand standing on the south give Tabriz the appearance of being shut in by mountains. The squalor of the native huts and the poor sanitary precautions are counteracted by the abundance of water and the numerous refreshing orchards and gardens. The town, in addition to its hundred public baths, numerous caravansaries, and five Christian (Armenian) churches, has over 300 mosques. Among these, the 'Blue Mosque,' incrusted within and without with blue faïence tiles, is especially worthy of mention. The 'Ark' in the centre of the town, the residence of the heir apparent, is a large, somewhat imposing brick building. Its cracked walls bear witness to the frequency and violence of earthquakes in this region. The 'Great Maidan' square and the ample barracks are examples of modern progress. There is an international telegraph. Before the Caucasus Railroad and the Caspian Sea became important mediums of transportation and the Russian trade was diverted to Astara and Resht, Tabriz was the emporium of Western trade.

In 1898-99, according to the books of the custom-house, the exports amounted to £219,930 and imports to £682,330, but it is likely that these figures are much less than the total trade. Dried fruits, silk, and various kinds of manufactures are exported from Tabriz. There are lead mines in the vicinity, and copper and cobalt are found in the Sahand. The population is estimated at from 165,000 to 200,000. It was formerly much larger.

Tabriz is said to have been founded by the wife of Harun-al-Rashid in 791, but is mentioned before that date. In 858, 1041, 1721, and 1780 it was devastated by earthquakes. In that of 1721 80,000 persons lost their lives. It was held in turn by the Arabs, Seljuks, Mongols, and Turkomans, from whom it was taken by the Persians. It was several times in the possession of the Turks and was finally taken from them by Nadir Shah in 1730. Tabriz is essentially a Turkish city and Turkish is the prevalent language.

TAB′ULA BANTI′NA. The chief source of knowledge of the Oscan tongue; a bronze tablet in the Naples Museum, containing on one side an Oscan inscription of 33 lines referring to affairs of Bantia, and on the other a portion of a law in Latin. It was found near Bantia in 1793.

TABULA ILI′ACA (Lat., Ilian Tablet). A small relief in soft marble found near the ancient Bovillæ in 1683 and now in the Capitoline Museum at Rome. The slab, 10 × 11½ inches, is covered with scenes from the Trojan War, taken from the *Iliad* and the poems of the Trojan Cycle (see CYCLIC POETS), with explanatory Greek inscriptions. It is generally supposed to have been intended for school instruction, but was probably an ornamental panel of a bookcase.

TAB′ULA′RIUM. A large building on the slope of the Capitoline Hill facing the Roman Forum, built by Quintus Lutatius Catulus in B.C. 78 for the preservation of State records. It rested on massive substructures and consisted of a series of vaults with an upper portico of Doric half columns, some of which are still to be seen. Its extent corresponded with the present Palazzo del Senatore, which is built on the ancient walls. The structure is in good preservation, although the masonry of the vaults is corroded by the action of salt stored in them during the Middle Ages.

TABULAR STANDARD. A proposed standard of value which should obviate difficulties due to changes in the purchasing power of money. The proposal involves the preparation, by public authority, of a table of relative values of certain selected commodities after the fashion of an index number, and the permissive use of this table as a legal standard in contracts involving deferred payments. A tabular standard has been briefly defined as an official index number. Its compilation would require a commission or other body with power and facilities to collect price statistics. Having decided what commodities should be employed as basis for the standard, the commission would then calculate a yearly or monthly index number according to some accepted method. (See article INDEX NUMBERS.) The statistics would of course be public, and any one who chose could verify the calculation. The rise and fall of prices would either be expressed in percentages, or an arbitrary unit would be adopted, whose changing values, expressed in money, would indicate the same thing.

The practical operation of the tabular standard is simple. When a person makes a loan of say $100 for one year, the contract entitles him to receive the same number of dollars (usually with interest) at the end of the specified time, but it does not insure that the $100 which he lent and the $100 he receives will have the same purchasing power. If prices have risen in the interval, his $100 will buy less, if prices have fallen it will buy more. In so far as changed purchasing power is not compensated by a change in rates of interest, debtors are likely to be burdened by an appreciation, creditors by a depreciation, of the value of money. Suppose, however, the tabular standard to be employed, and that A sells a piece of property to B for $12,000, of which ¼ is to be paid at once, and ¼ more at the end of each succeeding year. The $3000 cash is of course paid as such. But after a year the tabular standard might show the purchasing power of money to have fallen 10 per cent. Expressed in tabular units, if at the time of sale a unit was worth $10, it would now be worth $11.11, giving the proportion 10.00 : 11.11 : $3000 : $3333.33, which last figure is what B will have to pay. If at the end of the second year a unit of the tabular standard was worth $9, B would be called on for only $2,700. Whether he pays more or less in money, the sum will always have a uniform value in terms of the commodities on which the standard is based.

That many advantages would be gained from the use of a tabular standard has generally been admitted. Two serious practical difficulties stand in the way of its introduction. First, the conservative attitude of business men toward any change of this sort; second, the difficulty of agreeing upon the precise mode of calculating the standard, and especially upon the precise commodities which should be selected as basis. Gen. F. A. Walker and others have questioned with good reason the practicability of the standard for the frequent short-time transactions of ordinary business, but for contracts of long duration, and for correcting injustice to recipients of fixed salaries, there seems no ground to question its suitableness.

The first conception of a general index number, or tabular standard, however, appears to date from 1798, when Sir George S. Evelyn read before the Royal Society a paper on "Endeavors to Ascertain a Standard of Weights and Measures" (*Philosophical Translations*, vol. lxxxviii., pp. 175 et seq). Evelyn's selection of articles is open to criticism, as was pointed out by Arthur Young in 1811. Joseph Lowe (*The Present State of England*, London, 1822), referring to both Young and Evelyn, proposes the actual introduction of a tabular standard, and discusses the modes of calculating it. (New York edition, 1824, p. 287, and Appendix.) His is the first practical treatment of the subject in English. In Germany the principle of the tabular standard had been suggested about 1805, in application to rent payments. (Horton, *Silver and Gold*, 1877, pp. 39, 157.) G. P. Scrope, in a pamphlet of 1833, and in *Principles of Political Economy* (London, 1833, pp. 405, 424), again proposed the standard. G. R. Porter also treated the subject, and gave a table, in his well-known *Progress of the Nation* (London, 1838 and 1847). The matter was finally brought to prominence by W. S. Jevons, in an essay of 1865, and more forcibly in his *Money and the Mechanism of Exchange* (1875, chap. 25).

Bibliography. Consult the *Reports of the Committee of the British Association on Measuring Variations in the Value of the Monetary Standard* (*British Association Reports*, 1887, 1888, 1889, 1890; the most important material in English); also Price, *Money and Its Relation to Prices* (London, 1896); Walker, *Money* (New York, 1878); *Report of the Monetary Commission of the Indianapolis Convention*, 1898.

TABULATA (Lat. nom. pl., tabulate, floored, table-shaped). A suborder of fossil corals characterized by the development of distinct horizontal septa or tabulæ across the visceral chambers of the corallites. It includes such genera as Favosites, Pleurodictyum, Michelinia, Aulopora, Syringopora, and others which are important members of the Paleozoic faunas. See Cœlenterata; Coral; and articles on genera mentioned above.

TABULATING MACHINES, Electric. See Calculating Machines.

TACAHOUT, tä′kȧ-hōōt′ (native name). The small gall formed on the tamarisk tree, *Tamariscus Indica.* Tacahout is one of the sources of gallic acid, of which it contains a large proportion.

TAC′AMAHAC′ (South American name), or Tacamahaca. A name applied to several different resins. One variety of tacamahac is yielded by the balsam-poplar (*Populus balsamifera*) growing in the United States. Another variety is obtained from certain tropical American trees (*Elaphrium tomentosum* and *Elaphrium tacamahaca*). East Indian tacamahac is obtained from the *Calophyllum calaba, Calophyllum inophyllum*, and *Calophyllum tacamahaca.* These and certain other varieties are used in making varnishes and to some extent also in medicine. See Calophyllum.

TACANA, tȧ-kä′nȧ. A group of tribes, constituting a distinct linguistic stock, inhabiting the banks of the Upper Beni and Mamore Rivers, Northeastern Bolivia. They are remarkable for their light complexion, fine features, and independent expression.

TACCA (Neo-Lat., from the Malay name). A genus of large perennial tuberous-rooted plants of the natural order Taccaceæ. The few species are found in maritime places and woods in the South Sea Islands, tropical Asia and Africa. Some of them (*Tacca pinnatifida*, etc.) are much cultivated for the sake of their starchy tubers, which are used, generally with an acid, as food, although their acridity must be removed by maceration with water. They yield tahiti arrowroot, which is used as a substitute for West Indian arrowroot. The leafstalks of various species are boiled in China and Cochin-China and used as food. Hats, brooms, and other articles of value are made from them.

TACCHINI, tȧ-kē′nē, Pietro (1838—). An Italian astronomer, born at Modena. He was appointed director of the observatory there in 1859, and was transferred to a similar post at Palermo in 1863. In 1879 he became director of the observatory in the *Collegio Romano.* He became known for his observations of eclipses and for his work with the spectroscope. His publications include *Il passaggio di Venere sul sole dell' 8-9 dicembre 1874, osservato a Muddapur* (1875), *Ecclissi totali di sole del 1870, 1882, 1883, 1886, e 1887* (1888).

TACHÉ, tȧ′shȧ′, Alexandre Antonine (1823-94). A Canadian Catholic archbishop, born in the Rivière-de-Loup, Lower Canada. He joined the Order of the Oblate Fathers, traveled great distances toward the northwest and became known for his mission work among the Indians. In 1871 his see, that of Saint Boniface, was erected into an archbishopric. Archbishop Taché was the founder of the Saint Boniface Theological College, and wrote *Vingt années de missions dans le nord-ouest de l'Amerique* (1866), and *Esquisse sur le nord-ouest de l'Amérique* (1869), which has been translated into English and is one of the most valuable works of reference on the region.

TACHINA-FLY, tȧ-kī′nȧ (Neo-Lat., from Gk. ταχύς, *tachys*, swift). A parasitic fly of the family Tachinidæ. These insects resemble in general the common house-fly and as a rule are gray, sometimes striped. They are usually parasitic upon caterpillars, upon the backs of which the females lay their eggs. The maggots penetrate the body of the victim and feed upon its soft internal organs. Frequently, however, caterpillars cast their skins before the eggs hatch. The tachina-flies are considered beneficial to man.

TACHYGENESIS, tăk'ĭ-jĕn'ē-sĭs (Neo-Lat., from Gk. ταχύς, *tachys*, swift + γένεσις, *genesis*, origin, production, generation). A term proposed by Hyatt for rapid evolution, or evolution by leaps, i.e. without the vast series of intermediate forms postulated by Darwin. In his own words Hyatt defines tachygenesis as "the law of acceleration in the inheritance of characters." It has been found, for example, that characteristics are inherited in a series of species in a given stock at earlier and earlier stages in the ontogeny of each member of the series. These characteristics, as a rule, altogether disappear from the ontogeny, through lapse of heredity in the last members of a series, and thus the terminal forms become very distinct in their development. Rapid evolution was also very marked at the beginning of the evolution of any stock. In the dawn of geological history, as soon as divergent evolution set in, each type had a more or less free field, and its first steps in evolution were obviously not affected by natural selection. Afterwards evolution became much slower. On the other hand, when the type began to decline there was a sensible quickening of evolution. Dall suggested the term 'saltatorial evolution'; Galton, De Vries, and others, and especially the paleontologists, have all supposed that evolution has often been by leaps or spurts. Consult: Hyatt, "Cycle in the Life of the Individual (ontogeny) and in the Evolution of Its Own Group (phylogeny)," in *Proceedings of the American Academy of Arts and Sciences*, vol. xxxii. (Boston, 1897); Dall, "On a Hypothesis of Saltatory Evolution," in *American Naturalist*, vol. xi. (Boston, 1877).

TACITUS, tăs'ĭ-tŭs, MARCUS CLAUDIUS (c. 200-276). Roman Emperor (275-276). He was born at Interamna (modern Terni), in Umbria, and was elected Emperor by the senate after the death of Aurelian and an interregnum of seven months (275). He began his brief reign of 200 days at the advanced age of seventy-five years. He instituted needful reforms and favored the restoration of the power of the senate. His victory over the Alani and Goths, for which he took the title *Gothicus Maximus*, is recorded on his coins. He was murdered by the soldiers in Asia about April 12, 276.

TACITUS, PUBLIUS CORNELIUS (c.55-c.117). A Roman historical writer. Information as to his life is exceedingly meagre. Tradition, however, designates Interamna as his birthplace. His training and career certainly indicate that he belonged to a Roman family of good standing. He was prætor in the reign of Domitian and consul suffectus under Nerva. In the year 78 he married the daughter of Gnæus Julius Aricela, a man prominent as a soldier and statesman. This event had great influence on his subsequent career. After his prætorship he was absent from Rome for at least four years until after 93, the year after the death of his father-in-law. The intimacy of Tacitus and Pliny the Younger is proved by references in the letters of the latter, and the two were associated in the successful prosecution of Marius Priscus, proconsul of Africa, charged with extortion. Tacitus's annals were published in 116 or 117, so that we may believe that he lived to the reign of Hadrian. Apparently he looked forward to writing a history of the reign of Domitian and of that of Trajan, but he must have changed his plan, for he began his *Histories* with Galba and continued the work through the reign of Domitian. In the *Annals* he declares his purpose of writing the history of Augustus and in the *Histories* of narrating the reigns of Nerva and Trajan, but we have no indication that he ever carried out this contemplated task. He wrote, however, the history of the Empire from the death of Augustus down to the beginning of his earlier work, i.e. through the reign of Nero.

The earliest extant work of Tacitus is the *Dialogus de Oratoribus*, published about 75 or somewhat later, but not later than the reign of Titus. The *Agricola* followed in the year 98, and even when engaged upon these books the historian was preparing for some greater work. It is possible that his *Germania*, or more fully *De Origine, Situ, Moribus, ac Populis Germaniæ*, represents some of the material accumulated in preparation for some more extensive history. The *Histories* belong to the reign of Trajan and the date of completion may be set in 108. The *Annals* are the last work of the historian and are plainly the production of the fully developed writer. As we have references to the *Annals* in the *Histories*, the date must be later than 108, and as there is apparently a reference in the second book to Trajan's conquest in the East (115-116), the publication may have been just prior to the reign of Hadrian. The *Dialogue on Oratory* belongs to the writer's early manhood, and gives evidence of the influence of Cicero and Quintilian, in so marked a degree that some scholars have attempted to assign it to Quintilian or to some other author not identified. The best opinion of the present day is in favor of the genuineness of the work. The subject is an investigation into the causes of the decline of eloquence, and the discussion is carried on by two celebrated orators of the Flavian period who are respectively supporters of the old and new oratory. After an eloquent silence—eloquent because we know the depth of feeling from the bitter words as to the reign of Domitian found in the introduction—Tacitus wrote the *Agricola*. This work is a gem, a most carefully prepared piece of biographical composition. The rhetorical power of the writer is plainly felt in the closing chapters, which are unexcelled in Latin literature. His *Germania* is a most important work because of the descriptions of political institutions and of the customs of various tribes. As the writer brings into vivid contrast the life of the Germans and that of the Romans. it has been thought by some that he was endeavoring to instruct his countrymen, either pointing out their evil ways, or startling them and warning them against the dangers threatening on their northern frontier. Tacitus shows an exact knowledge of those Germans near to the Rhine. but is uncertain as to the interior and more remote tribes. The greatest work of Tacitus has not come down to us entire, for of the *Histories* there are extant only the first four books and a part of the fifth, so that we have merely the year 69 and a part of 70. Of the *Annals* there is extant only about one-half and this does not give a continuous narrative. After the fifth chapter of the fifth book there is a lacuna which marks the loss of the events of 29-31. Tacitus probably ended this book with the death of Sejanus, so that the beginning of the sixth book is also lacking. The seventh to the tenth, the beginning of the eleventh, and the close of the sixteenth are also missing, and we thus lose all of the reign of Caligula, the first five years of Claudius, and the last two years of Nero.

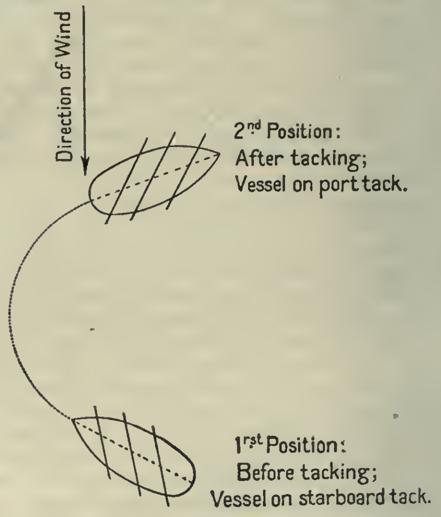
In the *Annals* Rome and the Princeps form the centre about which are grouped the events of a history which is not that alone of Rome, but of the associated provinces. The Medicean manuscript designates the work *Ab Excessu Divi Augusti,* and this is no doubt the original title. In the *Histories* Tacitus writes as a contemporary, and therefore with a surer touch, and he gives full play to his dramatic powers in his description of what is quite familiar to him. The *Annals* represent the culminating task of his lifetime and are the work of the period of his full development as a writer.

The great power of Tacitus as an historian is due to his skill in discerning the motives which lead men to act, and his 'deep psychological insight' is very marked. He studies men, not things, and hence he is skilled in character painting. A marked feature of the Tacitean spirit is the tendency to impute a base or unworthy motive to all the actions of those men whom he describes. This is particularly true of his treatment of Tiberius. Certain it is that Tacitus writes of Roman society as a pessimist, and we may obtain a juster view by turning to the more attractive picture presented by his friend and contemporary Pliny the Younger.

Tacitus early recognized that the style taught in the schools of rhetoric was not adequate for his history, and he thereupon evolved one of his own. There are three distinguishing features of Tacitus's style—conciseness, variety, and poetical coloring. There is not a superfluous word, and his condensation sometimes causes obscurity. We may say that his conciseness corresponds to his thought, for there is nothing artificial in it, and the style is characteristic of the writer. Tacitus's fondness for variety is found in his word positions, and in his variation in forms and constructions. The poetical coloring came from his study of the Augustan poets, particularly Vergil. Many words and expressions may be traced to Vergil, and this is true particularly of the minor writings and the *Histories.*

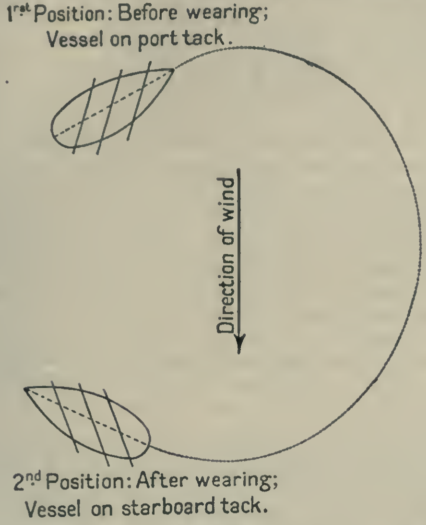
The manuscripts of Tacitus are the Codex Mediceus (I.), dating from the ninth century and containing a part of the *Annals;* and the Codex Mediceus (II.) of the eleventh or twelfth centuries containing what remains of the other books of the *Annals* and *Histories.* The *Germania* and *Dialogus* are obtained from a manuscript in the Vatican based on an earlier one of the ninth century and again from a mauscript at Leyden, dating from the fifteenth century. The *Agricola* is found in two transcriptions of the fifteenth century now in the Vatican. The *editio princeps* is by Puteolanus of Milan, about 1476. The best text is that of C. Halm in the "Teubner Series" (Leipzig, 1886). Important editions are the *Annals,* with English notes by H. Furneaux (Oxford, 1891-92; vol. i., 2d ed. 1896); Allen, *The Annals of Tacitus,* i.-vi. (Boston, 1890); Nipperdey and Andresen, *Ab Excessu Divi Augusti* (Berlin, 1892); Codley, *The Histories* (New York, 1891); Spooner (London, 1891); Frost, *Agricola* and *Germania* (ib., 1861); Hopkins (Boston, 1893); Furneaux, *The Agricola* (Oxford, 1896); Gudeman (Boston, 1899); id., *Dialogus* (ib., 1894); and Peterson (Oxford, 1893). The lexicons for Tacitus are Boetticher's (1832) and the great work of Gerber and Greef (completed 1903). An excellent English translation is that by Church and Brodribb (London, 1876-77).

TACKING (from *tack,* from OF. *taque, tache,* dialectic Fr. *tache,* nail, tack; so called because of the part of the sail to which the rope is attached), AND **WEARING** (from *wear,* AS. *werian,* Goth. *wasjan,* OHG. *werjan,* to clothe; connected with Lat. *vestis,* Gk. *ἐσφής, esthēs,* clothing, Skt. *vas,* to put on clothing). A vessel is said to be *on the starboard tack* when she is sailing with the wind on her starboard side, and *on the port tack* when the wind is on her port side. She is *close-hauled* on either tack when she is sailing as near to the wind as the set of her sails permits. The operation of changing from one tack to the other is called *tacking* if the vessel comes up head to wind and then falls off on the other tack, and *wearing* or *gybing* if she falls off—bringing the wind astern—and then comes up to the wind on the new tack.



TACKING.

It is evident from the sketches that in tacking there is a gain to windward—if the vessel is a weatherly one and well managed—while in wearing there is a loss, because part of the time the ship is running away from the wind. Therefore, tacking is always preferred when practicable. While all properly built vessels will tack under ordinary conditions of sea and wind, there are times when the sea is very rough and the wind so strong that little sail can be carried; or the wind may be too light to give sufficient headway for tacking; or the vessel may be improperly sparred or ballasted. In these cases *wearing* is necessarily resorted to. In vessels carrying fore-and-aft sails only the operation of tacking requires little labor, but in square-rigged ships the yards must be swung and the sails adjusted on the new tack. *Wearing* is called *gybing* when the vessel is fore-and-aft rigged and carries a boom mainsail which is not taken in or lowered during the operation. It is evident that when the wind, in wearing, passes from one side to the other of such a sail it will give a thrust of considerable violence, and this thrust must be carefully watched in small vessels—and in large ones if the wind is strong—or it may cause them to capsize.


1st Position: Before wearing;
Vessel on port tack.
Direction of wind
2nd Position: After wearing;
Vessel on starboard tack.

WEARING.

Tacking is frequently called *going about.* While the operation is in progress a vessel is *in stays;* if she fails to tack and falls back on the same tack as before she is said to *miss stays.* A lively, fast-moving vessel, particularly if deeply loaded, will, before losing way, shoot some distance directly up into the wind after it is out of her sails. Advantage is frequently taken of this fact to avoid some slight obstruction, when tacking is undesirable or otherwise unnecessary, and the operation is called making a *half board.* To make a *good board* is to lose nothing to leeward; to make *short boards* is to tack frequently; to make *sternboard* is to go astern.

TACKING OF MORTGAGES. The act, permitted by a doctrine in English equity practice, of one who takes a mortgage or lien on real property subsequent to a second or later mortgage and in ignorance of its existence, to purchase the first mortgage and merges or 'tacks' his security in it. The effect of this is to compel the intermediate incumbrancers to redeem the first mortgage, including the one thus merged with it, before they can enforce their liens. This doctrine has been repudiated in most of the United States.

TACKLE (MDutch, Dutch, LG. *takel;* possibly connected with Goth. *taujan,* to do, or with Goth. *tēkan,* Icel. *taka,* AS. *tacan,* to take, Lat. *tangere,* to touch). A combination of blocks and ropes designed to increase the capacity of the available power to move heavy weights or decrease the time required to move an object with a power capable of moving only at a certain speed. The block consists of a *shell* or frame containing one or more *sheaves* or pulleys and a *strap* to attach the block to the weight or support. It is evident that in all cases one block of a tackle, or one end of the rope—if there is a single movable block—must be fixed. This being the case, in simple purchases and neglecting friction we have $P = \frac{W}{N}$, in which P is the power,

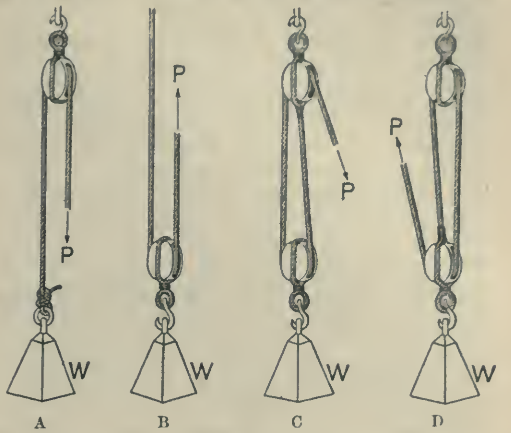


FIG. 1.
A, single whip ; B, runner ; C and D, gun-tackles.

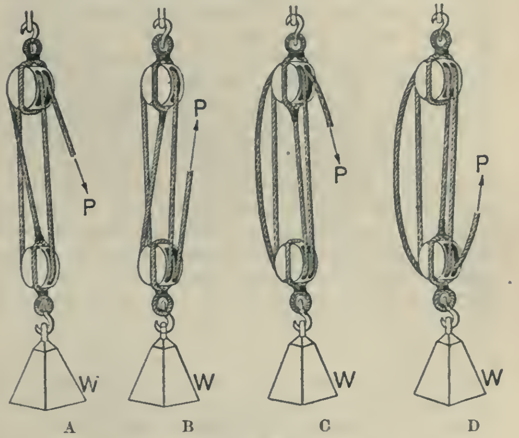


FIG. 2.
A and B, luff or watch tackle ; C and D, two-fold purchases.

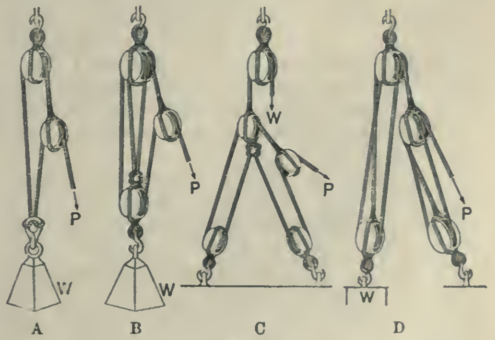


FIG. 3
A, single Spanish burton ; B, double Spanish burton ; C, Bell's purchase ; D, luff upon luff.

W the weight, and N the number of parts of rope at the movable block. The amount of power lost by friction depends upon many things, such as: the character of the rope; its size with reference to the diameter of the pulley and the weight to be raised; the condition of the atmosphere; the bearings of the pulleys, etc. But in ordinary tackles, with the usual type of pulleys, rope, etc., the loss by friction is estimated at about one-sixth the gain effected by each pulley or sheave. The different classes of tackles, or *purchases* as they are frequently called, are shown in the accompanying figures.

TACKLETON, Mr. A toy-maker with a virulent dislike of toys and children, in Dickens's *Cricket on the Hearth.*

TACLOBAN, tăk-lō-bän′. Capital of the Province of Leyte (q.v.), Philippine Islands, in latitude 11° 15′ N. and longitude 124° 59′ 30″ E. The town, which is on the eastern coast, is well built and has an important trade. The port is well protected and has four different wharves. Population, about 11,000.

TACNA, täk′nȧ. The northernmost province of Chile, bounded by Peru on the north, Bolivia on the east, the Chilean Province of Tarapacá on the south, and the Pacific on the west. Area, 8688 square miles. Its level and arid interior is inclosed by the slopes of the Andes on the east and the coast range on the west. The rainfall is very scanty, and with the exception of the river valleys, the interior is an arid desert almost uninhabited. The climate is unhealthful and earthquakes are not infrequent. There are deposits of nitrate, silver, and copper, which are mined to a limited extent. Population, in 1895, 24,160; in 1900 (estimated), 25,031, concentrated chiefly in the capital, Tacna (q.v.), and the port Africa. The province formerly belonged to Peru and was ceded to Chile for a period of ten years in 1884. At the expiration of that period, according to the provisions of the treaty, the ownership of the province was to have been determined by a plebiscite of the inhabitants. The political state of Peru, however, made it impossible to carry out the provisions of the treaty, and Chile still exercises control.

TACNA. The capital of the Province of Tacna, Chile, in the northwestern part of the province, about 40 miles by rail from Arica (Map: America, South, B 4). It was formerly a place of considerable commercial importance with notable municipal and industrial establishments, but the construction of railway lines in the Province of Antofagasta diverted the trade southward. Population, in 1895, 9418, as against 14,000 in 1885. In the vicinity a battle took place on May 26, 1880, betwen the Chilean and the allied Peruvian and Bolivian forces, in which the former were victorious.

TACO′MA. The county-seat of Pierce County, Wash., 140 miles north of Portland, Ore., at the head of Commencement Bay, Puget Sound (Map: Washington, C 2). It is a terminus of the Northern Pacific Railway, and is on the Great Northern, the Canadian Pacific, and other railroads. Many steamship lines, of which several are trans-Pacific, sail from Tacoma. The harbor is spacious and secure, and is admirably provided with shipping facilities, the railroad and steamship terminals being among the best on the Pacific Coast.

Tacoma has a picturesque site, rising from the bay to an altitude of 320 feet, with high mountains in the vicinity, Mount Rainier (q.v.), locally known by the old Indian name, Tacoma, to the southeast, being 14,526 feet in height. There are some 700 acres in public parks, of which Point Defiance is by far the largest. The city hall, court-house, Chamber of Commerce, Northern Pacific Railway headquarters, Tacoma Hotel, and Tacoma Theatre are among the prominent buildings. The city has a public library (Carnegie) containing some 25,000 volumes, the Ferry Museum of Art, and the State Historical Society. The educational institutions include Whitworth College (Presbyterian) and the University of Puget Sound (Methodist Episcopal), both opened in 1890; Annie Wright Seminary (Protestant Episcopal), the Pacific Lutheran University, and an Indian school. The State Insane Asylum is a few miles to the south, and there are in the city a number of charitable institutions, the more important of which are the City and County Hospital, Saint Joseph's Hospital, and the Fanny Paddock Memorial Hospital.

Superior transportation facilities, and a vast and highly productive tributary region have made Tacoma one of the leading business centres on the Pacific Coast. Coal is mined extensively in the vicinity, and the city has also advantages of rich agricultural and timber lands. It carries on a large wholesale trade and is largely interested in manufacturing, but derives its chief importance from an extensive coastwise and foreign commerce, particularly with the Orient. The principal articles of commerce are wheat, flour, lumber, coal, coke, fish, and fruit. In the census year 1900 the various industrial establishments had $8,147,000 capital, and an output valued at $12,029,000. The manufacture of lumber, shingles, furniture, carriages and wagons, woodenware, flour, foundry and machine shop products, cars, car wheels, and engines, ship and boat-building, smelting, and brewing are the chief industries.

Under the revised charter of 1896 the government is vested in a mayor, elected for two years, and a unicameral council. Most of the administrative officials are appointed by the mayor, the comptroller, treasurer, and board of education, however, being chosen by popular vote. The city spends annually for maintenance and operation about $698,000, the largest items being: interest on debt, $228,000; schools, $164,000; electric light plant, $69,000; fire department, $47,000; police department, $35,000. The water-works and the electric light plant are owned and operated by the municipality. Tacoma was formed in 1883 by the consolidation of Old Tacoma (founded in 1868) and New Tacoma. New Tacoma, founded about 1869, was made the western terminus of the Northern Pacific Railway in 1873, was organized as a city in 1874, and became the county-seat in 1880. Population, in 1890, 36,006; in 1900, 37,714.

TACOMA, Mount. A peak of the Cascade Range. See Rainier, Mount.

TACON′IC MOUNTAINS, or **TAGHKANIC MOUNTAINS.** A low mountain range on the eastern boundary of New York State and occupying a small area in Massachusetts and Vermont (Map: Massachusetts, A 3). It extends from the Highlands east of the Hudson in a north-northeast direction, becoming gradually higher as it enters the northwestern corner of Massachusetts, and passes into southwestern Vermont, where it connects with the Green Mountains. Its highest peaks are Mount Equinox in Vermont, 3816 feet, and Greylock in Massachusetts, 3535 feet. It consists chiefly of metamorphosed Cambrian and Silurian rocks to which it has given the name Taconic System (q.v.).

TACONIC SYSTEM. A name applied by Emmons in 1842 to a series of rocks found in eastern New York, western Massachusetts, and Vermont, and considered by him to be of pre-Potsdam age because of their metamorphosed character and the supposed absence of fossils. It has been suggested by some that the term Taconic should be substituted for Cambrian. Consult: Emmons, *Geology of New York*, part ii. (Albany, 1842); Dana, "A Brief History of Taconic Ideas," in *American Journal of Science*, third series, vol. xxxvi. (New Haven).

TACTICS (from Gk. τακτικός, *taktikos*, relating to arrangement, especially in war, from τάκτός, *taktos*, arranged, from τάσσειν, *tassein*, to arrange), Military. The art of conducting and arranging troops on the battlefield, or in its immediate vicinity. Strategy (q.v.) strives to make all the conditions for the coming battle favorable, while tactics endeavors to realize what strategy has prepared for. The same principles apply in both, but tactics is more dependent on actual practice, while strategy is more of an art, derived from study, reflection, and genius.

Tactics not only demands from the individual officer understanding, comprehension, and genius, but in addition the masters of the art must be men of iron constitution and iron will. War alone can develop great soldiers—they are born, not made. But even they need preparation, education, and training—not to acquire theoretical knowledge, but to learn how to handle the tools of their art. Moreover, the great leaders need assistants, and these can be developed from the men of average ability, by the careful study of the use of the tools required, and practice with them and by the lessons of military history, bearing in mind that every case arising in war is an exception, and will never arise again, and not a general rule, which may be used as a model.

TACTICS OF INFANTRY.

Infantry, except during a single period, namely, the Era of Knights or the Age of Chivalry, has always been the *principal* arm, that is to say numerically the strongest, and in its action the most decisive, and ever since the introduction of firearms the infantry has been gaining in importance. It is the only arm which can act *independently*, that is without the assistance of the other arms, under all conditions of ground, weather, and other circumstances, in attack or defense, while in motion or when at rest, in closed or open order, with fire action or shock action; it can operate on all kinds of ground; it is more independent of circumstances than the other arms; in it movement and effective firing may be combined to a far greater extent than in the other arms; it can come into action more easily and readily; it is equally effective in attack and defense; it is more easily and cheaply equipped and maintained than the other arms; and it can be more quickly made efficient. But it is limited in its rate of movement, hence the advantage of combining cavalry with it; and in the range of its effective action, hence the advantage of combining artillery with it for battle, and cavalry for reconnaissance.

Infantry holds its high position mainly on account of its great fire-action combined with its capacity to utilize fully the configuration of the ground.

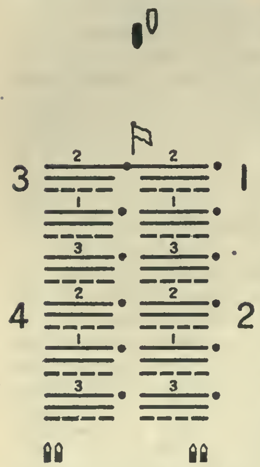
The fire of the present breech-loading rifle begins to make itself felt at 2500 yards, but does not become effective as aimed fire until about 1000 yards from the enemy; at 500 yards it is decisive, and at 300 practically annihilating. Constant improvement gradually increases these distances, and in the Boer War it was noticed that the British attack usually came to a standstill at 900 yards.

The perfection of firearms and the more extended utilization of the configuration of the ground have greatly increased the power and significance of fire-action. The introduction of an automatic firearm is now only a question of a comparatively short time, and this will still further increase fire effect. The bayonet attack, as an independent act, has ceased to exist; it can no longer overcome fire-action, but can only win the results of previous fire-action. The latter takes by far the longer time and makes the highest demands on the strength and endurance of the troops; moreover, its annihilating effect punishes promptly any rash resort to the bayonet, nevertheless the necessity for the bayonet remains; not indeed in hand to hand conflict, but as a threatening measure in the assault of a position, and because of the confidence it inspires and the power of the initiative which it confers. According to the great German tactician Meckel, "The laurel of victory still hangs on the point of the bayonet."

The power of infantry fire necessitates cover, and the utilization of the natural configuration of the ground to secure this has acquired vital importance. The crossing of open spaces is avoided as much as possible, or postponed to decisive moments; hence, the battle usually crystallizes around woods, villages, and groups of buildings. But in broad open fields, as in the United States, or where troops are opposed to each other in strong natural or artificial positions for a considerable time, artificial cover must be obtained, consequently intrenchment is resorted to, and an intrenching tool has become a necessary part of the soldier's equipment.

The formations in which infantry moves and fights are not the result of haphazard theory, but have grown out of the conditions of warfare, and their importance is attested by the fact that, in spite of the improvement in firearms, the losses in battle have become gradually smaller. Infantry can fight only when the distance from the enemy, or the available natural or artificial cover, permits it to fire, and effective fire can only be obtained when the soldier has room to use his arm freely, consequently this arm fights in open or dispersed order, the closed order being used only for troops in rear of the firing line. The greatest difficulty in leading infantry is the loss of control by the officers due to this dispersed order, and this can only be overcome by training, discipline, drill, and the example of the officers.

The tactics of infantry are designed to facilitate, as far as in them lies, that great object of every commander, namely, to make himself stronger than the enemy at the time and place of actual combat, and this can only be done by preserving unity of command, concerted action and mobility, combined with the least exposure of the men to loss. The formations in use attempt to fulfill these conditions, and the main principles governing in modern infantry tactics, are an individual training and instruction to develop a high degree of initiative combined with perfect subordination, the greatest development of fire in the firing line; a subdivision into fire units of such strength as to insure complete fire control by commanders; in the attack, pressure against the flank combined with a frontal attack; the reënforcement of the firing line by a succession of lines gradually closing to the front; and, if possible, the accumulation of a greater depth of forces opposite the portions of the enemy where the attack is to be concentrated.

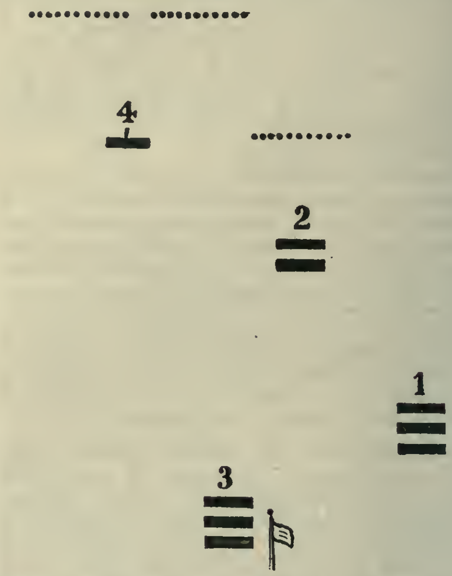


BATTALION DOUBLE COLUMN.

Colors; Battalion Commander; Adjutant; Company Commander; ● Platoon Commander.

The double column of the battalion (from which the column of march is usually deployed for battle). The larger numbers indicate the, companies, the smaller the platoons.

The front line in the attack is composed of the *fighting line* and its *reserve,* and the former is subdivided into the actual *firing line* and its *supports.* The battalion is the tactical unit and the front it covers, as well as the particular nature of the action, determines the number of companies it places in the fighting line. The battalion covers normally about 400 yards of front and a company about 100 yards. The progress of the attack will proceed in general outline somewhat as follows: Before entering the zone of artillery fire (or at about 3000 yards) each regiment forms from column of march into line; the battalions then designate the companies to form the fighting line and those to form the reserve; the companies of the fighting line then designate the sections for the firing line and for the supports. The best form of advance of the companies is in column of sections (half platoons). This line of columns is kept up as long as possible because in this formation the men are under the perfect control of their officers. Within effective infantry fire the column must deploy, since the bullet from the modern firearm can pass through two men at 1500 yards, and at 400 yards it can go through four men, so that the column, if preserved here, must expect heavy losses. In the attack closed columns cannot appear in open country within a range of 2100 yards. The successive lines, deployed in open order, or in company column of sections, depending on the effect of the enemy's fire, continue to advance. When within effective range, fire is opened, by volleys, or a designated number of rounds at will, the skirmishers halting to deliver their fire, then advancing again. In open country, within 1100 yards skirmishers can no longer remain standing. The supports gradually close on the firing line, deploy as skirmishers and begin to reënforce the firing line. Then begins the advance by rushes, by alternate subdivisions, and portions of the reserve are added to the firing line, the rest still held in reserve in rear of the point of main attack. The final act is the charge, the reserves being brought up to insure victory and hold the position. The engagement is in general decided at about 900 yards' distance.



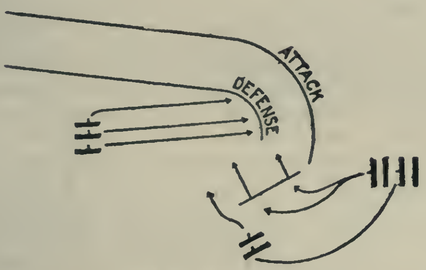
A BATTALION ON THE RIGHT FLANK OF A GENERAL LINE DEPLOYED FOR BATTLE.

On a war footing the companies have three platoons each. The numbers indicate the companies, the fourth having two platoons deployed.

This is the general picture, but the details are very various. Long lines of skirmishers can only advance or retire on lines perpendicular to the front, and changes of front are no longer possible after the open order is adopted; moreover, throwing out a skirmish line oblique to the front is dangerous, consequently the companies must first be placed on the front to be formed before deploying as skirmishers. The skirmish line, to avoid losses, is often compelled to advance at a run, and systematic rushes are possible only on the drill ground; in the field these rapid advances depend on the local conditions, especially the effect of the enemy's fire. The long line, at three or four thousand yards from the enemy, will pass over varied ground, part covered, part open; on the latter artillery fire will make itself felt here and there, and at such points the men will advance at a run, then halt under cover, or out of the zone of fire, to await the other parts of the line. These conditions will constantly change in all the different parts of the field.

The infantry attack is decided by fire-action, and to determine the number of skirmishers in the firing line, it must be remembered that there should be at least enough to prevent surprises, and not so many as to interfere with the commander's freedom of action, in case, for example, it should turn out that a considerable portion of the forces had been placed where they were not really needed. The further development of the fire-action will be determined by the points selected for decisive action, which cannot usually be determined beforehand.

One of the principal conditions for the success of the attack is that fire once opened should be kept up to about the same strength, and this again indicates the necessity for comparatively weak lines at first; on the other hand, the enemy should be met with superior forces from the beginning, and this superiority kept up. Between these two limits the commander must decide.



THE FLANK ATTACK.

The attack covers the entire front of the defense and has in addition sufficient troops for outflanking the right wing of the latter, and attacking him in a direction perpendicular to his front.

Decisive action is usually sought on a flank, but not necessarily an extreme outer flank of the line, for a modern skirmish line, from various causes, is very apt to have a number of inner flanks, which are also points of weakness. In the early part of the engagement the enemy must be forced to unveil his position, and then these interior flanks can be determined, and the commander may decide where to concentrate his forces, for superiority is desired only at the decisive points. The rest of the front can be held by comparatively weak forces. This also indicates the necessity for keeping as many troops as possible in reserve, but it must be borne in mind that the requisite number to insure superiority must be put in the firing line from the beginning, and this aside from all other considerations. The reserves must be added to the firing line in dispersed order, for the commander who hopes to force a decisive action by means of reserves in closed order disregards the effects of modern firearms. In an ideal action all the rifles are in use at the decisive moment, but this is not possible in long lines. Still, the troops remaining in close formation will find other uses. To cover a retiring skirmish line only those reserves can be used that stand far enough to the rear to be readily placed in a defensive position to which the line may fall back; if they are already on the way to the front they had better be thrown into the skirmish line, to turn the tide, if possible.

Breaking through the front of a line is a very difficult undertaking and hardly possible to-day. Consequently, the reserves should not be in rear of the centre, because they are of no use there, and would have to be kept so far in rear, to avoid the effects of the enemy's fire, that they might not enter the action in time. Their place is on one or both flanks, and so far beyond the flanks that they can enter the fight by a simple, direct forward movement, without any lateral gaining of ground. A regiment held in reserve, for example, should be placed in rear of the flank and about 600 yards beyond it. The main reserve is always behind the flank where the decisive action is expected to be brought about.

The regimental commander can only assign to each battalion its general duty; the execution must be left to the battalion commanders. On the defensive he assigns to each his section of ground, on the offensive his point of attack; and he lets go his control as fast as the circumstances require. The battalion commander, in the same way, gradually gives up control of his companies, and when once the battalion is deployed, he can only aid by caring for the supply of ammunition. A skirmish line fires only when at a halt, and the position taken depends on the range, but lying prone is now regarded as best because it gives the enemy's artillery no opportunity to get the range. Before opening fire the distance must be estimated, a difficult matter even for those well trained in it in time of peace. The skillful designation of the target also requires much practice. The firing may be by volley or at will, the former being advantageous when the range has been determined and the ground is suitable for observation of the fire, but in general is merely a drill-ground exercise of little practical use. The conduct of the fire and all fire control is in the hands of the company and subordinate commanders, and one of the most difficult duties of these officers is the observation of the effects of the fire.

These are the generally accepted principles of infantry tactics, but in the different States of Europe there are still considerable variations. The fighting front of a battalion, for example, varies from 200 yards in the Italian Army to 400 in the French, and the latter has practically abolished the supports for the firing line. In France and Russia fire is opened at great ranges, over 1900 yards; all the nations except Germany lay great stress on volley firing. Again, in France (and in the United States, as set forth in Wagner's *Tactics and Organization*, New York, 1895, officially approved), great attention is given to successive regular lines of attack, the first to introduce the action, the second to carry it out, and the third as a reserve: an indication of a love for theoretical forms, types, and systems in matters that are too elusive for such treatment, and which experience on the battlefield has shown to be very different in practice.

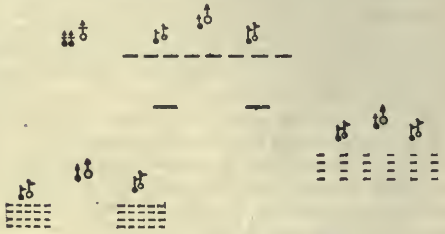
TACTICS OF CAVALRY.

The prominent characteristic of cavalry is *rapidity* of movement, and its greatest duty is the service of security and information: a cavalry which is superior to the enemy's in screening its own army and clearing up that of its adversary will more than pay for itself. Its duty next in importance is pursuit, as it alone is capable of overtaking and holding a retreating enemy till the arrival of the infantry. On the battlefield its use is important, but limited.

Cavalry is the arm of surprise, of sudden and vigorous attack; but its power of defense is comparatively poor, consequently it cannot hold for any length of time the ground it has gained. It is dependent to a great extent on the configuration and character of the ground, and its use in conjunction with the other arms is limited to favorable moments. Cavalry for its best and most effective action requires a broad, open country, and this is available only rarely on modern battlefields. For this reason, and on account of the increased range, rapidity of fire, and accuracy of firearms, cavalry can seldom decide battles.

Surprise is to-day absolutely essential for the success of a cavalry attack, but to seize the proper moment is very difficult, and requires constant watching of the progress of the battle, and even anticipation of the enemy's movements in order to place the cavalry in readiness to grasp the fleeting moment, ere it be too late; consequently the cavalry must often wait for hours, and even under fire, but of course this has its limits, and after a certain percentage of losses the cavalry must retire out of range, and thus give up temporarily any opportunities for attack that may possibly arise.

The true action of cavalry in battle has been shock action, its fire-action being quite subordinate, and employed mainly on the defensive. Under present conditions the precise sphere of activity for the arm in battle is a subject of much debate. Positions seized by an advancing cavalry may sometimes be held by its means until the infantry comes up, or it may be used to check the advance of the enemy; occasionally it may serve to support infantry. As a rule, fire-action of cavalry is delivered dismounted, but mounted fire-action, although rare, has been used with advantage in covering a retreat when the pursuit was very active. The formation of cavalry used in the attack is the line, composed of two ranks in Europe. At other times the cavalry is generally kept in columns. The line allows of the simultaneous use of the greatest number of weapons, but because of its unwieldiness the squadron front is not exceeded for any formations other than the attack. Columns serve to assemble the troops in a narrow space, and render movement up to the moment of attack easy; they must be open to facilitate forming line, with comparatively narrow front and full distances.



CAVALRY DIVISION DEPLOYED.

Division Commander; Regiment Commander; Battalion Commander;

Division Staff Officers; Regiment Adjutant; Battalion Adjutant.

The division represented is composed of three regiments, one of which is deployed in line; the regiment on the right flank is in line of squadrons in column of troops with extended intervals ready to deploy; the other regiment is massed in close column.

In the attack of *cavalry against cavalry*, victory can be gained only by the rapid assault of closed lines. In the advance of two opposed lines toward each other the respective lines will necessarily be more or less broken, the closed portions of the line still remaining on either side will penetrate the open places, both fronts will thus be broken through, and a hand to hand conflict begins. The extent to which either side retains closed lines up to the last will be of great effect on the result, hence the necessity of keeping closed and advancing with determination. The squadron commander can always take personal part in the attack, and the regimental commander can generally do so, but the brigade commander very rarely. The enemy should be kept uncertain as to the direction of the proposed attack as long as possible, so that he cannot prepare to meet the attack on his flank or rear, where it is usually directed. The principles applying to the subdivision of the forces are the same as for infantry. Enough men must be put into action at the beginning to insure success, and the first contact should decide the affair, consequently the forces directed against the flanks must be so directed from the beginning, and therefore must have an entirely different base from those directed against the front. In the front it will hardly be possible to put more men than the enemy has, and overlapping flanks will charge against nothing. More than necessary for decisive action should not be put in at first, because a reserve will be necessary to meet other approaching troops while the attack is going on. However, if all the troops are needed for the first effect then there can be no reserve, but one should be formed as soon as possible out of the reassembled squadrons. After the attack the action gradually changes into flight on one side and pursuit on the other, and the latter should be kept up till new infantry or artillery stops it, or the horses are exhausted.

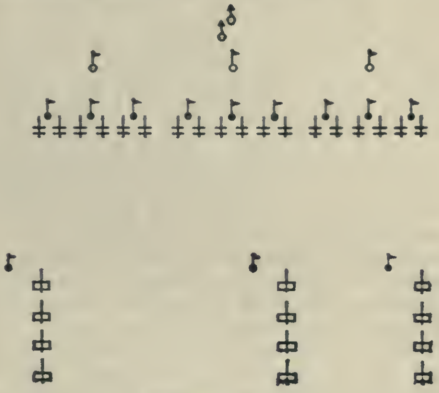
In the attack of *cavalry against infantry* victory can only result when the attack is so sudden that the infantry has no time to fire at all, or when the latter is badly demoralized by previous losses. *Cavalry against artillery* has a better chance for success, because a firing artillery line cannot protect itself toward the flanks, and in the early part of an engagement such unprotected lines will often be found. *Fighting on foot* enables cavalry to act for a time independently of the other arms, especially when it is supported by horse artillery, and is the only means by which cavalry can continue its advance through defiles, woods, or villages occupied by weak forces of the enemy. The action of dismounted cavalry is limited in general to holding particular points, such as defiles or villages, until the arrival of stronger forces. There are, however, instances where cavalry on account of their extreme mobility can be used advantageously in foot fighting, and modern tacticians are paying increased attention to this point. Such cavalry, however, must be distinguished from mere mounted infantry as they have a far wider tactical use.

The principal duty of the horse artillery attached to the cavalry is to support the latter since it can clear out the enemy from positions which a cavalry force would have hard work to take. In the attack of cavalry against cavalry horse artillery cannot always find application, but it can aid when its cavalry is deploying from a defile. While the opposed cavalries are still manœuvring the artillery takes the enemy's cavalry as its target, and pays no attention to its artillery unless its fire is masked by its own cavalry or to facilitate the deployment of its own cavalry. The artillery should be massed, but artillery duels to prepare the action would be absurd. There will probably be no time for any change of position until after the cavalry attack is decided, when the artillery takes part in the pursuit. In case of defeat it will not have time to take up a new position, but must remain firing in its previous position.

These are in outline the principles involved in cavalry tactics, though they are constantly undergoing modifications and the discussion of the true sphere and use of cavalry is a favorite topic for military authorities. In France more attention is given to theoretical forms, and the French tactics prescribe three lines for the division, the third being a reserve in the hands of the division commander, which is put into action only by squadrons and never entirely, except as a last resort; and the horse batteries are directed to form about 900 yards on the flank of the field of attack.

TACTICS OF FIELD ARTILLERY.

The artillery is the arm of destruction, and, on account of its great moral effect and the fact that it can reach troops in every part of the field, in all kinds of ground, and behind all artificial field cover, it is essentially the arm for preparing for the attack, demoralizing the enemy, and facilitating the work of the other arms. The use of artillery in masses is the great feature of a modern battle, and this use results from the long range of the guns, which enables them to do in one position that which formerly required a number. Its mass action begins the battle, prepares it, supports the action of the other arms, and ends it, and as an arm of pursuit artillery ranks with cavalry. The disadvantages of artillery are that it is tied for a considerable period to a particular position, and cannot act alone, consequently it is always an auxiliary arm. Moreover, it is cumbersome in its movement and defenseless when moving. It is also expensive and difficult to train. Leaving out of consideration the artillery of the seacoast and that used in the attack and defense of land fortifications, which have a tactics of their own, that is treated elsewhere (see COAST DEFENSE and FORTIFICATIONS, ATTACK AND DEFENSE OF), the artillery taken along by the field army may be divided into light artillery and heavy artillery, the former comprising field, horse, and mountain batteries, the latter guns of position. The field batteries include howitzer and mortar batteries for curved or high-angle fire. The formations of the artillery of practical use in the field are simply a formation for going into battery, and the formation *in battery*, ready for firing. To train the cannoneer for his arduous work under enormous strain, the greatest precision in accuracy in drill must be insisted upon, for the numerous duties of a cannoneer (setting the fuze accurately, also the sight for the range as well as deviation ordered, and the use of the trail in pointing), under a fire, which may burst shells near the battery as often as one a second from each of the enemy's batteries, require the highest order of discipline. Moreover, to regulate the fire properly, each shot must be observed, in order to correct fuze-setting and sight. All this demands a formation of the battery in a small space, so that the men may be directly under the eyes of their superiors, and the batteries must be able to move easily, under cover if possible, to their positions. Beyond the range of firearms the artillery can move in column of platoons, but within that zone it apears only in the open order (in line at full intervals) or in column of sections. Firing artillery always stands in the open order (*in battery*), and this formation in open order is also the best for advancing into position, where it can be used, but the column of sections will be more generally applicable in coming into position.



ARTILLERY BATTALION.

Battalion Commander; Gun;

Battery Commander; Caisson.

Platoon Commander and Chief of Caisson;

This illustrates the manner in which an artillery battalion of three batteries (of six pieces and four caissons each) comes into action. The rest of the caissons are concealed further to the rear.

The greater range of artillery naturally makes it the arm to open the battle, and the desire to rapidly overpower the enemy's artillery, in order that it may take under fire the point selected for attack by the infantry, or, on the defensive, the enemy's infantry during the attack (the real duty of the artillery), as naturally leads to the accumulation of the artillery in masses. The support of the infantry attack is the true purpose and the real duty of the artillery, and everything else is only a means for this end. Consequently, the object which the commander-in-chief has in view determines the time, place, and strength in which the artillery is first placed in position, and he also must give the orders therefor. The artillery should, of course, endeavor to utilize its long range, and if possible come into position beyond the range of the enemy's infantry fire, but since its main duty is to support the infantry, then, in order to give the latter prompt and effective aid, it must not hesitate to enter the zone of infantry fire, if required, because only when the *infantry* is beaten is the battle lost. On the other hand, it is the duty of the neighboring troops of other arms to protect the artillery against infantry fire. This does not, however, relieve the artillery from the duty of reconnoitring the ground, especially on the flanks, and artillery scouts or patrols (under energetic officers or non-commissioned officers) have become a necessity on the battlefield. The artillery, once in position, remains there, the losses being made good from the reserve, the ammunition train, and finally the drivers, while ammunition when exhausted can only be awaited. The battery is never relieved, but constantly strengthened and supported from the rear. Before occupying a position the ground must be carefully reconnoitred, and in selecting positions the principal condition is effective action, hence the target should be plainly visible; but more than that, a clear field of view is desirable because other targets may appear from time to time. This indicates that a line of heights is most suitable. Of course, in many cases some of the batteries will not be able to see the target, and when the enemy's artillery is superior a hidden position may be preferred; in these cases indirect fire must be used, but the problem of overpowering the enemy's artillery is thereby rendered very difficult. As to the distance from the enemy, it can only be stated "as near as possible," remembering that beyond 3200 yards shrapnel is not always effective, and observation of fire extremely difficult; moreover, the enemy's fire determines the inferior limit of a position. Nevertheless, *effect* is more important than *cover;* consequently, if artillery finds that its fire from a good covered position is not effective, it must enter the danger zone. The great masses accumulated on battlefields to-day limit the choice of position very much, and in most cases the problem will be less the selection of a position than making the best use of a given position.

The brigade commander rides over the ground, considers the available space, and with due regard to the targets to be taken under fire, decides what front will be occupied. The regimental and battalion commanders are then given their orders, and the latter indicate to the batteries their respective positions. The batteries then enter their position, keeping the roads as long as possible, and after that utilizing cover when practicable. On a line of heights the guns are placed in position close behind the crest, then moved up so that a man standing can just see the target. No battery opens fire until its guns are ready. In large masses it may be necessary to take up first a preparatory position under cover, so that, moved to the front, the batteries may open fire simultaneously, but this is rarely practicable. The direction of the fire is so arranged that brigade and regimental commanders merely indicate the target in general, while battalion commanders designate the special target for each battery and also decide on a change of targets; the ranging, selection of kind of firing, and the actual firing is left to the battery commanders. Changes of position are, in general, ordered only by the commander-in-chief, but in special cases the artillery must act on its own responsibility. In large masses this change of position takes place by echelons, portions of the line remaining in position and continuing the fire while others advance to the new position.

The attack of the infantry must be supported by the artillery in such wise that the former may overcome the enemy's infantry, consequently the artillery of the attack should be superior to the enemy's from the very first. This does not mean necessarily in numbers, because a smaller force by greater rapidity of movement into position and subsequent ranging may gain the upper hand of a large force. If a weaker artillery fears being overpowered it can await in a preparatory position the arrival of reinforcements, but this will not always be possible, because the circumstances may demand its coming into action at once. In this case the artillery endeavors to utilize the ground to the best advantage. In the attack on a prepared defensive front the entire artillery must be in position before opening fire. By superiority of fire is not meant the complete silencing of the enemy's artillery, but such an effect that, after the artillery duel, which first takes place, the enemy's artillery is no longer able to direct a destructive fire on the attacking infantry. As soon as the attacking infantry approaches too near the enemy the artillery must direct its fire on the ground beyond the objective, to prevent the advance of subdivisions from the rear. The principal duty of the artillery of the defense is to take the attacking infantry, even though it may have overcome by its fire the infantry of the defense, under such a hail of shrapnel as to cause its attack to break down. But in the beginning it will have to take up the artillery duel, and here it has the advantage of selecting and strengthening its positions. It will not do, however, to occupy its positions at the beginning, because if it should be forced to change it will lose all its advantages. Consequently, it takes up at first a preparatory position, until the direction of the attack becomes known, and this has the additional advantage of preventing the attacker from getting an insight into the defender's plans before the battle opens. The artillery of the defense, however, cannot devote all its attention to the attacker's artillery. Wherever the infantry of the attacker gains a strong foothold it must be taken under fire. As soon as the attacking infantry prepares for the final assault the entire situation changes, and the defender's artillery takes up its true rôle. The main effort is directed against the enemy's infantry, and his artillery is only kept occupied by a few guns. During the artillery duel the guns of the defense were kept under cover; now they must come out for their proper work. If the artillery of the defense is overpowered it may retire to be placed in position again during the infantry assault, but this will rarely be possible or effective. It is better to keep it in position, the men lying down for better protection, entering into action again at the decisive moment. Should the enemy's attack be successful, the batteries of the defense remain in position firing to the last, for the loss of the guns is no longer a disgrace on the battlefield, provided the situation demands it.

Every army will hereafter take into the field *batteries of position*, heavy batteries, for breaking down obstacles which the ordinary field artillery cannot deal with, and for which the arrival of the siege artillery material cannot be awaited. It must combine great power with a mobility sufficient to enable it to keep up with the troops. Since they are necessarily some distance behind the other troops on the road, the arrival of these batteries must be awaited. They are used very much like the field batteries, but in the selection of the positions there will usually be more freedom, and their duties and changes of position are ordered only by the commander-in-chief.

TACTICS OF THE THREE ARMS COMBINED.

For most efficient action all three arms are combined, although under certain circumstances and in small bodies infantry and cavalry can act alone, and under others only two of the arms are combined, as infantry and cavalry, infantry and artillery, and cavalry and artillery. The addition of artillery to the larger bodies of cavalry confers on the latter the possibility of preparing its attack by artillery fire and strengthening its line when fighting on foot; but the absence of infantry prevents it from fighting an infantry enemy in difficult ground, or in villages, woods, or intrenchments. It is therefore used mainly in reconnaissance and pursuit. The addition of artillery to infantry greatly increases the offensive and defensive power of the latter; but absence of cavalry prevents this combination from obtaining timely information of the enemy or properly screening the forces from his view. The addition of cavalry to infantry confers on the latter security on the march and in battle; but for reconnaissance or pursuit the presence of the infantry interferes with the mobility of the combination, and for battle it is weak in offense or defense, due to the absence of artillery.

The combination of the three arms is, therefore, the only complete one for the battlefield.

TROOP LEADING.

The principles of troop leading belong mainly in the domain of strategy; that of tactics is far more limited, because the subordinate commander usually receives the plan of operations from higher authority; nevertheless, he must often act independently. Every action of a commander should be based on a definite purpose, but often the original plan may have been based on false premises, because in war the circumstances are rarely clear. Even a division commander can rarely be fully informed of the condition of his entire division, much less an army corps commander. Moreover, after making dispositions, the conditions may have entirely changed since the receipt of the reports on which they were based, and this is particularly true of cavalry forces, where events succeed one another so rapidly. These are some of the difficulties a commander has to contend with. The position taken by the commander in person is of great importance. Aside from the moral effect the commander must be influenced by the theatre of war and must have his hand on the pulse of his army; finally, in the critical moments his position is at the front where the decisive action must take place. The headquarters may remain in rear, but the leader himself must be at the front. In spite of all the modern aids to reconnaissance and the transmission of reports, in spite of telegraph, railroad, bicycle, automobile, in spite of heliograph, balloon, and carrier pigeon, the veil covering the enemy has with time grown more and more impenetrable, due more particularly to the great masses involved in modern armies, the immense space covered, the greater rapidity of movement, and the increased effect of firearms. Still, the commander who decides to wait for definite information, especially as regards the strength of the enemy, will wait in vain. In this connection it must be remembered that the value of the initiative for the successful execution of an undertaking cannot be overestimated; it often makes up for a poor plan. The greater the sphere of action the more difficult it is to get a clear idea of the entire situation, for the commander must have in mind a definite conception of the state of affairs on the enemy's front, at the heads of his own columns, and of the entire field, and this must be derived from the innumerable messages and reports, regarding the enemy, his own troops, and the lines of communication, coming in from all directions. The picture is probably never perfectly true, but on the whole it must sum up the situation correctly, for on it are based the orders issued to the troops, and the latter must always aim at a *decisive* action. Considering all the difficulties, it is evident that even the ablest leader cannot attend to all the duties of his position personally, and requires assistants; in other words, a staff. The leader must be fully responsible for all his decisions; the rest of the work his staff must relieve him of. Especially does he need an officer to look over and arrange the incoming reports of reconnaissance, and in large commands this is placed under a separate bureau, where the dispatches are filed, and only the important ones, or a number of connected ones, placed before the commander. See STAFF.

In carrying out the various operations and manœuvres here described much depends upon the completeness and efficiency of the organization of the army, consequently the subject of organization is closely associated with tactics. Therefore, in this connection the reader should consult the article ARMY ORGANIZATION and the articles ARMIES; ARTILLERY; CAVALRY; INFANTRY; MOUNTED INFANTRY; STAFF; ADVANCE GUARD; OUTPOST; RECONNAISSANCE; and BATTLE. The various arms and materials of war mentioned will be found treated either under such collective titles as ORDNANCE and SMALL ARMS, or under their own heads.

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TACTICS, Naval. The science of arranging combinations, groupings, movements, and methods of handling of ships and other naval weapons, and the art of carrying these plans into effect. Roughly speaking, tactics may be said to solve the question 'how' a certain operation may be performed; strategy to furnish the reason 'why' it is likely to be desirable. They are necessarily mutually dependent; tactics only provides for effecting conditions found desirable by strategy; and strategy is confined to operations which are tactically practicable. In its broad sense naval tactics includes the manipulation of all naval weapons—the movements of a ship or of a fleet, the methods of mounting and placing guns and of handling them, the placing of torpedo tubes and their handling, etc. In a narrower and more usual sense it is understood to mean the handling of a ship and her weapons or of several ships, leaving the tactics of the gun *per se* to be included in *gunnery*, and those of the torpedo to be studied under *torpedo tactics*.

Of the abstract principles of strategy the most important is to oppose to the enemy at the point of contact a superior force. This may mean more powerful ships, numerical superiority, or a better arrangement for attack and receiving attack. The first point must be secured by superior design; the vessel's guns must be more powerful, better mounted, better protected, or she must carry more of them; or her protection or speed must be superior. Numerical superiority where the opposing ships are equal in number and supposedly equal in power may be attained only by good manœuvring and is likely to be only temporary; but a clever tactician and strategist would be likely to reproduce the inequality whenever opportunity offered. The best disposition of the fleet for attacking and receiving attack must depend upon many circumstances; advantage should be taken of the strong points of your own vessels and the weaknesses of the enemy's. For instance, the better protected ships should seek close action, the others avoid it; ships having heavy bow and stern fire should seek action compelling bow and stern fighting if the enemy is particularly weak in bow and stern guns but relatively strong in broadside fire, etc.

The battle tactics of to-day resemble more nearly those of the galley period than those of the epoch of sail, because steam, like manual power, enables any sort of combination of ships to be made and kept with reasonable precision. And the development of signaling has added to the facility of effecting these combinations, though the most experienced naval officers believe that after a fleet action has begun the changes of formation should be simple and few in number.

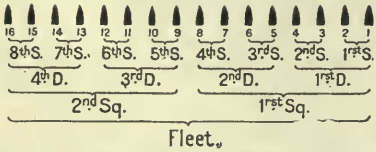

Fig. 1. FLEET IN LINE, NATURAL ORDER.
Showing numbers of section (S), division (D), and squadron (Sq).

There are three principal formations, *line* (Fig. 1), *column* (Fig. 2), and *echelon* (Fig. 3). In England line is frequently called 'line abreast' and column styled 'line ahead.' In Figs. 1 and 2, a fleet of 16 ships is shown divided into two squadrons of eight ships each. If the fleet consisted of 12 ships it might be divided into three squadrons of four ships each, or two squadrons of six. In the various navies of the world the subdivisions of a fleet are different. Some have units of two, others of three. In the United States Navy a *fleet* consists of two or more *squadrons;* a *squadron*, of two to eight ships; a *division* is half of a squadron which consists of more than five ships; a *section* is a pair of ships forming part of a division or squadron. Vessels, sections, divisions, and squadrons are numbered from van to rear when in column and from right to left when in line. When vessel No. 1 is lead-

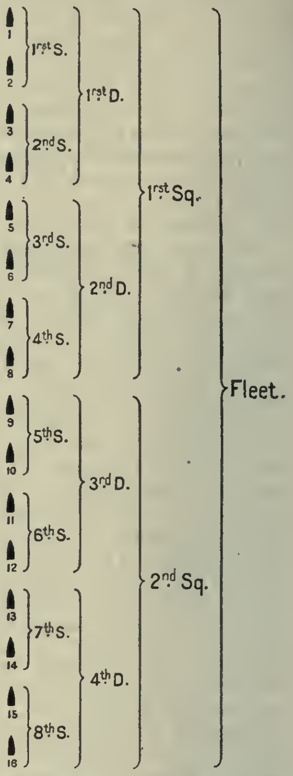

Fig. 2. FLEET IN COLUMN, NATURAL ORDER.
Showing numbers of sections (S), divisions (D), and squadrons (Sq.).

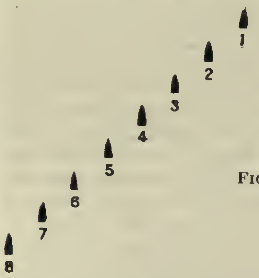

Fig. 3. SQUADRON IN ECHELON, NATURAL ORDER.

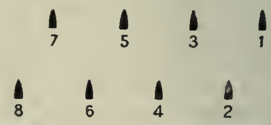

Fig. 4. SQUADRON IN INDENTED LINE, NATURAL ORDER.

ing in column or is on the right when in line the fleet is said to be in *natural order;* if vessel No. 16 is leading or on the right the fleet is said to be in *inverted order.* Vessels not intended for the line of battle are separately formed and manœuvred and constitute the reserve and auxiliary squadrons, according to their character or the circumstances of the case. Vessels which have a distinct fighting value but are not fast enough or powerful enough to join the fighting line would form the reserve; supply ships, colliers, repair ships, etc., would form the auxiliary squadron. The following terms are used:

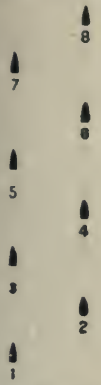

Fig. 5. Squadron in indented column, inverted order.

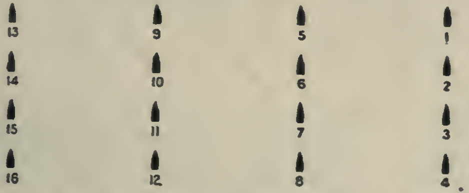

Fig. 6. Fleet in line of division columns, natural order.

About. A change of course of 180 degrees. *Advance.* Distance gained to the front in turning. *Alignment.* The direction of the line. *Arc of train or fire.* The angle through which guns may be trained or fired. *Column.* A formation in which vessels are in a line which is in the direction in which they are steering. *Double column* is a similar formation except that there are two parallel lines. In *indented column* the even-numbered ships are moved slightly to one side instead of being directly in rear of the odd-numbered ones. *Distance.* The linear distance (in yards) between the centres or foremasts of ships when in ordinary formation. *Half distance* is half this. *Double distance* is twice distance. *Echelon.* A formation in which the line of bearing of the ships makes an angle of about 45 e-

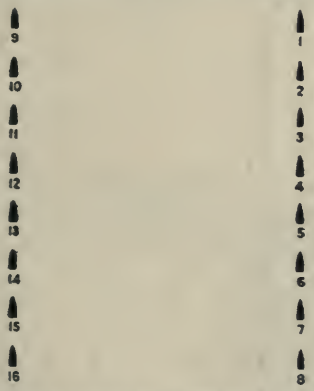

Fig. 7. Fleet in double column at squadron distance, or line of double column.

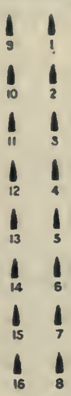

Fig. 8. Fleet in close double column.

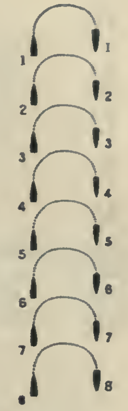

Fig. 9. 'Vessels, right about' (executed from column).

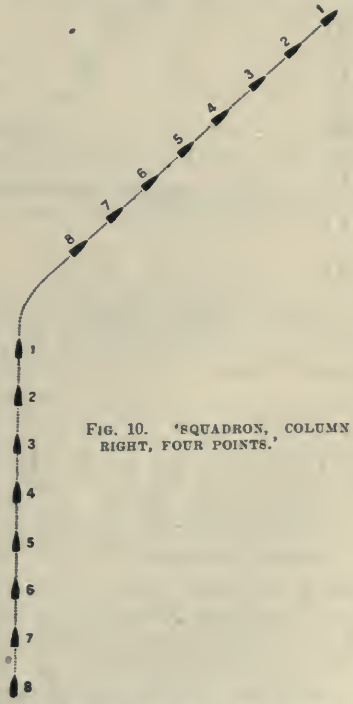

Fig. 10. 'Squadron, column right, four points.'

grees with the direction in which they are steering as in Fig. 3. *Evolution.* The combination of movements by which a fleet is changed from one formation to another. *Flank.* The sea to the right of the fleet is called the right flank; that to the left is called the left flank. *Formation.* The particular arrangement of the fleet. Simple formations are, column, line, echelon, etc. Compound formations are double column, line of division columns, etc. *Front.* The direction in which the fleet is steaming except when obliquing. The battle front is the direction of the enemy. *Guide.* The ship designated as the one upon which the formation is arranged for alignment and distance. *Interval.* The distance between divisions or squadrons when in compound formation. *Line.* A formation in which the line of bearing of the ships is at right angles to the direction in which they are steaming. *Line of Bearing.* An imaginary line passsing through the centres or foremasts of ships when in a particular formation. In compound formations each part has its own line of bearing. *Movement.* One of the component parts of an evolution. A movement is *simultaneous* when all ships execute it together, and *successive* when executed by each ship or group of ships in turn. *Oblique.* A change of course of less than 90 degrees. The ordinary oblique is three or four points. *Order.* The arrangement

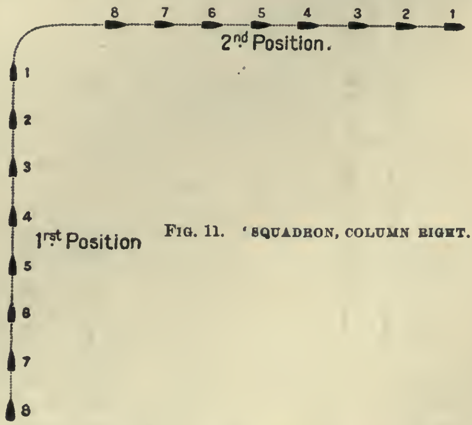

FIG. 11. 'SQUADRON, COLUMN RIGHT.'

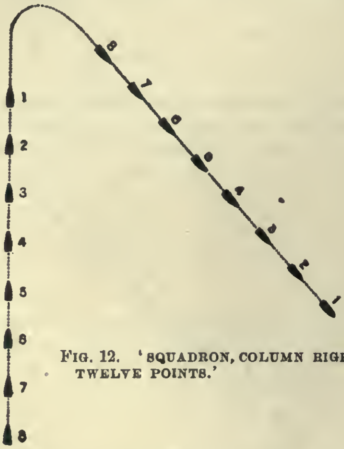

FIG. 12. 'SQUADRON, COLUMN RIGHT, TWELVE POINTS.'

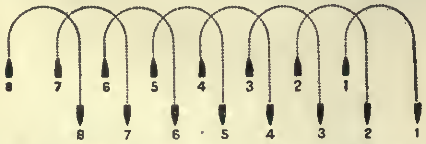

FIG. 13. 'VESSELS, RIGHT ABOUT' (EXECUTED FROM LINE).

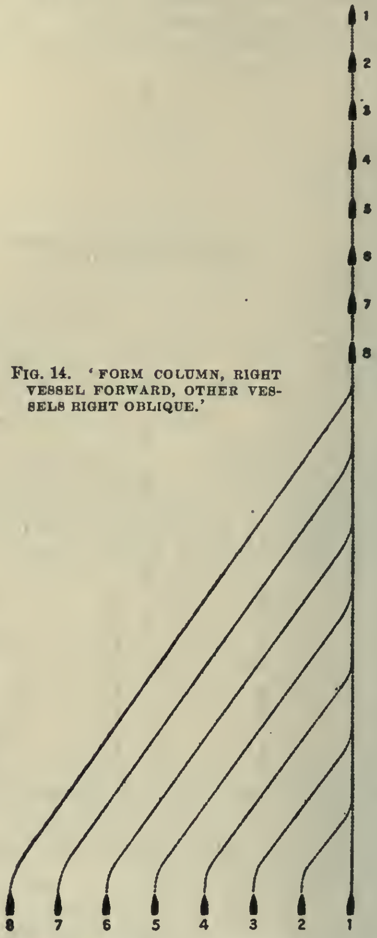

FIG. 14. 'FORM COLUMN, RIGHT VESSEL FORWARD, OTHER VESSELS RIGHT OBLIQUE.'

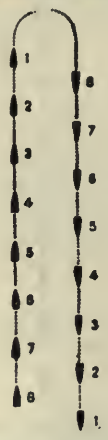

FIG. 15. 'SQUADRON, COUNTERMARCH.'

of the fleet (see above). *Point.* One thirty-second of a circle or 11¼ degrees. *Rear.* The direction opposite to the front. *Speed. Standard* or *battle speed* is that designated for battle or manœuvres. *Full speed* is a designated speed greater than standard; *half speed* is a designated speed less than standard; and *slow speed* is still less. *Tactical Diameter.* The perpendicular distance between the course at the beginning of a turn of 180 degrees and the course after the completion of the turn. *Transfer.* Distance gained to the right or left (i.e. toward the flank) in turning. *Turn.* A *turn* is a change of course of 90 degrees; a *half turn* is a change of 45 degrees. *Van.* The leading unit of a formation. *Wheel.* A movement in line in which the vessels preserve their relative positions but the line of bearing is revolved.

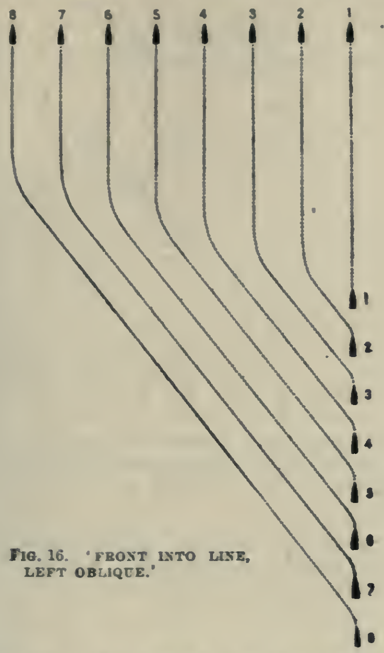

FIG. 16. 'FRONT INTO LINE, LEFT OBLIQUE.'

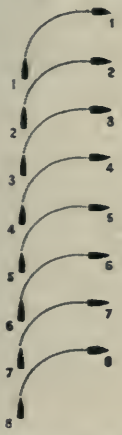

FIG. 17. 'VESSELS, RIGHT TURN.'
The manœuvre changes column to line in this instance.

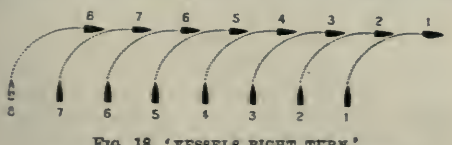

FIG. 18. 'VESSELS RIGHT TURN.'
In this manœuvre line is changed to column.

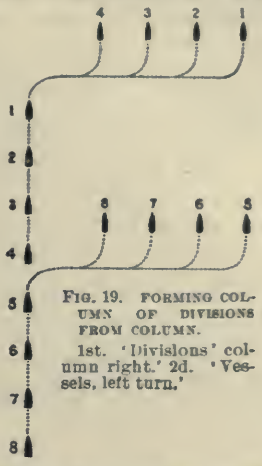

FIG. 19. FORMING COLUMN OF DIVISIONS FROM COLUMN.
1st. 'Divisions' column right.' 2d. 'Vessels, left turn.'

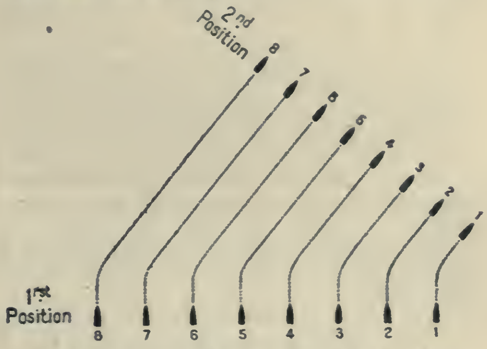

FIG. 20. 'SQUADRON, RIGHT WHEEL, FOUR POINTS.'
Executed similarly for any given number of points.

In performing evolutions there are two principal methods, by *rectangular movements* and by *direct* or *oblique movements.* Certain evolutions also admit of movement by *isodrome* and others by *conversion* or *wheel.* The ease of movement

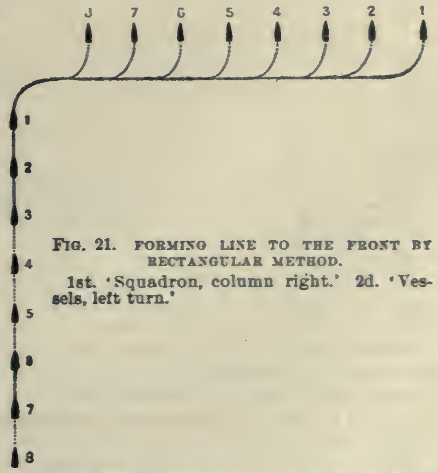

FIG. 21. FORMING LINE TO THE FRONT BY RECTANGULAR METHOD.
1st. 'Squadron, column right.' 2d. 'Vessels, left turn.'

attainable with bodies of men is not possible with ships. There can be no turning with fixed pivots, because ships must continue in motion or they cannot be kept under control; nor are sudden halts possible, for a heavy ship moving at high speed cannot be stopped in a less distance than several times her length. These and other considerations have led to the general acceptance of certain rules.

First.—Movements during battle should be as simple as possible.

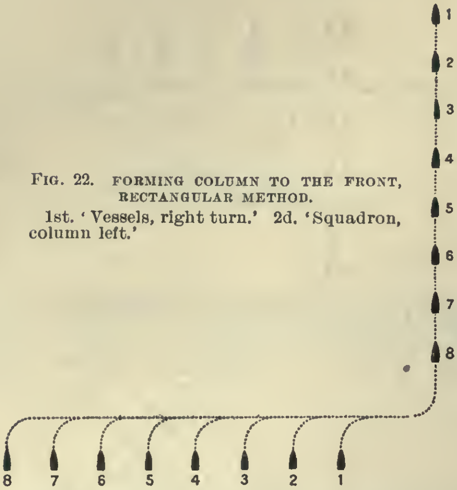

FIG. 22. FORMING COLUMN TO THE FRONT, RECTANGULAR METHOD.
1st. 'Vessels, right turn.' 2d. 'Squadron, column left.'

Second.—Changes in speed, particularly during evolutions, should be avoided as far as possible.

Third.—Evolutions should be performed by the method which requires the least time and the least space.

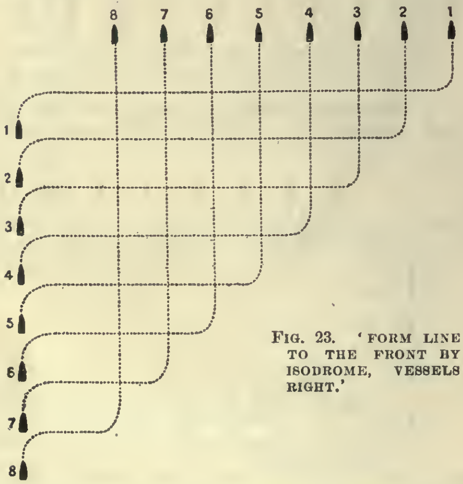

FIG. 23. 'FORM LINE TO THE FRONT BY ISODROME, VESSELS RIGHT.'

Fourth.—Ships of like characteristics should be separately grouped as far as possible; this is particularly true as regards speed and hardly less so as regards power and arrangement of battery and armor.

Fifth.—When approaching the enemy and until in position to deliver attack the fleet must be kept concentrated and in condition to assume any desired formation.

The accompanying figures show the various formations commonly used and the method of passing from one to the other. With the exceptions of Figs. 1, 2, 6, and 7, the plans show the movements of a squadron of eight ships; the evolutions would be similar for a fleet of sixteen ships.

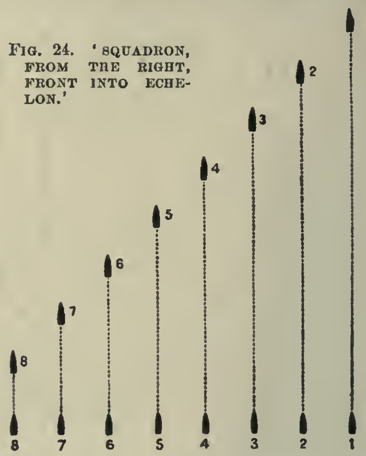

FIG. 24. 'SQUADRON, FROM THE RIGHT, FRONT INTO ECHELON.'

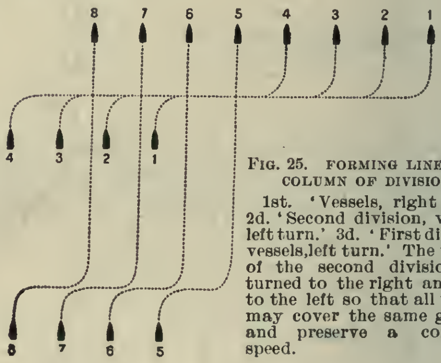

FIG. 25. FORMING LINE FROM COLUMN OF DIVISIONS.
1st. 'Vessels, right turn.' 2d. 'Second division, vessels, left turn.' 3d. 'First division, vessels, left turn.' The vessels of the second division are turned to the right and then to the left so that all vessels may cover the same ground and preserve a constant speed.

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TACUBAYA, tä′kōō-bä′yȧ. A Mexican town in the Federal District, the head of the prefecture of that name, three miles southwest of the City of Mexico (Map: Mexico, C 9). It is a fashionable suburb and is famous for its gaming establishments and handsome villas. It is pleasantly situated partly on a plain and partly on a hillside which is crowned by an ancient episcopal palace, now used as one of the national observatories. The population, in 1895, was 15,259.

TACUL′LI (Carriers). A tribe of Athapascan stock (q.v.) residing about Stuart and McLeod lakes, on the headwaters of the Peace and

Fraser rivers, in Central British Columbia. Their social organization was based on the clan system. Their canoes were neatly made from birch bark; they hunted during the winter season on snowshoes; and their women spun yarn from the hair of the mountain goat and also made a coarse pottery. They are all now Christianized through the efforts of French Catholic missionaries, who devised for their language a syllabic alphabet in which nearly all have learned to read and write, although they have no schools. They are gathered on small reservations, and they numbered about 750 in 1903.

The Déné syllabary, as it is called, is the invention of the Rev. Adrien Morice, who began his mission work among the Athapascan tribes of British Columbia in 1880. It consists of thirty characters, which by inversion of position and the use of accompanying dots or dashes can be made to indicate nearly two hundred distinct syllables or sounds common to the Taculli, Chilcotin, and other neighboring cognate languages. Its printed literature consists of text-books, religious works, and the *Carrier Review*, a monthly journal published by Father Morice at Stuart Lake.

TADEMA, tä′dĕ-mȧ, Alma-. An English painter. See Alma-Tadema.

TAD′MOR. Another name for Palmyra (q.v.).

TADPOLE (ME. *tadpolle*, *taddepol*, from *tadde*, *tade*, toad, AS. *tādige*, *tādie*, toad + *polle*, head, poll). The larval form of anurous amphibians. For its metamorphosis see Toad.

TAEL, tāl (Port. *tael*, from Malay *taīl*, *tahil*, weight, tael, from Hind. *tōla*, weight, from Skt. *tulā*, balance). The name commonly given to the Chinese *liang*, a money of account in China, and worth from .724 to .806 of an American dollar, but varying in value in different parts of the Empire.

TÆNIA. An animal parasite developed in the intestines of man and some animals. See Tapeworm.

TÆ′NIOP′TERIS (Neo-Lat., from Gk. *ταινία*, *tainia*, band, ribbon + *πτερίς*, *pteris*, fern). A genus of fossil ferns found in rocks of late Paleozoic and Triassic age. They have long leathery fronds of linguate form with entire margins, a strong central rib, and numerous closely parallel veins that run at right angles from the midrib to the margins. The fruiting frond is not known. See Fern.

TAENSA, tä-ĕn′sȧ, or **TENSA.** An historic American Indian tribe living, when first known to the French, about the year 1700, in seven villages between the Tensas River and the Mississippi, in the present Tensas Parish of Louisiana, about 20 miles from Natchez. Like the neighboring Natchez (q.v.), with whom they seem to have been closely connected, they were sun-worshipers and kept a sacred fire constantly burning in a temple. A part of the tribe, driven out by the Chickasaw (q.v.), was afterwards colonized by the French on the west side of Mobile Bay, in the neighborhood of Mobile, Ala., where the local name still remains. The settlement contained one hundred cabins about 1750. At a later period they removed higher up the Alabama River near the site of the present Tensaw. They were probably merged finally into the Choctaw or the Creek Confederacy. Nothing is known positively of their language, the *Grammaire et vocabulaire de la langue Taensa* by Haumonte, published in Paris in 1882, having been proved to be a transparent fraud. According to contemporary French testimony, however, the language was cognate with that of the Natchez.

TAFFETA (OF., Fr. *taffetas*, from Pers. *tāftah*, taffeta, woven, p.p. of *tāftan*, to weave). A term of somewhat general application in silk manufacture. It was formerly applied to all plain silks simply woven by regular alternations of the warp and filling (see Weaving), and is by some writers supposed to be the first kind of silk-weaving known even to the Chinese, from whom it came to us. Modifications have, however, been introduced, by varying the quality of the warp and filling, and by the substitution of various colors for the single one of the original taffeta. It has therefore become a sort of generic term for *plain silk*, and other silk fabrics, and even for some combinations of silk, wool, and other materials.

TAFFY. See National Nicknames.

TAF′ILET′. A large oasis in the northwestern part of the Sahara, belonging to Morocco, and situated at the southern base of the Atlas Range, 200 miles south of Fez (Map: Africa, D 1). Area, about 500 square miles. The chief product is dates, but the oasis is mainly important as one of the principal trading stations between Morocco and the Sudan. The oasis includes about 150 towns and villages, the largest and the most important commercial centre being Abuam. Population of the oasis, about 100,000.

TAFT, Lorado (1860—). An American sculptor, born at Elmwood, Ill. He was educated at the University of Illinois (Champaign, Ill.) and at the Ecole des Beaux-Arts in Paris (1880-83). In 1886 he became an instructor at the Art Institute of Chicago, and in 1893 a lecturer in the university extension department of the Chicago University. His works include statues of Schuyler Colfax (Indianapolis) and of General Grant (Fort Leavenworth, Kan.), and the sculptural decorations for the Horticultural Building of the World's Columbian Exhibition (1893).

TAFT, William Howard (1857—). An American jurist and administrator, son of Alphonso Taft, born in Cincinnati. He graduated at Yale in 1878, and at the Law School of Cincinnati College two years later. In 1881-82 he was prosecutor of Hamilton County, and later for a time was a collector of internal revenue. From 1887 to 1890 he was a judge of the Superior Court of Ohio, was Solicitor-General of the United States in 1890-92, and was a judge of the United States Circuit Court (sixth circuit) from 1892 to 1900, when at the request of President McKinley he resigned to become chairman of the commission appointed to establish civil government in the Philippines. The following year, on June 5th, he was appointed the first civil Governor of the islands. In 1903 Taft resigned this position to accept tne appointment of Secretary of War, as successor of Elihu Root. Consult: *American Monthly Review of Reviews*, vol. xxiv. (1901); and *The Outlook*, vols. lxiv., lxix., and lxx. See Philippine Islands.

TAGABALOYE, tä′gȧ-bȧ-lō′yȧ. A tribe of eastern Mindanao. See Philippine Islands.

TAGABAWA, tä′gȧ-bä′vä. A mixed people in Davao Province, southern Mindanao. See Philippine Islands.

TAGABELIE, tä′gȧ-bā′lȧ. A wild Malay people in southern Mindanao. See Philippine Islands.

TAGABELIE, tä′gȧ-bā′lė-ā. A wild Malay people in southern Mindanao. See Philippine Islands.

TAGAL, tȧ-gäl′, **TAGALA**, tȧ-gä′lȧ, **TAGALOG**, or **TAGALO**, tȧ-gä′lȯ. A Malay people of the Philippine Islands, having an alphabet and considerable culture in pre-Spanish times. They inhabit many provinces in middle Luzon, and form with the Ilocano (q.v.) and Visaya (q.v.) the bulk of the Filipino population. Their language and culture have spread among the other tribes. See Philippine Islands; Philippine Languages.

TAGANROG, täg′*a*n-rȯg′. A seaport in the Province of the Don Cossacks, Russia, on the northern coast of the Sea of Azov, 18 miles northwest of the mouth of the Don (Map: Russia, E 5). The harbor has now become very shallow and the trade of the town is decreasing. The principal export is grain. The total trade in 1899 was about $1,800,000. The manufacturing industries are well developed and the principal products are flour and tobacco. Population, in 1900, 60,678.

TAGBANUA, tȧg-bä′no͞o-ȧ. A Malay-Negrito people in Palawan Island and the Calamianes Archipelago. See Philippine Islands.

TAGHKANIC (tȧ-kä′nĭk) **MOUNTAINS.** See Taconic Mountains.

TAGLIACOZZO, täl′yȧ-kȯt′sȯ. A town in the Province of Aquila, Italy, 24 miles east by north of Tivoli, near which, on August 23, 1268, Charles of Anjou decisively defeated Conradin of Swabia (q.v.), the last of the Hohenstaufen.

TAGLIONI, tä-lyō′nė. An Italian family of ballet-dancers, of whom Filippo (1777-1871) was the first to attain prominence. He was born in Milan, became ballet-master, successively, at Stockholm, Cassel, Vienna, and Warsaw, and composed many ballets, of which *Sylphide* is the most noteworthy. His daughter Maria (1804-84), born at Stockholm, was connected successively from 1822 with the opera houses in Vienna, Paris, and Berlin, appeared with enormous success also on all the other principal stages of Europe, and in 1832 married Count Gilbert de Voisins. After her last appearance in London, 1847, she retired to Italy. Her brother Paul (1808-84), born in Vienna, performed successfully at Stuttgart, Vienna, and Paris, and in 1829 secured a permanent engagement in Berlin, where he was appointed ballet-director of the Royal Theatre in 1869. As a composer of ballets he earned world-wide reputation, especially with *Flick und Flock* and *Fantasca*. His daughter Maria (1833-91), born in Berlin, made her début (1847) in London, was for some time a great favorite at the Royal Theatre in Berlin, then at San Carlo in Naples, and married Prince Joseph Windischgrätz in 1866.

TAGOSASTI, or Togasasti. A shrub (*Cytisus proleferus albus*) of the natural order Leguminosæ. It is a native of the Madeira and the Canary Islands, where it is an important fodder plant and from whence it has been introduced into southern Australia. It is well adapted to dry soils and climates, but cannot be depended upon where there is danger of frost.

TAGUAN (East Indian name). A large Old World flying squirrel (*Pteromys petaurista*). Compare Petaurist.

TA′GUS (Sp. *Tajo*, Port. *Tejo*). The largest river of the Iberian Peninsula. It rises in the Sierra de Albarracin on the western boundary of the Spanish Province of Teruel, 88 miles east of Madrid, and flows in a general west-southwest direction through Spain and Portugal, emptying into the Atlantic Ocean shortly after passing the city of Lisbon (Map: Spain, D 2). Its length is 565 miles. In its upper course it traverses the arid steppes of New Castile, but at Toledo it plunges through a wild gorge between high granite cliffs. Farther west it again flows through sandy, level country, bordered by oak forests. About 40 miles above Lisbon it divides into two branches which inclose a low, marshy island, and which reunite in the Bay of Lisbon, an expansion of the river about 18 miles long and 5 miles wide. This bay is deep and sheltered, and forms one of the best harbors in the world. At Lisbon the river again contracts, and enters the ocean through a narrow and deep channel, which, but for the bar at the mouth, would be accessible for the largest ships. The river is regularly navigated 105 miles to Abrantes, but in Spanish territory navigation is impeded by rapids.

TAHAR′KA (?-c.668 B.C.). The name of the third King of Egypt of the twenty-fifth or Ethiopian dynasty, who ruled from about B.C. 694-693 to 668-667. He is the Tirhakah of the Bible, the Τάρκος, or Ταρκός, of Manetho, and the Tarqû of the Assyrian inscriptions. He seems to have been a usurper who seized upon the throne on the death of Shabataka, and strengthened his hold upon it by marrying the widow of King Shabako. In the Old Testament (Isa. xxxvii. 9; II. Kings xix. 9) he is said to have come to the aid of Hezekiah, King of Judah, when Jerusalem was besieged by Sennacherib. It would seem that no battle took place between the Egyptian and Assyrian forces, but that the latter, before they met, were forced to retreat by a pestilence. In B.C. 670 Esarhaddon, the son of Sennacherib, invaded Egypt, defeated Taharka in several engagements, sacked Memphis, and marched as far as Thebes, which surrendered to him. Taharka, in the meantime, retired to Nubia, but returned in the following year, and, deposing all the princes and other officers appointed by the Assyrian King, established himself in Memphis. Upon receipt of this intelligence, Esarhaddon gathered an army and was proceeding to the relief of his Egyptian vassals, when he died on the way. His army, however, continued the march and drove Taharka out of Lower Egypt. Retreating as far as Thebes, Taharka seized upon that city and was preparing to renew the contest when he died. Taharka was an active builder and memorials of him are found in many parts of Egypt and Nubia. At Napata (Jebel Barkal) he built a temple whose sanctuary was hewn out of the solid rock of the mountain, and he diligently restored the temples of Thebes, which he made his capital. Consult: Wiedemann, *Aegyptische Geschichte* (Gotha, 1884-88); Budge, *A History of Egypt* (New York, 1902).

TAHITI, tä′hē-tē *or* tȧ-hē′tē, or **OTAHEITE.** The largest of the Society Islands (q.v.), situated in latitude 17° 45′ S., longitude 149° 20′ W. Area. 402 square miles (Map: World, Western Hemisphere, L 6). The island consists of two unequal and nearly circular portions connected by a narrow isthmus. These are the remnants of old volcanoes, and rise in a succession of concentric terraces to the summits, the higher of which has an altitude of 7668 feet. The mountains are, however, very much eroded by numerous streams, which have cut large valleys and deep gorges down the slopes, leaving in many places isolated crags which make the scenery very romantic. The climate is warm, but equable, the temperature ranging from 60° to 90°. The rainfall is abundant, and the whole island is covered with a luxuriant vegetation. The central peaks are surrounded by a low strip of coastland consisting of volcanic detritus, which, mixed with coral sands from the surrounding reefs, makes an extremely fertile soil. Nevertheless agriculture is in a backward state, and only a few square miles of land are under cultivation. The population, in 1900, was 10,750. The chief town is Papéiti, the capital of the French establishments in the Eastern Pacific, with a cathedral, arsenal, hospital, and a population, in 1900, of 4282, about one-half of whom were French. For history and political and economic conditions, see Society Islands.

The Tahitians are typical Polynesians of the brown race. Many of them could be called handsome, and their general disposition is one of gayety with an undercurrent of cruelty and deceit, though their bad characteristics have, doubtless, been exaggerated. A remarkable institution of the Society Islanders was the Areois (q.v.), a society for the cultivation of poetry, the dance, and the drama combined with the indulgence of the sexual passion. Consult: Lutteroth, *O-Taïti* (Paris, 1843); Vincendon, *Iles Taïti* (ib., 1844); Buschmann, *Aperçu de la langue des îles Marquises et de la langue taitienne* (Berlin, 1843).

TAHITI APPLE. See Hog Plum.

TAHLEQUAH, tä′le-kwä′. The capital of the Cherokee Nation, Indian Territory, 80 miles northwest of Fort Smith, Ark. (Map: Indian Territory, J 3). It has the Tahlequah Institute, Cherokee Academy, male and female seminaries, and the Cherokee National Library. Tahlequah was settled in 1836 and was incorporated in 1889. Population, in 1900, 1482.

TAHOE, tȧ-hō′, Lake. A lake in the Sierra Nevada, on the boundary between Nevada and California (Map: California, C 2). It is 21 miles long and 8 miles broad, and lies at an altitude of 6225 feet. Its greatest depth is over 1500 feet, and its water is remarkably clear. It discharges through the Truckee River into Pyramid Lake, and it has been planned to draw its water through tunnels for irrigation purposes.

TAHPANHES, tȧ-pän′hēz (Heb. *Takhpankhēs*), or Tehaphnehes (Heb. *Tekhaphnekhēs*). A city of Northeastern Egypt mentioned in the Bible. It is probably to be identified with the town called by the Greeks Daphnæ, which was situated in the Delta about 25 miles southwest of Pelusium. Daphnæ was a military post of some importance in the time of Psammetichus I. (q.v.), who fortified it and established in it a garrison of Greek mercenaries. The site, represented by the modern Tell-Defenneh, was explored by Petrie in 1886. Consult Petrie, *Tanis*, Part ii. (London, 1887).

TAHR. See Thar.

TAILLANDIER, tȧ′yäN′dyȧ′, René Gaspard Ernest, commonly called Saint-René Taillandier (1817-79). A French writer on literature and history, born in Paris. He was professor in the Faculty of Letters in the university from 1863 and attracted general attention by his essays on the literature of Germany, among which were his *Histoire de la jeune Allemagne* (1848); as well as by his *Allemagne et Russie* (1856), a study made timely by the Crimean War. He wrote also *Scot Erigène et la philosophie scholastique* (1843); *Etudes sur la révolution en Allemagne* (1853); *La comtesse d'Albany* (1862); a critical biography of *Maurice de Saxe* (1865); *Dix ans de l'histoire d'Allemagne* (1875); and *Le roi Léopold et la reine Victoria* (1878).

TAILLE, tī′y′. In mediæval England and France, an arbitrary tax enacted by a seignior from his vassal. In France, specifically a tax originally imposed for the maintenance of the national defense, and one which in the course of time came to fall on the lower classes only, exemption from the tax being in fact the great mark of distinction between the privileged and non-privileged classes, the *taillables* and *non-taillables*. See Serf; France.

TAILLE, Jean de la. See La Taille, Jean de.

TAILOR-BIRD. One of a group of small Oriental thrushes or warblers of the genus Orthotomus, which stitch together leaves to sustain their nest. There are many species and allies, but the tailor-bird proper is *Orthotomus sutorius*, which is common in India and eastward about gardens. It has a back of olive green, is white beneath, the crown of the head is chestnut, and in the male two middle tail-feathers are greatly elongated. The bill is long and very straight and slender. Jerdon writes that it makes its nest of cotton and various other soft materials, and draws one leaf or more, generally two leaves, on each side of the nest, and stitches them together with cotton, either woven by itself, or threads picked up about a house. The process has been witnessed, however, by few competent observers. The fullest account extant is in Hume, *Nests and Eggs of Indian Birds* (London, 2d ed., 1890). The birds of a related genus, Cisticola (see Fantail), "ply the same trade on stems of grass, confining them by stitches above the nest, which is built among them and takes a globular form." See Plate of Pensile Nests of Birds accompanying article Nidification.

TAINAN, tī′nän′. A city of southern Formosa, known as Tai-wan fu until 1886, and the capital of the island until 1896. It is on a level plain of considerable extent, 3 miles east of Formosa Channel, with which it is connected by a canal. Its walls have a circuit of about 6 miles and inclose many open spaces, the principal markets being in the western suburbs, where most of the business is done. The Dutch made it their capital in the seventeenth century. Tainan was a treaty-port under Chinese rule, and under Japanese control it has the same status. It has three steam sugar mills and one rice mill. Population, about 140,000. The foreign population is very small.

TAINE, tân, Hippolyte Adolphe (1828-93). A French historian and critic of literature and art, born at Vouziers, April 21, 1828. He went to Paris in 1841, entered the Ecole Normale in 1848, where he showed much independence and restiveness under its philosophic eclecticism. In 1851 he was appointed to the chair of philosophy at the College of Toulon, but he immediately resigned, studied medicine and the sciences, and so brought himself into touch with the spirit of the rising generation, with whom his essays on *La Fontaine, Livy,* and *Les Philosophes français du XIXème siècle* (1853-56) won immediate recognition, while his *Voyage aux eaux des Pyrénées* (1855) showed his mastery of orderly and minute observation. Thus he compelled recognition, and the Government that had thought him dangerous in 1854 made him professor in the Ecole des Beaux-Arts in 1864. Here he gave several series of lectures on the history of art that are models of philosophic criticism, and, applying the same principles in another field, published a monumental *Histoire de la littérature anglaise* (1864). Then followed *Idéalisme anglais* (1864); *Positivisme anglais* (1864), the latter a study of J. S. Mill; *Philosophie de l'art* (1865); *Philosophie de l'art en Italie* (1866); *Voyage en Italie* (1866-72); *L'idéal dans l'art* (1867); the cynically amusing *Notes sur Paris* (1867); the important *De l'intelligence* (1870); *Notes sur l'Angleterre* (1872); and finally his greatest work, *Origines de la France contemporaine,* consisting of *Ancien régime* (1875), *La Révolution* (1878-84), and the *Régime moderne* (1890). A *Life and Letters of H. Taine* (1828-52) was published in French and in English in 1902.

Taine was the theorist of naturalism, of immense yet systematized erudition, and of a logic that was almost mechanical. He represents in criticism the scientific spirit that was making itself felt almost simultaneously in all branches of French intellectual activity, in the poetry of the Parnassians, the philology of Renan, the fiction of Flaubert, the dramas of the younger Dumas, the high art of Meissonier, and the low art of Forain. The analytic, meticulous spirit of his generation found in his "little facts, well chosen, important, significant, amply substantiated, minutely noted, the material of every science." He sought to make psychology, æsthetics, and literary criticism into exact sciences, capable of rigorous analysis and systematic deduction. Physiology determined psychology, environment was the cause of literary evolution. Moral standards fell under the same dissection. "Virtue and vice are products like vitriol and sugar." His is always the interest of the naturalist, not of the artist. The style was like the man and like the philosophy, grave, sincere, simple, almost always serene. There is in his work hardly a trace of irony, of strain or of enthusiasm, none at all of sentimentality or of mysticism. His system may not have been deep, but it was wonderfully opportune, and Taine was a guiding light to the intellectually productive men of France almost until his death. Oxford gave him an honorary degree of LL.D. in 1871. He was tardily elected to the French Academy in 1878, and died in Paris, March 5, 1893. Most of his works have been translated into various languages. Consult: Bourget, *Essais de psychologie contemporaine,* vol. i. (Paris, 1887); Lemaître, *Les contemporains,* vol. iv. (ib., 1890-92); Monod, in *Contemporary Review* (London, 1893); Margerie, *Hippolyte Taine* (Paris, 1894); Boutmy, *Taine, Scherer, Laboulaye* (ib., 1901); Tiraud, *Hippolyte Taine* (ib., 1901).

TAI-NGAN FU, tī′nän′fo͞o′. A departmental city of the Province of Shan-tung, China, situated at the foot of the famous Mount Tai (see Tai Shan), 60 miles south-southeast of Tsi-nan fu, the capital of the province. The importance of Tai-ngan is due chiefly to the immense numbers of pilgrims who come to visit Mount Tai. Its suburbs on the south and west, however, are large, populous, and prosperous. The most important of the numerous temples of Tai-ngan is the Tai Temple, covering several acres, surrounded by a strong wall and containing many fine old cypresses. Population, with suburbs, about 80,000.

TAI-PEH, tī′pā′, or **TAI-PAK**, tī′päk′ (pronounced by the Japanese *Dai-hokŭ,* dī′hok′o͞o). The capital of the Japanese island of Formosa (q.v.). It is a small walled city, about 13 miles from Tamsui (q.v.), with which it is connected by rail, as well as with Kelung (q.v.). Near it is found the large and populous town of Bangka or Mangka, the centre of the tea trade. The total population of Tai-peh proper and of the suburbs is estimated at over 100,000, including nearly 6000 Japanese.

TAI-PING (tī′pĭng′) **REBELLION** (abbreviation of Chin. *t'ai p'ing chao,* great peace dynasty). The name given by foreigners to the uprising which threatened the overthrow of the Chinese Empire (1850-64). See Chinese Empire (*section Modern History*) and Hung Siu-Ts'euen.

TAIRA, tä′ê-rä. A Japanese clan of Imperial descent, one of the four great families, Fujiwara, Minamoto, and Tokugawa being the others, which have been most distinguished in the history of Japan. The Taira family was established in the ninth century, when some of its members were given the control of provinces in the west. In 814 another house, the Minamoto, also of Imperial descent, had been put in control in the east. For centuries the Taira and the Minamoto were content in their respective spheres, but in the twelfth century they came into conflict over the succession to the Imperial throne. The head of the Taira was Kiyomori, a man of great ability and of large experience in warfare. He was successful in his plans, defeated the Minamoto, and made himself supreme in the Empire. He took the office of Prime Minister from the Fujiwara family, married his daughter to the Emperor, filled all important offices with his clansmen, humiliated the Fujiwara nobles, and attempted the extermination of the Minamoto family. After his death in 1181 the Minamoto clan obtained possession of the eastern part of Japan, and then of Kioto. The Taira retreated westward, were pursued by Yoshtsune, and finally defeated in 1185 in the sea fight of Dan-no-Ura.

The clan was all but exterminated and never regained its importance.

TAIRA. A South American weasel-like carnivore. See Tayra.

TAI SHAN, tī′ shän′. The most easterly of the Five Yo or great sacred mountains of China whose worship goes back into the fabulous period of Chinese history. It is a great massive complex of rugged limestone ridges, buttressed on the east and southeast by the mountains and hills which cover most of the Shan-tung peninsula. Its highest peak is 4111 feet above the level of the sea. It is about 60 miles south-southeast of Tsi-nan fu, the capital of Shan-tung (q.v.), and is thickly dotted, especially on the south side, with both Buddhist and Taoist temples, monasteries, and pavilions. It is annually visited by tens of thousands of pilgrims from all parts of the country.

TAIT, Archibald Campbell (1811-82). Archbishop of Canterbury. He was born in Edinburgh, and was brought up as a Presbyterian. During his studies at the University of Glasgow, to which he went in 1827, he determined to enter the ministry of the Church of England, and went up to Balliol College, Oxford, in 1830. He took his degree there in 1833, was elected fellow in 1834, and ordained in 1836. He steadfastly refused to be carried away by the Oxford Movement, and joined with three other tutors in a famous protest against the principle involved in Tract XC. In 1842 he succeeded Dr. Arnold as head master of Rugby, which he left in 1850 for the deanery of Carlisle. In 1856 he became Bishop of London, and, amid the difficulties of times full of bitter controversy, won the respect of all by his courage and impartiality. The same may be said of his administration of the still more difficult post of the primacy, on which he entered at the beginning of 1869. He took a tolerant position toward the ritualists throughout the excitement which caused the passing of the Public Worship Regulation Act in 1874, and on all questions showed independence and firmness. Consult his biography by Davidson (afterwards his successor) and Benham (London, 1891).

TAIT, John Robinson (1834—). An American landscape painter and author, born in Cincinnati, Ohio. He studied art in Florence, Düsseldorf, Munich, and the Tyrol. He wrote a German comedy *Ein aufrichtiges Heiratssgesuch*, and, in English, *European Life, Legends, and Landscape* (1859). His paintings, several of which were exhibited at Philadelphia in the Centennial Exhibition, include "Siebengebirge," "Under the Willows," "Tyrolean Cottage," and "Landscape and Cattle."

TAIT, Peter Guthrie (1831-1901). A Scotch physicist, born at Dalkeith, Scotland, and educated at Edinburgh University and Peterhouse, Cambridge, where he was made a fellow in 1852. He was appointed professor of mathematics in Queen's College, Belfast, in 1854, and was professor of natural philosophy in the University of Edinburgh from 1860 to the time of his death. He carried on many important investigations in mathematics and physics, particularly on the mathematical and theoretical side of the latter science. His most famous work in mathematics was on quaternions, while his studies in thermodynamics and thermo-electricity were of unusual value. His papers on the kinetic theory of gases are among his many important contributions to science and his various works cited below are marked by conciseness and lucidity of statement. He was the author of: *Dynamics of a Particle* (1865); *Elementary Treatise on Natural Philosophy* (1867), with Lord Kelvin (then Sir William Thomson); *Quaternions* (1867); *Thermodynamics* (1868); *Recent Advances in Physical Science* (1876); *Heat* (1884); *Light* (1884); *Properties of Matter* (1885); *Dynamics* (1895); and other works, including *Scientific Papers* (1898) and Newton's *Laws of Motion* (1899). He also wrote in coöperation with Professor Balfour Stewart *The Unseen Universe*.

TAITTIRIYA, tī′tė-rē′yȧ (Skt., from *Tāittiri*, name of an ancient Hindu sage). The title of a school of the Yajur-Veda and of the redaction of the Yajur-Veda itself, which belongs to that particular school. See Veda.

TAIWAN, tī′wän′ (Chin., terraced bay). The name by which the island of Formosa (q.v.) is known to both the Chinese and Japanese.

TAI-YUEN FU, tī′yo͞o-ĕn′fo͞o′. A walled city of China, capital of the Province of Shan-si. It stands between loess-covered hills near the head of a fertile plain 30 to 40 miles wide, about 70 miles long, 3000 feet above the level of the sea. Both coal and iron are worked near the city on the west, and there are silver mines about 65 miles north. The coal is bituminous and is of fine quality. The city consists, like Peking, of an 'inner' and an 'outer' city, the 'inner' on the north and the 'outer' on the south. The former measures 2⅔ miles by 1⅔, is surrounded by walls of moderate height, and has eight gates with towers over each and on the corners. The outer city is surrounded by mud walls, with three gates, one of which is kept closed for Imperial use. There is no extra-mural population. Among the buildings worthy of mention is the *Wan-Show Kung*, or 'palace of ten thousand ages,' arranged as a temple, roofed with yellow tiles, and containing one room, in which is the Imperial tablet. There is an Imperial gun and cannon foundry here. Population, 200,000.

TAJIKS, tȧ-zhēks′. The term applied particularly to the rural population of Eastern Persia, and generally to their representatives and congeners scattered from Constantinople to the borders of China, and from Orenburg to the Indian Ocean. It is sometimes more of a descriptive than a racial epithet. There are 'mountain Tajiks' and 'Tajiks of the Plain'—the Galchas (q.v.) of the Pamir being also known as 'mountain Tajiks.' The Tajiks are rather above the average in height, brachycephalic, and show traces of Turkish intermixture. It is possible that the Galchas and Tajiks may represent an Asiatic section of the so-called Alpine race of Western Europe. Both peoples are thus Aryan intruders into their respective areas, who have more or less mingled with the preëxisting non-Aryan population. Consult: Ujfalvy, *Les Aryens au nord et au sud de l'Hindou Kouch* (Paris, 1896); Houssay, *Les races humaines de la Perse* (ib., 1887).

TAJ MAHAL, täzh mȧ-häl′ (Pers., Crown of Mahal). A white marble mausoleum a mile east of Agra, India, built by Shah Jehan as a burial place for his favorite wife, who died in 1629. It is said to have occupied twenty-two years in building and its cost is variously stated at from $9,000,000 to $60,000,000. The building is octagonal, with sides of 130 feet and a height of 70 feet. It is surmounted by a dome which rises to the height of 120 feet above the roof, and is flanked by four minarets 133 feet high. In the central chamber, above the vault containing the bodies of the Emperor and his wife, are two cenotaphs surrounded by a fine marble screen. The exterior of the mausoleum is covered with arabesques and passages from the Koran in mosaic.

TAKAMATSU, tä′kȧ-mät′sōō. The capital of the Prefecture of Kagawa in Japan, on the northern coast of Shikoku (Map: Japan, D 6). It was formerly the seat of a daimio and has a fine landscape garden in its southern suburb. Population, in 1898, 34,416.

TAKAOKA, tä′kȧ-ō′kȧ. A town in the Prefecture of Toyama, Central Hondo, Japan, 10 miles by rail northeast of Kanazawa (Map: Japan, E 5). It manufactures dyes and hardware. Population, in 1898, 31,490.

TAKASAKI, tä′kȧ-sä′kė. A town in the Prefecture of Gumma, Central Hondo, Japan, situated 63 miles by rail northwest of Tokio (Map: Japan, F 5). It has manufactures of cotton and silk. Population, in 1898, 30,893.

TAKASHIMA, tä′kȧ-shē′mȧ. A small island of Japan, about eight miles southwest of the entrance to the harbor of Nagasaki (Map: Japan, J 2). It is noted for its extensive coal mine, which has been worked since the middle of the eighteenth century.

TAKATA, tȧ-kä′tȧ. A town in the Prefecture of Niigata, Northern Hondo, Japan, 42 miles by rail north of Nagano. It has extensive manufactures of cotton goods (Map: Japan, F 5). The town was formerly the residence of the daimio of Sakakibara belonging to one of the most noted feudal families of Japan. Population, in 1898, 20,315.

TAKIN, or Gnu-goat. A goat-like animal (*Budorcas taxicolor*) of Eastern Thibet, allied to the serow (q.v.), but having horns (in both sexes) bent at right angles, and resembling those of a gnu. Little is known of its habits.

TAKOW, or **TAKAO,** tä′kou′. A village on the west coast of Formosa thrown open in 1864 by the Chinese for foreign residence and trade and continued as a treaty-port by the Japanese (Map: Japan, E 9). It lies 20 miles south of Tainan (q.v.), with which it is connected by rail, and on the edge of a fertile plain inhabited chiefly by immigrants from Kwang-tung, and producing good crops of rice, sugar, etc. The trade of the port is not very important, but there is a considerable export of sugar. Population, estimated at 7000.

TAKU, tä′kōō′. A village in the Province of Chi-li, Northern China, near the mouth of the Pei-ho, 30 miles east of Tien-tsin (Map: China, E 4). It is known for its strong fortifications, which were taken by the British and French fleets in 1858-60 and by the allied troops on June 17, 1900, during the Boxer uprising.

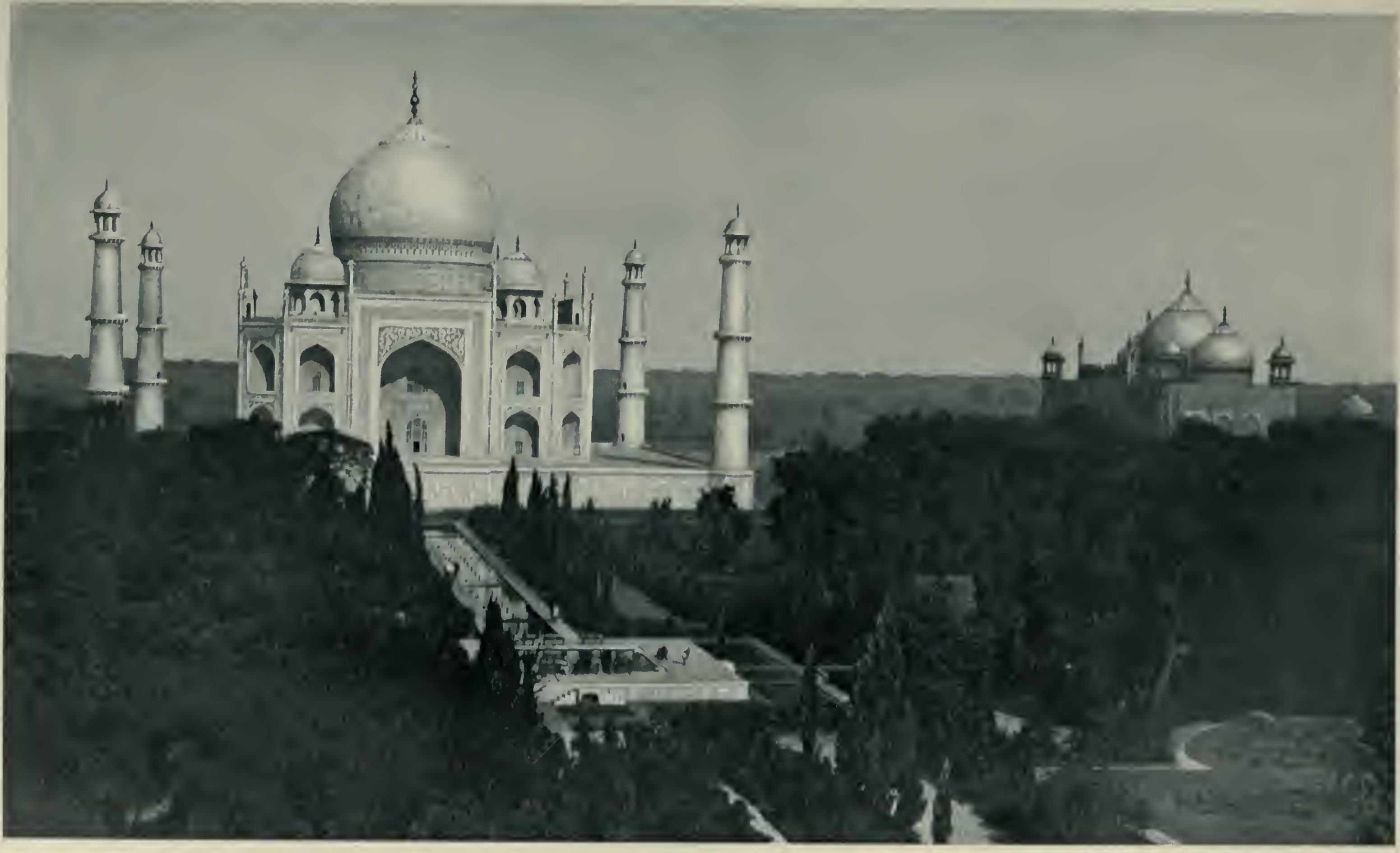
TALAING. See Mons.

TALAVERA DE LA REINA, tä′lȧ-vā′rȧ dȧ lȧ rā′ė-nȧ. A town of New Castile, Spain, in the modern Province of Toledo, 68 miles southwest of Madrid, on the Madrid-Valencia de Alcântara Railroad (Map: Spain, C 3). It is charmingly situated on the right bank of the Tagus, which is here spanned by a quarter-mile bridge of 35 arches. The town is in a fertile, well-watered valley. Its former silk-weaving industry is now fast disappearing, but the town contains important potteries, and cloth, hat, leather, soap, and varnish factories. Its population in 1900 was 9990. An important battle took place here July 27 and 28, 1809, in which Wellington defeated the French under Joseph Bonaparte, Jourdan, and Victor.

TALBOT. The name of an ancient breed of white dogs, also called 'old Southern hound,' from which have descended many of the modern breeds. The talbot probably derives its name from the ancient family of Talbot, whose coat of arms bears the figure of a dog. See Hound.

TALBOT, tạl′bŭt, Charles, twelfth Earl and only Duke of Shrewsbury (1660-1718). An English statesman. He was the son of the eleventh Earl, his mother being the notorious Anna Maria Brudenell, the mistress of the Duke of Buckingham, who in a duel killed Charles's father. He was educated as a Roman Catholic, but after the 'Popish Plot' attached himself to the Anglican Church. Although a prominent official at the coronation of James II. in 1865, he was one of the seven noblemen who invited William, Prince of Orange, to England. He was active in securing the success of the Revolution, and was Secretary of State for the northern province from 1689 to 1690 and again in 1694, on the latter occasion being made a Knight of the Garter and created Marquis of Alton and Duke of Shrewsbury. In 1710 he was appointed Lord Chamberlain by Queen Anne, in 1712 Ambassador to France, and in 1713 Lord Lieutenant of Ireland. Two days before her death in 1714 the Queen appointed him Lord High Treasurer. Under George I. he became Lord Chamberlain. His ducal title became extinct at his death in 1718.

TALBOT, John, first Earl of Shrewsbury (c.1388-1453). An English general of Welsh descent. Henry V. appointed him Lord Lieutenant of Ireland in 1414, where he was engaged in subduing some of the septs and in other military operations. In 1419 he went to France and took an active part at the sieges of Melun and Meaux and in the battle of Verneuil. In 1424 he received the Order of the Garter, and again became Lord Lieutenant of Ireland under Henry VI. In 1427 he again returned to France, and after numerous successes in Brittany was taken prisoner at Patay in 1429 by Joan of Arc. The ransom demanded for his release was so high that he did not regain his freedom until 1433, and then by exchange. In 1442 he was created Earl of Shrewsbury, and in 1446 Earl of Waterford, Lord of Dungarvan, and Steward of Ireland. With the exception of an interval of rule in Ireland from 1445 to 1447, the rest of his life was spent in France, where he was distinguished for the audacity and daring of his military exploits, and where he was killed at the battle of Castillon in 1453.



THE TAJ MAHAL

TALBOT, John (1645-1727). One of the early Church of England missionaries in America. He was rector of Freetherne, but resigned his living to come to America with the first missionaries sent by the Society for the Propagation of the Gospel. He was the founder and first rector of Saint Mary's Church, Burlington, N. J., and labored diligently there and in other colonies. There is considerable evidence for believing that he was consecrated bishop by the Nonjurors (q.v.) in 1722, as well as Robert Welton, who for a time was rector of Christ Church, Philadelphia—sixty years before Seabury obtained consecration from the Scottish bishops. Talbot is said occasionally to have assumed the episcopal dress, and to have administered confirmation privately. Consult: Hills, *History of the Church in Burlington* (2d ed., Trenton, 1885); id., *John Talbot, the First Bishop of North America* (ib., 1878).

TALBOT, Richard, Duke and Earl of Tyrconnel. Viceroy of Ireland in the reign of James II. See Tyrconnel, Richard Talbot, Duke and Earl of.

TALBOT, Silas (1751-1813). An American naval officer, born in Dighton, Mass. He was engaged, as a boy, in the coasting service, and in June, 1775, after the outbreak of the Revolutionary War, entered the American Army as lieutenant, serving at Boston, and becoming a captain of infantry in January, 1776. At New York in 1776 he made an attempt, by means of a fire ship, to destroy a part of the English squadron in the harbor, and on October 7, 1777, Congress promoted him to the rank of major. He was wounded (October 23, 1777) at Fort Mifflin, served with gallantry at Butt's Hill (August 29, 1778), and on October 28, 1778, in command of a small sloop, captured off Newport the British blockading schooner *Pigot*. For this he was commissioned lieutenant-colonel by Congress on November 14th. He became a captain in the United States Navy September 17, 1779, and was directed to protect the Long Island coast and to keep General Gates's communications open. In May, while in command of the *Pigot* and the *Argo*, he captured the British schooner *Lively* and two privateers, and subsequently defeated and captured the *King George* and the *Dragon*, the latter after a four hours' battle. He was taken by the British in 1780 and treated with the utmost barbarity, being confined for a time in the prison-ship *Jersey* and then in the 'Old Sugar House,' and then being taken to England, where he was exchanged late in 1781. After the war he bought the confiscated estate of Sir William Johnson, and was a member of Congress from 1793 to 1794. The frigate *Constitution* (q.v.) was built under his supervision, and in 1799 was his flagship during a cruise in the West Indies. Owing to a dispute with Commodore Truxton, concerning priority in rank, he resigned in 1801, and passed the rest of his life in New York. Consult Tuckerman, *The Life of Silas Talbot* (New York, 1850).

TALBOT, William Henry Fox (1800-77). An English photographer and philologist, well known as one of the inventors of photography. He was educated at Cambridge, received the junior chancellor's medal in 1821, and subsequently became member of Parliament for Chippenham. But soon afterwards he gave up politics, and devoted himself entirely to scientific investigation. The first problem to attract his attention was that of fixing shadows, and by patient research he was gradually led to the discovery of a process of obtaining and fixing sun-pictures. On the dissemination of a report as to Daguerre's successes in the same field, Talbot secured his just rights by publishing a paper (*Phil. Mag.*, March, 1839), in which the successive steps of his investigation and their result were detailed. This process was subsequently improved by his invention (1841) of the calotype process. His discoveries and inventions in photography are described in his *Pencil of Nature* (1844-46). Latterly he devoted himself to the study of philology and archæology, and was one of the first to read the cuneiform inscriptions of Nineveh. Among his works are: *Hermes, or Classical and Antiquarian Researches* (1828-39); *Illustrations of the Antiquity of the Book of Genesis* (1839); and a work on *English Etymologies* (1846). See Photography.

TALC (Fr. *talc*, Sp. *talco*, *talque*, from Ar. *ṭalq*, talc). A mineral hydrated magnesium silicate crystallized in the orthorhombic system. It has a pearly or semi-metallic lustre, is soft, and is silvery-white to gray or green in color. Talc seldom occurs in crystals, but is usually found in foliated or granular masses. It is an exceedingly common mineral and in some regions is found in large beds. The granular massive varieties are commonly known as soapstone and find extensive use in commerce as slabs for hearthstones, mantels, sinks, etc., and when powdered, as a pigment, in paper-making, as a lubricator, for dressing skins and leather, etc. The fine granular or crypto-crystalline varieties are used for marking purposes under the name of French chalk. In 1900 27,943 tons, valued at $383,541, were mined in the United States.

TALCA, tāl'kȧ. A province of Chile, bounded by Argentina on the east and the Pacific on the west (Map: Chile, C 11). Its area is 3678 square miles. It is mountainous, with the Andes in the east and the lower coast range in the west, and the central portion is covered with plains interspersed with low hills. The mountains are well wooded and the interior is very fertile. Wheat is the chief agricultural product and grazing is carried on extensively. The province is crossed by the main railway line of Chile and has a branch line from the capital, Talca, to the coast. Population, in 1895, 128,961.

TALCA. The capital of the Chilean Province of Talca, on the left bank of the Calaro River, a tributary of the Maule, 140 miles south of Santiago on the Santiago-Concepción Railway, and 45 miles from the coast, with which it has railway connection (Map: Chile, C 11). Extremes in heat and cold render its climate disagreeable. The chief industry is the weaving of *ponchos* (woolen blankets). Population, in 1901 (estimated), 40,987.

TALCAHUÁNO, täl'kȧ-wä'nṓ. A seaport of Chile, on the Pacific coast, eight miles north of Concepción. The town is located on a peninsula which forms a very safe harbor, the entrance of which is protected by the island of Quiriquina. The harbor is equipped with a breakwater and an extensive system of docks. Wheat grown in the interior provinces of Santiago and Valdivia, with which the town has railway connection, is exported. Population, in 1900, 15,376. Talcahuano was founded as a military post in 1780 and was almost totally destroyed by an earthquake in 1835.

TALENT (Lat. *talentum*, from Gk. *τάλαντον*, *talanton*, talent, weight, balance; connected with *τλῆναι*, *tlēnai*, to bear, Lat. *tollere*, to lift, Skt. *tulā*, balance). The maximum unit of weight and value among the Greeks; the equivalent of 60 minæ or 6000 drachmæ. In the Homeric poems the word is used in a different sense to signify a small weight of gold, apparently of no great value, since two talents are worth less than a handsome bronze caldron. While the name is Greek, the weight came from Babylonia and Phœnicia. Here a system of 60 shekels to a mina and 60 minæ to a talent was employed in early times, and in two forms, a 'common' and a 'royal,' the latter being about one-twentieth heavier than the common. Furthermore, both forms had a 'heavy' and a 'light' system, of which the latter was one-half the former. Moreover, in weighing gold, 50 shekels were reckoned to a mina, or 3000 instead of 3600 to a talent. For silver, again, a new standard was introduced, so arranged that while the ratio in value of silver to gold was 1 to 13½, the ratio of weight should be 1 to 10 (Babylonian) or 1 to 15 (Phœnician). The 'royal' forms seem also to have varied at different times. The Greeks, in borrowing these systems, naturally varied them somewhat, and we therefore find considerable variety among the different Greek States. It is obvious that a very slight variation in the weight of the shekel, or drachma, would make a large difference in the talent. Of the chief Greek systems the Æginetan is not exactly identical with any of these Eastern standards, but is perhaps connected with a Babylonian 'royal' form, and at any rate seems to have been adapted to their trade with Asia Minor. This talent weighed about 37.8 kilograms. The other common standard was the Euboic-Attic with a talent of about 26 kilograms, which has been usually connected with the common light Phœnician standard, though recent writers prefer to connect it with the Babylonian. In Athens this was used in reckoning money, while in the market a talent of about 37 kilograms was employed. The value of the Attic silver talent, which was not a coin, but a sum of money, was about $1080. Consult Hill, *Handbook of Greek and Roman Coins* (London, 1899).

TALE OF A TUB. (1) A comedy by Ben Jonson, licensed in May, 1633, and printed in folio in 1640. The first performance has been conjectured to have been given either in 1601 or in the winter of 1603-04. A revised version was produced in 1634. (2) A religious satire by Jonathan Swift, published anonymously in 1704. It deals with the various alterations which three brothers make in the coat which their father has bequeathed to them. Peter stands for the Roman Catholic Church, Martin for the Lutherans, and Jack (from John Calvin) for the extreme Protestants.

TALE OF TWO CITIES, A. An historical novel by Charles Dickens, first published in *All the Year Round*, April 30, to November 26, 1859, and immediately after in book form. Its scene is laid partly in London and partly in Paris during the French Revolution, of which it presents striking pictures. It is regarded as the most perfect in point of plot-construction of the author's works. See DEFARGE, THÉRÈSE.

TALESMEN (from Lat. *tales*, nom. pl. of *talis*, such, from the initial word in the summons of the original Latin phrase *tales de circumstantibus*, such of the bystanders + Eng. *men*). Men called to supply a deficiency in the number of jurors in a panel. In some jurisdictions a list of competent men is kept by the proper officials for this purpose, and in many States, in an emergency, the court may call upon bystanders to fill the panel. Jurors thus summoned are called talesmen. See JURY.

TALES OF A GRANDFATHER. A collection of historical pictures by Sir Walter Scott, the first two series (1828-29) dealing with England, the third (1830) with Scotland, and the fourth (1830) with France. They are put in extremely simple and popular form, and were intended by the author for children.

TALES OF A TRAVELER. A series of sketches and stories by Washington Irving (London and New York, 1824), the scenes of which are laid in England and France. A large part of the *Tales* is taken up by the autobiography of an imaginary personage, Buckthorne, and an account of his friends and their adventures.

TALES OF A WAYSIDE INN. A collection of poetical narratives by Henry Wadsworth Longfellow, the first of which is entitled *The Challenge of Thor*, and was written in 1849; the last is entitled *The Rhyme of Sir Christopher*, and was written in 1873. The series was published in three parts, at Boston, in 1863, 1872, and 1873. The 'Wayside Inn' was an old tavern, the Howe Tavern, still standing in Sudbury, Mass.

TALES OF MY LANDLORD. The name given by Sir Walter Scott to four different sets of his novels. Their publication was begun in 1816 under the fictitious editorship of Jedediah Cleishbotham (q.v.). The first set contained *The Black Dwarf* and *Old Mortality;* the second (1818), *The Heart of Midlothian;* the third (1819), *The Bride of Lammermoor* and *The Legend of Montrose;* and the fourth (1832), *Count Robert of Paris* and *Castle Dangerous.*

TALES OF THE CRUSADERS. The name given by Sir Walter Scott to *The Betrothed* and *The Talisman* (1825).

TALES OF THE GENII. A series of Oriental stories, modeled on the *Arabian Nights*, by James Ridley, published in London in 1764.

TALFOURD, ta̤l′fẽrd, Sir THOMAS NOON (1795-1854). An English lawyer and author, born at Reading, in Berkshire. He studied law with Joseph Chitty (q.v.), and was called to the bar at the Middle Temple (1821). He was eventually elected to the bench in the Court of Common Pleas (1849). His famous case was a defense of Edward Moxon, who was prosecuted for publishing Shelley's *Queen Mab.* Entering Parliament in 1835, he won great honor for his speech in favor of the copyright bill (1837), which he himself had introduced. In recognition of his service, *Pickwick* was dedicated to him. With Lamb his name is especially associated by *Letters of Charles Lamb with a Sketch of His Life* (1837) and *Final Memorials of Charles Lamb* (1848). In 1875 these two books were published together under the title, *Memoirs of Charles Lamb*. They have since been edited by Percy Fitzgerald (London, 1892). Talfourd's great literary success was *Ion*, a tragedy performed by Macready (May 26, 1836). It was followed by *The Athenian Captive* (1838) and *Glencoe* (1840). Consult the *Tragedies* (Routledge's Pocket Library, London and New York, 1889); *Critical and Miscellaneous Writings* (Philadelphia, 1842); and *A Memoir of Mr. Justice Talfourd* (London, 1854).

TALIAFERRO, tŏl′ĭ-vẽr, WILLIAM BOOTH (1822-98). A Confederate soldier, born at Belleville, in Gloucester County, Va. He attended Harvard College, and then William and Mary College, where he graduated in 1841. At the beginning of the Civil War he was made a colonel in the Provisional Army of Virginia. He participated in most of the battles fought by the Army of Northern Virginia prior to March, 1863, and was promoted brigadier-general in March, 1862. In March, 1863, he was put in command of the district of Savannah, Ga. In the following July, at the time of the desperate attacks on Fort Wagner, he was in command of the defenses on Morris Island, and in August of those on James's Island. In 1864 he commanded the Seventh Military District, comprising a part of South Carolina, and in December was given command of the entire State. He was promoted major-general January 1, 1865. After the war he resumed the practice of law, and served for ten years in the Virginia House of Delegates. He contributed "Jackson's Raid Around Pope" to *Battles and Leaders of the Civil War*.

TA-LIEN-WAN, tä′lĕn′wän′. A bay on the eastern coast of the Liao-tung Peninsula in Manchuria (Map: China, F 4). It is roomy and protected at the entrance by two islets. It is ice-free throughout the year. At its head lies the new Russian port Dalny (q.v.). Ta-lien-wan with the surrounding territory was ceded to Russia in 1898.

TALIESIN, tăl′ĭ-sĭn. A British bard, who is supposed to have lived about the middle of the sixth century. Nothing definite is known as to his career, and some scholars hold that he is a mythical personage. According to legend he was called 'the chief of the bards.' The "Book of Taliesin" contains 56 poems, which were formerly attributed to Taliesin. All are now generally believed to be of a later date. Consult: Skene, *The Four Ancient Books of Wales* (2 vols., Edinburgh, 1868), in which the "Book of Taliesin" is included; for the legends, Guest, *Mabinogion* (2d ed., London, 1877).

TALIPES, tăl′ĭ-pēz. The technical term for club-foot (q.v.).

TALIPOT PALM (Hind. *tālpāt*, from Skt. *tālapatra*, palm-tree leaf, from *tāla*, palm-tree + *patra*, leaf), GREAT FAN PALM (*Corypha umbraculifera*). The noblest palm of the East Indies, a native of Ceylon, Malabar, etc. Its straight cylindrical trunk, 60 to 100 feet high, is crowned with a tuft of enormous palmate plaited leaves, divided near the outer margin into numerous segments, and united to the trunk by spiny leafstalks. The leaves are usually about 8 or 10 feet long, exclusive of the leafstalk, which is 7 or 8 feet long. At the age of thirty or forty years the tree produces a long pyramidal cluster of whitish flowers rising to the height of 30 feet from the midst of its crown of leaves, and dividing into simple alternate branches, the lower of which sometimes extends laterally 20 feet. After maturing the numerous globose fruits about an inch and one-half in diameter the tree generally dies. The leaves are used for covering houses, for making tents, and for many other purposes. The leaves of this palm are used in Malabar for writing upon, characters being traced upon them with an iron style. They are prepared for this purpose by boiling, drying, damping, rubbing, and pressing. The soft central part of the stem, like that of many other palms, yields a kind of sago.

TALISAY, tä′lê-sī′. A town of Cebú, Philippines, situated 6 miles southwest from Cebú (Map: Philippine Islands, H 9). Population, in 1887, 16,055; now 19,000.

TALISMAN (Sp., Port. *talisman*, from Ar. *tilsam*, *tulsam*, *tilism*, pl. *tilsamān*, talisman, from Gk. τέλεσμα, *telesma*, consecrated object, talisman, religious rite, completion, from τελεῖν, *teleĩn*, to end, to make perfect, from τέλος, *telos*, end). In its strict sense, a species of charm, consisting of a figure engraved on metal or stone when two planets are in conjunction, or when a star is at its culminating point, and supposed to exert some protective influence over the wearer of it by keeping away diseases or bringing luck. While the proper distinctive character of the talisman thus resides in its astrological character, in common usage the terms talisman and amulet (q.v.) are synonymous, referring to any object used as a charm against evil spirits or evil influences. Consult Elworthy, *The Evil Eye* (London, 1895).

TALISMAN, THE. A novel by Sir Walter Scott, published, with *The Betrothed*, in June, 1825. The action takes place in Palestine, during the Crusades. The title of the story is derived from an amulet or charmed stone with which Saladin cures King Richard Cœur de Lion in his illness and which he afterwards presents to the hero, Sir Kenneth, finally discovered to be the Prince Royal of Scotland, on his marriage with Edith, the sister of Richard.

TAL′LADE′GA. The county-seat of Talladega County, Ala., 60 miles east of Birmingham; on the Southern and the Louisville and Nashville railroads (Map: Alabama, C 2). It is the seat of State schools for the deaf, dumb, and blind; of Talladega College (Congregational), an institution for colored students; and of a Presbyterian Orphan's Home. Talladega has considerable industrial importance. There are cotton mills, a cottonseed-oil mill, an iron furnace, and manufactories of hosiery and fertilizers. Under the charter of 1901 the government is vested in a mayor, elected biennially, and a unicameral council. The water-works and the gas plant are owned and operated by the municipality. On the site of Talladega, General Jackson, at the head of 2,000 men, defeated a force of 1000 Creek Indians on November 9, 1813, the Indians losing about 300, and the Americans, 15 killed and 86 wounded. Population, in 1890, 2063; in 1900, 5056.

TAL′LAHAS′SEE. The capital of Florida, and the county seat of Leon County, 165 miles west of Jacksonville; on the Seaboard Air Line, the Carrabelle, Tallahassee and Georgia, and the

Georgia, Florida and Alabama railroads (Map: Florida, D 1). It is finely situated on an eminence, in the vicinity of several picturesque lakes, and has wide, beautifully shaded streets. The Florida State College, occupying a site overlooking the city, the Florida State Normal and Industrial College for Colored Students, and the Leon County Academy are the leading educational institutions. The State Library has 9500 volumes; and there are also in the city the Supreme Court Library, with more than 7000 volumes, and the David S. Walker Library (formerly the University Library), with 6000 volumes. Other prominent features are the State Capitol, the court-house, the post-office, and Bloxham Park. The vicinity is especially adapted to the production of cotton, tobacco, and sugar-cane, and also has important dairying and stock-raising interests. Cottonseed oil and cigars constitute the principal manufactures. The government, under the revised charter of 1869, is vested in a mayor, chosen annually, and a unicameral council. Tallahassee was laid out in 1824 on a site selected two years earlier as the seat of the Territorial Government, and was incorporated as a city in 1827. Population, in 1890, 2934; in 1900, 2981.

TALLEMANT DES RÉAUX, tål′mäɴ′ dâ râ′ō′, Gédéon (1619-92). A French writer, born at La Rochelle, and connected through his mother with the famous Rambouillet family. He took his degrees in law, but refused to fulfill his father's wish that he should go into the magistracy. He employed his leisure in literary work, wrote verses in the taste of the time, and began a tragedy of *Œdipe.* But he is chiefly remembered by his *Historiettes,* a series of biographical, anecdotal, and character sketches of contemporary personages. Light, witty, somewhat cynical, and usually less restrained than modern taste demands, they are an invaluable document of the period, and particularly of the Hôtel de Rambouillet. They have been collected by Monmerqué, Levavasseur (1840) and Techener (1860). Tallement also began the *Mémoires de la Régence d'Anne d'Austriche*, intended to throw light upon the administration of Cardinal Mazarin. These, however, have not come down to us.

TALLEYRAND-PÉRIGORD, tȧ′lâ′räɴ′pâ′rė′gôr′, Charles Maurice, Duke de' Prince of Benevento (1754-1838). A French statesman, born in Paris. His father was an officer in the French Army, and fought through the Seven Years' War. Charles Maurice was the eldest son; on account of an accident in infancy which rendered him lame for life, he was trained for the Church at Saint Sulpice, the Sorbonne, and Rheims. He showed brilliant talents, but neither moral purpose nor a calling for the Church. He obtained, however, several ecclesiastical benefices, among them the abbacy of Saint Denis, in the diocese of Rheims (1775), in the year of his ordination. Appointed agent-general for the clergy in 1780, a lucrative and important post which brought him into close connection with the Government, he began a serious apprenticeship in public business, leading at the same time a notoriously licentious life. In 1788 his administrative abilities secured for him the bishopric of Autun. As representative of his diocese in the States-General of 1789, he favored uniting with the Third Estate, and thus won the good will of the popular party. He was appointed one of the commission to draw up a constitution for the nation. He assisted in framing the Declaration of Rights; proposed, October 10, 1789, the confiscation of Church property as belonging of right to the nation; and on February 16, 1790, he became president of the National Assembly. He was among the first of his order to take the oath to obey the Constitution, and urged the clergy of his diocese to follow his example. Excommunicated by the Pope, he was compelled to resign his bishopric. In January, 1792, Talleyrand was sent to London in a semi-official capacity, the object of his mission being to conciliate England. It was, however, suspected that he was a person 'disposed to serve the King,' and he was put on the list of *émigrés.* He remained in England until January, 1794, then spent more than a year in the United States, and after the fall of the Terrorists procured the revocation of his banishment, and in March, 1796, reëntered Paris, having paved the way for a favorable reception by a series of the most adroit and judicious intrigues. He attached himself to the group of constitutionalists and in 1797, mainly through the influence of Mme. de Staël, was named Minister of Foreign Affairs.

With his usual shrewdness Talleyrand saw the significance of the rise of Napoleon Bonaparte, attached himself to the fortunes of the young Corsican, and became his ally and confidant in the coup of the 18th Brumaire, which resulted in the overthrow of the Directory. After this Talleyrand, who had been reappointed Minister of Foreign Affairs by Bonaparte, directed his whole effort toward consolidating the power and authority of his master. In the diplomatic negotiations that followed the victories of France under the Consulate he had the principal part; he was the prime mover in the seizure and execution of the Duke d'Enghien, and assisted in the establishment of the Empire and in the organization of the Confederation of the Rhine. For these services he was made Prince of Benevento in 1806. He opposed Napoleon's disastrous policy with regard to England, and soon after Tilsit (1807) laid down his office as Foreign Minister, and after some intriguing retired from active life (1809), residing on his estates, and preparing for the turn of the tide. When after the French disasters of 1812 Europe rose against Napoleon Talleyrand became the centre of a group of malcontents, whose influence grew with the advance of the allied armies, and finally communications were opened with the Bourbons. Talleyrand dictated to the Senate the terms of the deposition of Napoleon; and on the restoration of the Bourbons he became Minister of Foreign Affairs in the first Government of Louis XVIII. He represented France at the Congress of Vienna and played there a game of masterly politics, working on the jealousies of the powers, and by appealing to the principle of legitimacy gaining solid advantages for France. He had succeeded in bringing about a secret alliance between Austria, Great Britain, and France against Russia and Prussia when Napoleon's return from Elba shattered his plans. Henceforth he had little part in public affairs. He resumed the office of Foreign Minister in May, 1814, after the second restoration, but soon resigned, owing to the hostility of the old nobility.

After the July Revolution Louis Philippe employed him as Ambassador at the English Court, where he contrived to bring about a friendly feeling between the new monarchy and the English Government, and negotiated the Quadruple Alliance of 1834 between France, Great Britain, Spain, and Portugal. He returned to France in 1835, and died at Valençay, May 17, 1838. Talleyrand stands out preëminently as the type of the unscrupulous diplomat and politician. A skeptic in religion and a cynic in morals, he possessed a remarkable insight into the grosser nature of man and almost unexampled adroitness for playing on the lower motives. He had a rare talent for caustic epigram, and his disillusioned view of human nature is attested by numerous witty sayings which have become part of the world's narrower wisdom.

The *Mémoires* of a man of Talleyrand's keen perceptions and close contact with great events necessarily have considerable historical value. His plan was to have them published thirty years after his death, but at that time it was decided to postpone their publication, and they were finally issued in five volumes (Paris) in 1889-91. Consult, in addition to general works on the period: Bastide, *Vie réligieuse et politique de Talleyrand* (Paris, 1838); *Correspondance du prince de Talleyrand et du roi Louis XVIII. pendant le congrès de Vienne* (ib., 1881); Sorel, *Essais d'histoire et de critique—Talleyrand au congrès de Vienne* (ib., 1883); Sainte-Beuve, "Talleyrand," in *Nouveaux Lundis*, vol. xii. (ib., 1872).

TALLIEN, ta'lyäɴ', Jean Lambert (1769-1820). A French revolutionary leader, born in Paris. He was educated by his father's employer, the Marquis de Berry. He early imbibed the spirit of the Revolution, was attached to the *Moniteur*, and started a journal, *L'Ami des Citoyens*, in imitation of Marat's *Ami du Peuple*. He acquired great influence with the people and became a leader in extreme and sanguinary measures. On August 10, 1792, he was made secretary to the Revolutionary Commune of Paris, was later chosen to the Convention and there became the apologist of Marat, voted for the death of Louis XVI., and was eager for the destruction of the Girondists (q.v.). Toward the close of 1793 he was sent to Bordeaux as the representative of the Committee of Public Safety. A passion which he there conceived for Madame de Fontenay, whom he married December 26, 1794, made him amenable to her influence, which was exerted on the side of clemency. On March 22, 1794, he was chosen president of the Convention. Robespierre, who hated him, and felt that he could not be trusted, denounced him in the Convention. Tallien recognized his danger and dexterously rallied the remnants of the Dantonists, Hébertists, and other factions against the Government of Robespierre, Saint Just, and Couthon, and brought about the events of the 9th Thermidor (July 27, 1794), which caused the fall of the triumvirate. Tallien became head of the Committee of Public Safety, lent his aid in suppressing the Revolutionary Tribunal and the Jacobin Club, and drew up the accusations against Carrier, Le Bon, and others of the Terrorists. From 1795 to 1798 he was a member of the Council of Five Hundred, where, however, his influence rapidly diminished. He accompanied Bonaparte to Egypt, editing the official journal, *Décade Egyptienne*, and, when returning to France, was captured by an English cruiser, and taken to England, where he was lionized by the Whigs (1801). Soon after he returned to France, and was sent in 1805 as consul to Alicante. He died in Paris, November 16, 1820. Under the Directory Madame Tallien's salon was one of the most brilliant in Paris. While Tallien was absent in Egypt, she was divorced from him and married in 1805 Count de Caraman, afterwards Prince de Chimay. See Chimay, Jeanne Marie Ignace Thérèse de Cabarrus, Princess de.

TAL'LIS, Thomas (c.1510-85). A famous English organist and composer. He achieved great proficiency in organ-playing, and was organist at Waltham Abbey for many years. About 1542 he was appointed gentleman of the Chapel Royal, and served under Henry VIII., Edward VI., and the queens Mary and Elizabeth. He was also organist to Elizabeth. In 1575-76 he obtained, with William Byrd, letters patent, giving the exclusive right, for twenty-one years, of printing music and ruled music paper. The first work printed under this patent was their *Cantiones quæ ab Argumento Sacræ Vocantur Quinque et Sex Partium* (London, 1575), containing 34 motets, by Tallis and Byrd, the work being a beautiful specimen of typography. About this time he composed his famous song of 40 parts, originally written to Latin words, but adapted to English about 1630. Tallis's compositions consist of Church music, *Order of Daily Service; Full Cathedral Service; Order for Morning Prayer, with the Litany Noted* (all of which have been edited in this century); Te Deums, chants, hymns, motets, and responses. His manuscripts are in the Oxford and Cambridge University libraries, and in the British Museum.

TALL'MADGE, Benjamin (1754-1835). An American soldier, born in Brookhaven, N. Y. He graduated at Yale in 1773; taught school at Wethersfield, Conn., for three years; and in June, 1776, became lieutenant and adjutant of a Connecticut regiment, rising to the rank of captain in December, 1776, and of major in April, 1777. On September 5, 1779, without the loss of a single man, he surprised and captured 500 Tory marauders at Lloyd's Neck, L. I., and in May, 1780, captured Fort George at Oyster Bay. He was present, besides, at the battles of Brandywine, Germantown, and Monmouth, had the custody of Major André until that officer's execution, and served at Washington's headquarters in 1781-83. After the war he became a successful merchant at Litchfield, Conn. His *Memoirs* were printed privately by his son in 1859.

TALLMADGE, Nathaniel Pitcher (1795-1864). An American legislator and governor, born in Chatham, N. Y. He graduated at Union College in 1815, and in 1818 was admitted to the bar. He was elected to the lower branch of the State Legislature in 1828 and to the State Senate in 1830. In the latter body he served until 1833, when he was elected to the United States Senate as a Democrat. Afterwards he allied himself with the Whigs and served by reëlection until 1844, when he resigned to accept the appointment of Territorial Governor of Wisconsin tendered him by President Tyler, and served until removed by President Polk in 1846.

TALLOW (MDutch *talgh, talch,* Dutch *talk,* LG. *talg,* Ger. *Talg,* tallow; possibly connected with AS. *tælg,* color, Goth. *tulgus,* fast, firm, and ultimately with Eng. *long*). A mixture of stearin, palmitin, and olein (qq.v.) derived from animal fat in the process of rendering. This fat is generally obtained from beef or mutton by melting and separation by heat, usually under pressure. Tallow is a white and almost tasteless substance in its pure condition, but the commercial article is usually of a yellowish color. It is soluble in boiling alcohol and has a specific gravity which varies from .925 in the case of beef tallow to .937 in the case of mutton tallow. It melts between 100° and 120° F. Tallow is employed in making candles (q.v.) and soap. It may also be used as a lubricant. See FATS.

TALLOW, MINERAL. See MINERAL TALLOW.

TALLOW TREE. Various trees which produce a thick oil or a somewhat resinous substance, which, like tallow, may be used for making candles. The tallow tree of Malabar (*Vateria indica*), a tree of the natural order Dipterocarpaceæ, has leathery leaves 4 to 10 feet long, and panicles of white, fragrant flowers. From incisions in the stem, which is often 16 feet in circumference, east Indian copal is obtained. Its seeds yield a firm, white, odorless vegetable tallow valued for soap and candle making. The tallow tree of China (*Sapium sebiferum*) belongs to the natural order Euphorbiaceæ. The nearly hemispherical seed and the capsules yield a white vegetable tallow, which the Chinese obtain by crushing and boiling both capsules and seed and skimming off the fluid fat. Three parts wax is added to ten of tallow to give a firmer consistency. This tree has been introduced into North America, is cultivated about Charleston and Savannah, and is almost naturalized in the maritime parts of the Carolinas. It is very beautiful at the approach of winter, when the leaves become bright red, among which hang the white seeds suspended by threads. The name tallow tree is sometimes given to Aleurites triloba, a species of candlenut (q.v.). The tallow tree, or butter-and-tallow tree, of Sierra Leone is Pentadesma butyracea, of the natural order Guttiferæ, the fruit of which furnishes an oil used as butter.

TALLY (OF., Fr. *taille,* cut, size, figure, tax, from Lat. *talea,* rod, cutting twig). The name given to the notched sticks once used in England for keeping accounts in Exchequer. They were well seasoned rods of hazel or willow, inscribed on one side with notches indicating the sum for which the tally was an acknowledgment, and on two opposite sides with the same sum in Roman characters, along with the name of the payer and the date of the transaction. The tally was cleft through the middle by the deputy chamberlain with knife and mallet, and one half was retained by the payer as his receipt, while the other was preserved in exchequer. They accumulated there until 1834 when an act of Parliament ordered them to be burned. The destruction of the houses of Parliament by fire at the time is supposed to have arisen from the overheating of the flues in which the discarded tallies were being burned.

TALMA, tȧl'mȧ', FRANÇOIS JOSEPH (1763-1826). A distinguished French tragedian, born in Paris. In 1787 he made his début on the stage of the Comédie Française. Some time afterwards in a minor part in the tragedy of *Brutus* he attracted attention by a novelty of costume. It was the fashion for actors to appear in the garb of their own country and even their own time, and Roman senators stalked about the stage attired as Parisian dandies of the eighteenth century. Talma saw the absurdity of the custom and, setting out to reform it, appeared clothed in a Roman toga and with arms bare. His first great triumph was in Chénier's *Charles IX.*, produced in 1789. In the division of the Comédie Française (q.v.) which soon followed in the months of Revolutionary confusion, Talma and those who adhered to him went over to the new theatre in the Rue Richelieu, which was for a time known as the Théâtre de la République. There many of his greatest successes were won. Though irritable and often at strife with his fellow actors, he was a great favorite with Napoleon, of whom it was jestingly said that he took lessons of his friend Talma in the art of behaving like an Emperor. Talma was, however, equally well received later by Louis XVIII. Consult his "Quelques réflexions sur Lekain et sur l'art théâtral," prefixed to the *Mémoires de Lekain* (Paris, 1825); *Mémoires de Talma,* ed. by Alexander Dumas (1849-50); Lumière, *Le Théâtre Français pendant la Révolution, avec plusieurs lettres inédites de Talma* (Paris, 1894).

TAL'MAGE, THOMAS DE WITT (1832-1902). An American clergyman and pulpit orator, born at Bound Brook, N. J. After taking a partial course at the University of the City of New York (now New York University) he entered the theological seminary of the Dutch Reformed Church at New Brunswick, N. J., where he graduated in 1856. In the same year he was ordained and became pastor of the Reformed Church at Belleville, N. J. He filled pastorates in churches of the same denomination at Syracuse, N. Y. (1859-62), and at Philadelphia (1862-69). In 1869 he was called to the pulpit of the Central Presbyterian Church of Brooklyn, N. Y., which, from the new edifice erected in 1870, came to be known as 'The Tabernacle.' During his occupancy of this pastorate, where he remained until 1894, he became widely known as a sensational preacher. The Tabernacle Church, after being twice burned and rebuilt (in 1872 and 1889), was again burned in 1894, after which the church organization ceased to exist. Dr. Talmage preached for a time in the New York Academy of Music, and from 1895 to 1899 was associate pastor of the First Presbyterian Church of Washington, D. C. His wide influence was largely increased by frequent lecturing tours, both in America and England, and by the publication of his sermons in book form, and through syndicates in more than 3600 weekly newspapers, in the United States, Canada, and Great Britain. They were also regularly translated, and published in a number of foreign languages. He was editor of *The Christian at Work* (1873-76); *The Advance* (1877-78); *Frank Leslie's Sunday Magazine* (1879-89); and *The Christian Herald* (1890-1902). Of the more than fifty volumes published under his name, a majority were pirated or unauthorized. Among his more important works were: *The Almond Tree in Blossom* (1870); *Old Wells Dug Out* (1874); *Every Day Religion* (1875); *Woman: Her Powers and Privi-*

leges (1886); *From the Pyramids to the Metropolis* (1892); *From Manger to Throne* (1894); *The Earth Girdled* (1895); and *The Pathway of Life* (1895). Dr. Talmage's sermons were written in a popular vein and were characterized by extravagant statements and fantastic figures of speech. For his life and work consult Adams (Chicago, 1902).

TALMUD (Aram. *talmūd*, instruction; connected with Heb. *lāmad*, to learn). The name given to the comprehensive compilation of laws and ceremonial regulations pertaining to Rabbinical Judaism together with the elaborate discussion of those laws and regulations. As already implied in this definition, the Talmud consists of two divisions, which in the compilation are kept distinct: (1) the laws and regulations which are technically comprised under the designation *Mishnā* (literally, teaching, then used concretely for 'the law,' as that which is taught or which is the outcome of teaching); (2) the discussion and elaboration of the laws, comprised under the term *Gĕmārā* (literally, 'supplement,' 'completion,' and then also in the sense of 'tradition,' 'doctrine'). The language of the Mishna is Hebrew; that of the Gemara Aramaic, which both in Palestine and Babylonia drove out Hebrew as the popular speech.

Of these two divisions, the compilation of the Mishna comes first in the order of time and also in importance. In its present form it consists of six main divisions known as *Sĕdārīm*, comprising 63 treatises or *Massektōth*. This comprehensive compilation, which is attributed to Rabbi Jehuda ha-Nasi (c.219 A.D.) represents the close of an intellectual and religious process that may be said to date from the acceptance of the 'Priestly Code' through Ezra and Nehemiah in B.C. 444 as the supreme and sole standard of religious observances and secular regulations. The acceptance of this code definitely established obedience to a law for which divine origin was claimed as the test for fidelity to Yahweh. The observer of the law was the only type of the faithful Jew possible under this conception of religious duty. Such a principle necessarily led to the study of the law as the highest vocation of the individual. The law could not be observed unless it was known and thoroughly understood, and generations of scholars arose who strove to determine the exact meaning of the enactments in the codes and to account for numerous existing practices not specifically recorded in them, by deduction from principles underlying the code itself. The attempts to deduce the established religious practices and the constantly growing ceremonial details from the law itself resulted naturally in the formation of smaller and larger collections, which may have served either as notes for the pupils or as guides for the teachers, and despite a certain opposition that always manifested itself against committing to writing the large body of oral tradition, which, according to the theory of Rabbinic theology, was revealed simultaneously with the written law at Sinai, it was inevitable, if the practices established by or based upon this oral tradition were to maintain their hold as ingredient parts of Judaism, that they should be given a fixed form equally with the 'written' law. We have direct evidence for the existence of 'Mishnaic' compilations prior to the days of Rabbi Jehuda ha-Nasi, but the general acceptance which his compilation met naturally drove the earlier (and probably more incomplete) ones out of the field. Traces of these are to be found in the supplement to the Mishna, where enactments and observations are referred to which differ from those found in the Mishna; they are designated as the *Bāraythā* (i.e. outside). Another collection of this kind is known as the *Tōsephtā* ('addition'), which, however, partakes of the character of the Gemara.

Passing on to the supplement to the Mishna, its rise represents the natural continuation of the process which led to the Mishna. In the course of several centuries there was a large accumulation of material that could only be preserved by being committed to writing. The combination of the Mishna with the Gemara forms the Talmud proper, and for the Babylonian schools the first authoritative compilation of the discussions of the several generations was made by Rab Ashi, the head of the school at Sura, who flourished from 375 to 427; but additions were made by later authorities, such as Rab-Abina, and the final touches were given to it about the first half of the sixth century. In a certain sense, however, the Gemara was never finished, for of the 63 treatises of the Mishna, 26 have no Gemara. The Palestinian schools also compiled their discussions, and in this compilation the influence of Rabbi Jochanan (189-279), head of the school at Tiberias, is paramount, though the redaction of the Palestinian Talmud—the work of a series of authorities—did not take place until the fourth century, while additions continued to be made to it in the fifth century. Considerable portions of this Palestinian Talmud are lost. In fact, the Mishna of only the first four Sedarim or divisions has been preserved, and a portion of one treatise in the sixth division. In the second division the Gemara is not complete, four chapters of one treatise being wanting, and likewise in the fifth division the Gemara is lacking to the last chapter of one treatise and to two other treatises. That the Palestinian Talmud once existed in a more complete form is certain and it is more than likely that there was a Gemara to most of the treatises of the entire six divisions. The loss of such a considerable portion is due in part to the almost constantly disturbed conditions that prevailed in Palestine, and in part to the subsequent neglect of the Palestinian Talmud, which never acquired the authority that came to be enjoyed by the Babylonian compilation. The Babylonian Gemara in fact drove its rival entirely out of the field, and as a consequence the Babylonian Talmud became the main factor in the history and development of Judaism.

To characterize and convey an idea of the contents of the Mishna is a comparatively simple matter, but it is almost an impossible task to indicate the heterogeneous character of the Gemara, more particularly of the Babylonian Talmud. The discussions on the Mishna led the Rabbis and their pupils far away from the subject, at times, indeed, a section coming to a close without a return to the starting point. In the course of these digressions, anecdotes, bits of historical gossip, folk-lore, the popular science of the day, and mathematical calculations are intermixed with sober and playful exegesis of the Old Testament by the application of a series of hermeneutical principles evolved in the schools of Palestine and

Babylonia. Sophistry and hair-splitting dialectics are suddenly interrupted by charming parables and poetic allegories. In a sense, it is easier to say what the Gemara does not contain than to summarize its contents. It is a veritable encyclopædia of Rabbinical knowledge, and only the lack of system prevents the justifiable application of that term to this remarkable compilation. To distinguish the purely legal from the extraneous material, a division is commonly made into Halacha (lit., norm) and Hagada (lit., tale).

The history of the Talmud is the history of Judaism from about the beginning of our era to the dawn of the nineteenth century. In that history we may distinguish the following periods: (1) To the completion of the Mishna, during which time the Rabbis bear the name of *Tana'ım* ('teachers'); five generations are enumerated. (2) The growth of the Gemara, the Rabbis of this second period being known as *Amoraim* ('speakers'), comprising seven generations. (3) To the completion of the Talmud, the Rabbis of this period being distinguished as *Saboraim* ('examiners'). (4) To the struggle in the ninth and tenth centuries between the Karaites and the adherents of the Talmud known as the Rabbanites, marked by the labors of Saadia (q.v.). (5) The adjustment of Talmudical Judaism to the prevailing form of Aristotelianism, which arose under the influence of Islamic theology. This period extends well into the thirteenth century and is dominated by the influence of Maimonides and the Spanish school of Jewish thinkers. It led eventually, after a long conflict between the adherents and opponents of Maimonides's attempt to codify the Talmudical enactments and regulations in systematic form, to the compilations of the codes of Joseph Karo (born 1487), known as the *Shulchan Aruch* ('Spread table'), which became the standard guide implicitly followed by orthodox Jews to the present time, and may be regarded as marking a sixth and final period.

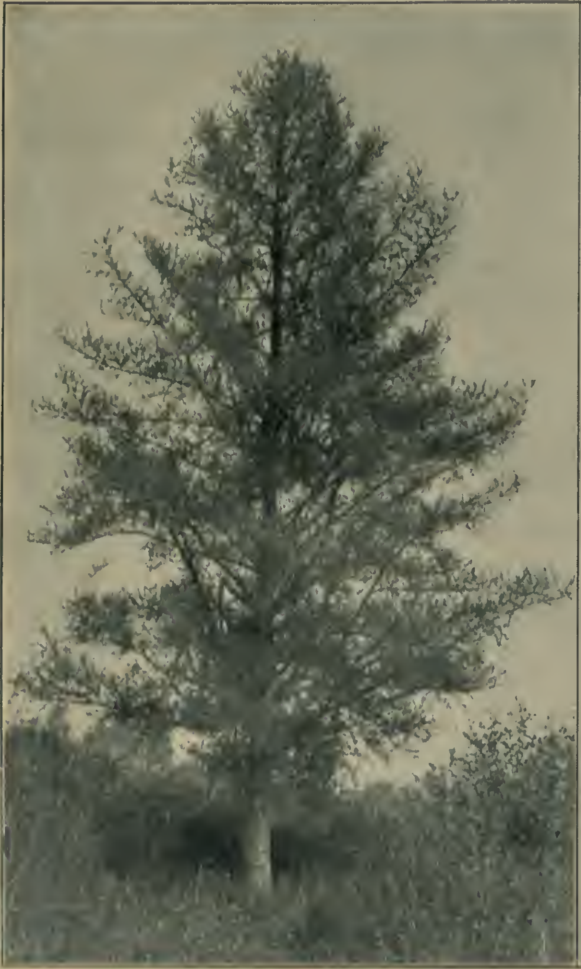
In the course of the last two periods the study of the Talmud spread gradually into Southern Europe and thence made its way into Germany, Galicia, Hungary, and Russia. Commentators arose who devoted themselves to the interpretation of the Gemara, much as the Amoraim and Saboraim elaborated the Mishna and super-commentaries were added to these commentaries. The most notable of the Talmudical commentators was Rabbi Solomon Yishaki (or Isaac), known as Rashi (q.v.), whose work, almost invariably added to the Talmudic text, is still used as the basis of Talmudical study. A school of Talmudists arose in Germany and France during the twelfth and thirteenth centuries known as *Tosaphists* ('Supplementers'), whose comments are likewise written on the margins of the Talmud—a method that follows the example of the Mohammedan theologians. Other commentators of more recent date whose works acquired a high degree of authority were Solomon Luria (d. 1573), Elijah Wilna (d. 1797), and Akiba Eger (d. 1837). From Germany, which remained for several centuries the centre of Talmudical study, that centre gradually shifted to the east of Europe, and at the present time the traditional methods of Talmudical study are still carried on with vigor in Galicia and Russia, while the centre of the scientific study of the Talmud based on adequate philological acquirements and the application of proper historical principles may be said to be Germany, whence the study is spreading into France, England, and the United States, as the value of the Talmud for the student of language, of history, and of religion is coming to be recognized. Christian theologians are also beginning to take it up, and notable contributions have been made by some of these.

BIBLIOGRAPHY. No critical edition of the entire Talmud has as yet been published. The variant readings gathered from manuscripts and older editions have been published by Raphael Rabbinovicz, *Sefer Dikduke Sopherim* (15 vols., Munich, 1868-86), which constitutes the basis for a future standard edition. Of translations of the Talmud into modern languages, it will be sufficient to mention here the French translation of the Palestinian Talmud by Moïse Schwab (7 vols., Paris, 1871), the German translation of the Babylonian Talmud by L. Goldschmidt (Berlin, 1896 sqq.), and the English translation of the Babylonian Talmud by Rodkinson (New York, 1896 sqq.). An English translation of 18 treatises of the Mishna by J. Barclay was published in London in 1878. Of general works on the Talmud, the following may be mentioned: I. Hamburger, *Realencyklopädie für Bibel und Talmud* (Leipzig, 1886); Ferd. Weber, *Jüdische Theologie auf Grund des Talmud* (ib., 1897). Of monographs or articles on the Talmud, consult: Deutsch, "The Talmud," in *Literary Remains*, republished by the American Jewish Publication Society (Philadelphia, 1897); Arsène Darmesteter, *The Talmud* (Eng. trans., Philadelphia, 1897); Bernfeld, *Der Talmud, sein Wesen, seine Bedeutung und seine Geschichte* (Berlin, 1900); Strack, *Einleitung in den Talmud* (3d ed., Leipzig, 1901), which contains in concise form the contents of the Talmud, editions, history, and a valuable bibliography. Consult also Mielziner, *Introduction to the Talmud* (2d ed., New York, 1902); Rodkinson, *History of the Talmud* (New York, 1903). See GEMARA; HAGGADA; HALACHA; MISHNA.

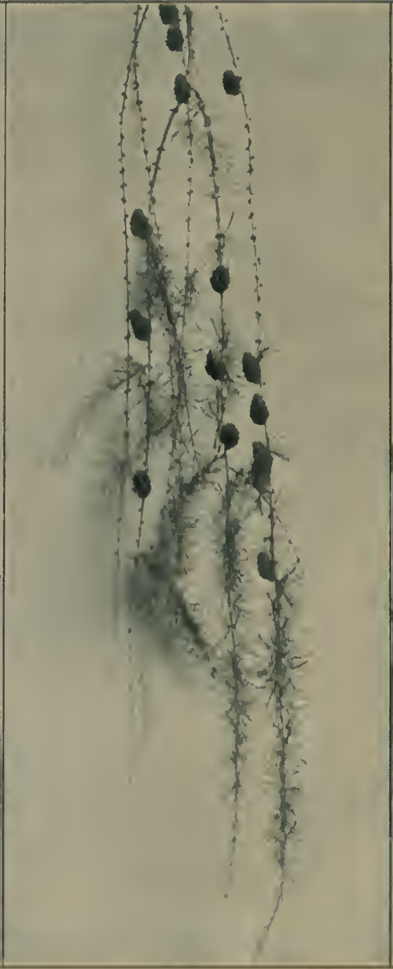
TALON, tȧ'lôɴ', JEAN BAPTISTE (1625-91). A French official in Canada, born in Picardy. He entered the civil service, and, after serving in subordinate capacities in France, was appointed in 1663 intendant of justice, police, and finance in Canada, Arcadia, and the other French possessions in North America. Talon built ships, began trade with the West Indies, and built a brewery to lessen the consumption of brandy. Exploring parties were sent to Hudson Bay and to the country of the Upper Lakes, and the purchase or seizure of New York was urged. In 1668 he returned to France on account of failing health, but returned in 1670 and remained until 1672. Later three of his seigniories were erected into baronies and he assumed the title of Comte d'Orsainville. His *Mémoire à la majesté sur l'état present du Canada* (1667) is a valuable original source of information.

TALTAL, tȧl-täl'. A town of the Province of Antofagasta, Chile, on the Bay of Taltal, Pacific Ocean, 527 miles north of Valparaiso (Map: Chile, C 9). It is the terminus of the railway of some 95 miles running to the mining town of Cachinal, and is the point of export for the nitre-beds and silver and copper mines of the deserts of Atacama (q.v.). Taltal was founded about 1855. Population, in 1885, 4761.

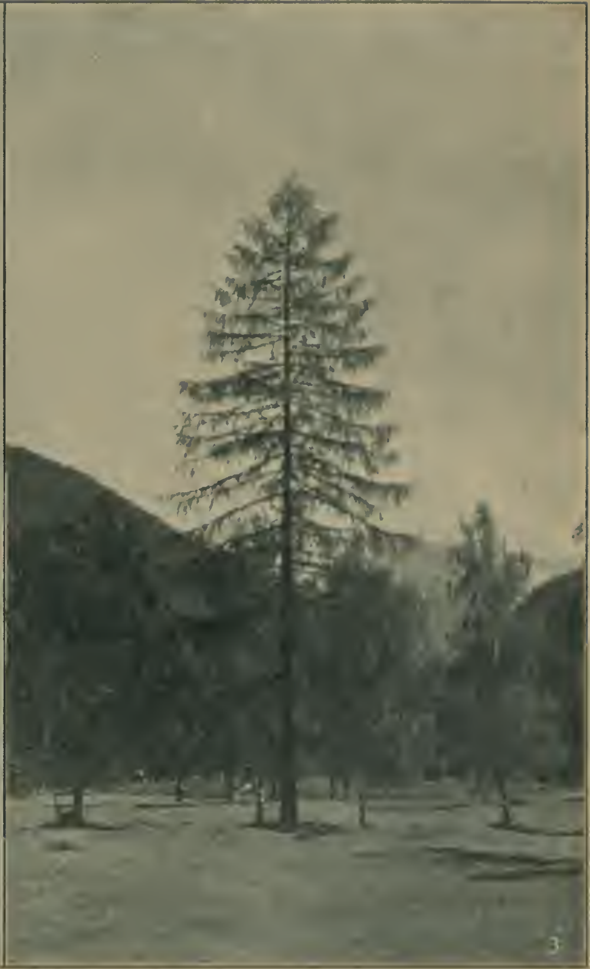
TAMARACK AND LARCH



1. TAMARACK (Larix Americana).



2. SPRAY WITH CONES OF EUROPEAN LARCH.



3. EUROPEAN LARCH (Larix Europæa).

TALUS (Lat., heel). The heap of fragments that accumulates at the base of cliffs and mountain slopes. Weathering is the most important process in the production of such masses, which tend to move slowly downward until they come within reach of the valley stream. The inclination of the surface of the talus varies with the size of the fragments, but it rarely exceeds an angle of 35° with the horizontal.

TA'LUS. The squire of Artegal in Spenser's *Faerie Queene.* He is made of iron, and with his 'destroying flail' overthrows giants and annihilates 'rascal routs.' The figure is suggested by Greek legend, but symbolizes the contemporary exploits of Lord Grey, himself represented by Artegal in the allegory, during the Irish rebellion.

TAL'VI. See Robinson, Therese Albertine Luise.

TAMANACA, tä'må-nä'kå. A tribe of Cariban stock (q.v.) who formerly lived on the Cuchivero River, a southern affluent of the Orinoco, Central Venezuela. They were at one time one of the most powerful tribes of Venezuela and were Christianized and gathered into mission villages by the Spanish missionaries before the year 1780, but by the incessant attacks of the savage Carib (q.v.) they were so utterly wasted that before the year 1840 the name had disappeared, and they are supposed to be entirely extinct.

TAMAN'DUA. See Anteater.

TAMAQUA, tå-mą'kwå. A borough in Schuylkill County, Pa., 17 miles northeast of Pottsville, on the Little Schuylkill River, and on the Philadelphia and Reading and the Central of New Jersey railroads, being the western terminus of the latter, and the headquarters of a division of the former (Map: Pennsylvania, F 3). It is known for its extensive coal-mining interests, and has considerable industrial importance. The leading manufactures are foundry and machine-shop products, stoves, powder, flour, shoes, furniture, knit goods, and beer. The water-works are owned by the municipality. Tamaqua was settled in 1799, was incorporated as a town in 1832, and was chartered as a borough in 1852. Population, in 1890, 6054; in 1900, 7267.

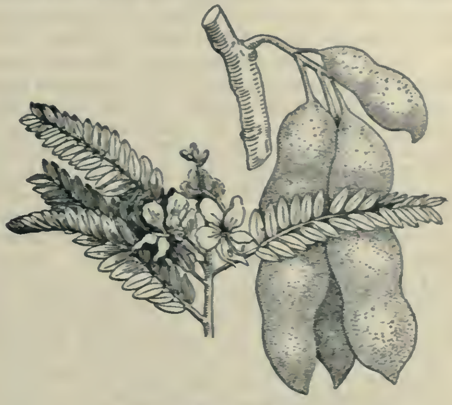
TAMAR, tā'mär. A picturesque river which rises in the north of Cornwall, England, and after a southeast course of 60 miles enters the English Channel by its estuary the Hamoaze, at Plymouth (Map: England, B 6). It forms the boundary of the counties of Cornwall and Devon for 45 miles, and is navigable as far as Launceston. Consult Bray, *The Tamar and the Tavy* (London, 1879).

TAMARACK (North American Indian name), *Larix Americana.* An American timber tree common in swamps, valued for posts, poles, ties, etc. It is less ornamental than its close relative, the European larch, which is more frequently planted. See Larch.

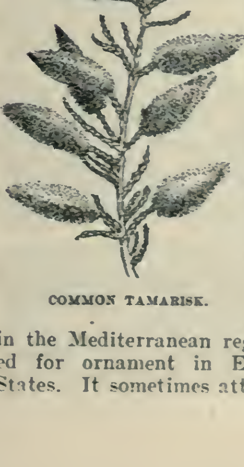
TAMARAO, tä'må-rä'ô (native name). A small, sturdily built native buffalo (*Bos Mindorensis*) of the Philippines. It is about 3½ feet high at the shoulders, is clothed with thick brown hair, and has short, triangular, massive horns, which have a lyrate curvature upward from the face. Compare Buffalo.

TAMARIN. See Marmoset.

TAMARIND (ML. *tamarindus,* from Ar. *tamr Hindi, tamr al-Hind,* date of India, from *tamr,* date, from *tamara,* to nourish on dates, and *Hindi, Hindu, Hind,* India), *Tamarindus indica.* A beautiful spreading tree, of the natural order Leguminosæ, a native of India, very generally cultivated in warm climates. It bears brown, many-seeded pods about six inches long and three-quarters of an inch thick, filled with acidulous, reddish-brown pulp which is exported in jam-like masses to Europe. Tamarinds are generally preserved by pouring hot syrup on the ripe pulp; but a better method is to put alternate layers of tamarinds and sugar in a stone jar, the color and taste being thus more like the fresh pulp. The wood of the tamarind tree, and especially of its roots, is extremely hard, but though worked with difficulty, it is valued for cabinet work. The tamarind plum (*Dialium indum*) and the allied brown and velvet tamarinds of Sierra Leone closely related to Tamarindus yield a similar pulp. Tamarind pulp is used in India as a cooling food, as an ingredient in curries, and for making sherbet. Tamarind trees are grown to some extent in Florida, but were not satisfactory when tested at Berkeley, Cal.


TAMARIND AND FRUIT.

TAMARISK (Lat. *tamariscus, tamarix, tamarice,* tamarisk; perhaps connected with Skt. *tamālaka, tamāla,* sort of tree with dark bark, *tamas,* darkness). *Tamarix.* A genus of plants of the natural order Tamaricaceæ. The common tamarisk (*Tamarix gallica*) grows in sandy places in the Mediterranean region and is often planted for ornament in Europe and the United States. It sometimes attains a height of 30 feet.


COMMON TAMARISK.

The twigs were once in repute as a tonic. The ashes of this and some other species of the genus contain much sulphate of soda. The Oriental tamarisk (*Tamarix articulata*) is one of the few indigenous trees in the Arabian and African deserts. It is called atle or ethel. Its wood is used for fuel and for economical purposes. The galls found on some East Indian species are valued in dyeing. *Tamarix mannifera*, perhaps a variety of *Tamarix gallica*, owing to the punctures of an insect, yields Mount Sinai manna. The German tamarisk (*Myricaria germanica*) belongs to another genus of this order.

TAMASHEK, täm′ȧ-shĕk. The name applied to the Berber and Tuareg languages of Mauritania and the Sahara. It occurs in various dialectic forms as Tamahâg, Tahahûg, and Tamazigt. The last form, T-ama-zig-t, survives in the Amzigh or Imazighen (q.v.), the common name of Mauritanian Berbers and thought to be identical with the Maxyes of Herodotus. Consult: Freeman, *Grammatical Sketch of the Temahug or Towarek Language* (London, 1862); Hanoteau, *Essai de grammaire de la langue tamachek* (2d ed., Algiers, 1896); Kaoui, *Dictionnaire français-tamâheq* (ib., 1894); id., *Dictionnaire pratique tamâheq- française* (ib., 1900).

TAMATAVE, tä′mȧ-tä′vȧ. The most important seaport of Madagascar. It is on the east coast in latitude 18° 10′ S., on a small peninsula (Map: Africa, J 6). It is fortified. It has a good roadstead owing to the outlying coral reefs, but the facilities are not superior for loading and unloading vessels. South of the city is a series of lagoons which have been connected by canals and thus add to the transportation advantages of the town. (See MADAGASCAR.) A railroad at present connects Tamatave with the neighboring Ivandro. The population is given at 4000. There are about 600 Europeans.

TAMAULIPAS, tä′mou-lē′pȧs. A maritime State of Mexico, bounded by Texas on the north, the Gulf of Mexico on the east, Vera Cruz and San Luis Potosí on the south, and Nuevo León on the west (Map: Mexico, K 6). Area, 32,128 square miles. The coast is flat, sandy, lined with lagoons and marshes, and but sparsely inhabited. The northern part is occupied by plains, while the southern and central portions are mountainous. Tamaulipas is watered by several large rivers, of which the largest are the Rio Grande and Pánuco, forming respectively the north and south boundaries. The climate is temperate and healthful in the interior and hot and unhealthful on the coast. Agriculture is the principal industry, but is hindered by lack of irrigation facilities. Grazing is carried on extensively. The chief exports are hides and skins, live stock, some fruits, and rubber. There are three railroad lines in the State. The Mexican Free Zone, in which imports are liable to only 10 per cent. of ordinary duties, was first established by Tamaulipas in 1858. Population, in 1900, 218,948. Capital, Ciudad Victoria (q.v.).

TAMBÓBONG, tȧm-bō′bông. A suburb of Manila, Philippines, situated about 3 miles north of the capital (Map: Luzon, E 8). Population, in 1887, 21,827; now about 25,000.

TAMBOURIN, täɴ′b͞oo′răɴ′ (Fr. *tambourine*, diminutive of *tambour*, drum, tabor). An ancient, lively dance of Provence, in $\frac{2}{4}$ time. It was originally accompanied by a flute and a tambour (drum), hence the name.

TAMBOURINE. An ancient musical instrument of the drum type. It is composed of a piece of parchment, stretched on the top of a hoop furnished with pairs of small metal plates, and is sounded by the hands, fingers, or elbow.

TAMBOV, täm-bôf′. A government of Central Russia, occupying an area of 25,720 square miles (Map: Russia, F 4). Its surface is mostly flat, in the basins of the Oka and the Don, and intersected by numerous river valleys. The region is watered principally by the Voronezh and the Khoper (tributaries of the Don) and by the Moksha and the Tsna (tributaries of the Oka). Iron is found near Lipetzk, but it is little exploited. Tambov is one of the most fertile governments of Russia and its southern and larger part is covered with a thick layer of black soil. Rye and oats are the principal cereals. Flax, tobacco, and sugar beets are also produced on an increasing scale. The principal manufactured products are spirits, cloth, beet sugar, flour, and tobacco. The annual value of the output is estimated at $12,000,000. Population, in 1897, 2,907,519.

TAMBOV. The capital of the Russian Government of Tambov, situated in a low region on the Tsna River, about 300 miles southeast of Moscow (Map: Russia, F 4). Population, in 1897, 48,134. The city was founded in 1636 as a fortress against the inroads of the Tatars from the south.

TAM′BURLANE, THE GREAT. A tragedy in blank verse, by Christopher Marlowe, acted in 1587, and licensed for publication on August 14, 1590. It is in two parts, the first dealing with the many conquests of the hero, and the second with his sorrow at the death of his mistress and his own pathetic end. Its principal source is a translation of Petro Mexia's *Silva de Varia Lecion*, made by Thomas Fortesque, and published under the title of *The Foreste* in 1571. It is especially interesting as being among the first dramas to employ the bold diction and rhythmical freedom which characterized the Elizabethan stage.

TAMERLANE. See TIMUR.

TAMERLANE. (1) A tragedy by Rowe, produced at Lincoln's Inn Fields, in 1702, and adapted (1724) for the operatic stage to the music of Handel. The plot deals with the rivalry of the title character, who is more subdued than his prototype in Marlowe's play, and the villainous Bajazet. The latter represents Louis XIV., the former King William III. Owing to its political significance, the play came to be produced annually at the Drury Lane, on November 5th. (2) A poem by Edgar Allan Poe which gave its name to a volume of verse published by him in 1827.

TAMETOMO, tä′me-tō′mȯ. Japan's most famous archer. He belonged to the great Minamoto family and shared its misfortunes in the middle of the twelfth century. He is credited with many feats of strength and skill. He sent an arrow through the body of one man and wounded a second who stood behind him. He shot an arrow through the helmet of his own brother without hurting him. Being taken prisoner and a sinew of his arm having been extracted by his foes he came nevertheless to shoot a stronger bow and sank a boat by shooting an arrow through its bows. The accounts of his end are contradictory. After sinking the boat he fired his house and committed suicide, or he fled to Riu Kiu (Loo Choo) and became its king, the first of the historic line.

TAM′ILS. A Dravidian people of southern Hindustan and northern Ceylon, who number more than 16,000,000. They are, perhaps, the most important of the civilized Dravidian peoples of India. The Klings of the seaports of Farther India and certain parts of Malaysia are Tamils, who have emigrated temporarily or permanently from their native land. To the Tamil group belong also, in all probability, some of the wilder tribes of the hills and the region of Tinnevelli and South Travancore.

The Tamil language is the most important of the Dravidian languages. (See DRAVIDIANS.) It is spoken in the northern half of Ceylon, and the territory between Cape Comorin and Pulicat, north of Madras, extending inland about halfway across India. Tamil is divided into Old or Śon Tamil, and Modern or Kodun Tamil. The differences between the two epochs of the language are very marked. Of all the Dravidian tongues Tamil is the most archaic. It has nine cases, two numbers, and in gender distinguishes between 'high caste' (men, gods, spirits, etc.) and 'low caste' (animals, inanimate things, and abstract ideas). The verb is formed by suffixing the personal pronouns to a predicative verb stem. The same base, therefore, when case-suffixes are added, serves as a noun, and when the pronouns are affixed as a verb. The original tenses are the present, the preterite, and the future, but periphrastic formations denote the continuative or durative, the perfect and pluperfect, and the future perfect. Moods are altogether lacking. In its vocabulary Tamil is exceedingly rich, especially in compounds and synonyms. The alphabet, which is closely akin to that of the Telugu (q.v.), is based on one of the old forms of the Sanskrit Devanagari script. (See DĒVĀNAGARĪ.) Tamil literature is abundant and important. An outline is given under the title DRAVIDIANS.

Consult: Mateer, *Native Life in Travancore* (London, 1883); Caldwell, *Tinnevally and the Tinnevally Mission* (Madras, 1869); id., *Comparative Grammar of the Dravidian, or South Indian Family of Languages* (2d ed., London, 1875); Rhenius, *Grammar of the Tamil Language* (4th ed., Madras, 1888); Pope, *First Lessons in Tamil* (5th ed., Oxford, 1891); Hultzsch, *South Indian Inscriptions, Tamil and Sanskrit* (Madras, 1890-95); Burnell, *Elements of South Indian Palæography* (2d ed., London, 1878); Graul, *Bibliotheca Tamulica* (Leipzig, 1854-65).

TAMING OF THE SHREW, THE. A comedy by Shakespeare, written before 1596, produced in 1603. It is adapted from an earlier play entitled *The Taming of a Shrew*, of questionable authorship, produced in 1594. The story of Bianca is taken from Ariosto's *I Suppositi* through Gascoigne, *Supposes*, a play of 1566. The taming of Katherine by her husband is a form of an old and widespread story found in the *Arabian Nights* and in Straparola.

TAMISE, tȧ′mēz′. A town in the Province of East Flanders, Belgium, 11 miles southwest of Antwerp, on the Scheldt, and on the railway from Mechlin to Saint Nicholas (Map: Belgium, C 3). Its chief manufactures are cotton and woolen fabrics, laces, soap, and wooden shoes; boat-building and jute and flax spinning are carried on. Population, in 1900, 12,463.

TAMMANY HALL. The name applied (1) to a powerful political organization in New York City; (2) to the building which serves as the organization's headquarters; and (3) sometimes incorrectly to the society from which the organization leases the building. The name is adapted from that of an Indian chief, Tamanend, of the Lenni Lenape or Delaware tribe, who was famous for his virtues and his wisdom, but about whom little is definitely known. His name appears on deeds for tracts of land, dated June 23, 1683, and July 5, 1697; and according to tradition he died about 1740, and was buried in New Britain Township, Bucks County, Pa. Before and during the Revolutionary War, societies with Tamanend as their patron saint were organized in imitation, and to a certain extent in ridicule, of such societies as Saint Andrew's Society, Saint David's Society, Saint George's Society, and the Friendly Sons of Saint Patrick. The organizations were of a patriotic nature, and were affiliated in spirit with the Sons of Liberty. In Philadelphia the Sons of King (later Saint) Tammany met almost every year from 1772 to 1791, and later, in 1795, a short-lived branch of the New York society was established there.

On May 12, 1789, William Mooney, an upholsterer, who previously had been active as one of the Sons of Liberty, founded in New York, ostensibly as a patriotic and social organization, the secret Society of Saint Tammany or Columbian Order, which in 1805 was regularly incorporated as a fraternal aid association. The ritual and organization of an Iroquois lodge were followed more or less closely by the founders, the society being divided into thirteen tribes, each of which had its separate totem, the year being divided into four seasons, each month being called by some distinguishing characteristic, and the officers being known as the grand sachem, sachems, the sagamore, or master of ceremonies, and the wiskinskie, or doorkeeper. In 1811 the society built its first hall, at the corner of Frankfort Street and Park Row, and in 1867 moved into the present Tammany Hall on Fourteenth Street. The political organization is nominally distinct from the society, but the two may in many respects be regarded as virtually identical, the leadership of both being largely in the same hands.

Though the society was ostensibly organized for patriotic, social, and benevolent purposes, it early took an active interest in politics and soon came to stand distinctively for Democracy and decentralization, identifying itself definitely (in 1798) with the Democratic-Republicans as opposed to the Federalists. Aaron Burr is supposed to have given the society (indirectly) its first training in the devious ways of practical politics, and in 1800 the society first took an active part in a political campaign, being instrumental in carrying New York for Jefferson. From that time to the present Tammany has generally assumed to be the local representative of the National Democratic Party, and has exerted a powerful influence on the political history of the State, and a preponderating influence on the political history of the city. At times the organization has been bitterly assailed by rival factions of the Democratic Party, and on at least one occasion, in 1878, it bolted the party's regular State ticket, but for the most part it has controlled a vast majority of the Democratic voters of the city. After 1834, when the mayoralty first became elective, it devoted its attention primarily to securing control of the city government, and from 1834 to 1903 succeeded in electing fully two-thirds of the mayors. Gradually its organization became more and more perfected, and the inrush of immigrants after about 1840 added enormously to its strength, Tammany succeeding largely by its political skill and tact in securing the adhesion of an immense majority of the foreign-born citizens. In order to secure proper compactness and discipline within the organization, great power was necessarily thrown into the hands of a few individuals, and in the history of Tammany many of its officers are alleged to have succumbed to the temptations which such power has brought. From an early period charges of corruption, peculation, and blackmail were made against Tammany leaders by their political opponents, and the climax was reached in 1869-71, when Tweed and his associates were proved to have robbed the city of untold millions. (See TWEED, WILLIAM M.). Damaging disclosures concerning the methods of Tammany were also made during the investigations conducted respectively by the State Committee on Cities, headed by J. Sloat Fassett, in 1890, the special committee of the State Senate, headed by Clarence Lexow, in 1894, and the special committee of the State Assembly, headed by Robert Mazet, in 1899.

Tweed was the first to exercise over Tammany the powers of the modern 'boss.' After the exposure of his colossal frauds, Tammany was reorganized by John Kelly (q.v.), who caused some of the most prominent of Tweed's prosecutors—men like Tilden, Charles O'Conor, Horatio Seymour, and August Belmont—to be chosen as officers, while he, by perfecting the 'machinery' of the organization, gained almost entire control. At his death in 1886 he was succeeded by Richard Croker (q.v.), who, however, did not exercise the powers of a 'boss' until 1888, and who in 1901 retired. Lewis Nixon (q.v.) was then nominally the leader for several months. Tweed, Kelly, Croker, and Nixon had each been chairman of the finance committee; this committee was reorganized in 1903, after the policy of Tammany had been shaped for a time by a 'triumvirate,' and Charles F. Murphy was chosen leader, though nominally with greatly curtailed powers.

In organization, Tammany is highly centralized, the power resting ultimately in the hands of one man or of a relatively small number of men. There is a captain for each election district in the city, and a district leader for each Assembly district. The executive committee of the organization is generally made up of these various district leaders; while in addition each district elects a certain number of men to the so-called General Committee, in which ostensibly the power rests, and in whose name the lease of the building known as Tammany Hall is held. The men elected by each district to the General Committee, whose membership is somewhat in excess of five thousand, form the General Committee for that district, and are presided over by the district leader. The General Committee has standing sub-committees on finance, printing, naturalization, correspondence, and organization.

The power of Tammany is traceable, however, to something more than mere machine organization. It makes a systematic appeal for the votes of the lower classes, and accomplishes its purpose by numerous acts of real charity; by gratifying the social instincts of the tenement dweller, the district leaders giving at their own expense frequent dances, chowder parties, picnics, and excursions; by bailing unfortunates out of jail; by systematically ingratiating itself with the vast numbers of immigrants; by securing work for the unemployed; by an extensive and generally astute use of patronage (when Tammany is in power); and apparently by the application of 'pressure' and by various acts of virtual intimidation. It also gains tens of thousands of votes by virtue of its position as the representative in New York of the Democratic Party; and, by the lax enforcement of sumptuary laws when in power, it wins the support of those voters who on principle or through motives of self-interest oppose such laws. Arrayed against it are a large majority of the cultured and well-to-do classes, the members of the Republican Party, and large numbers, representing various classes, who are convinced that Tammany government means a government of blackmail, of fostered vice, of police corruption, and, if not of outright dishonesty in all respects, at least of general wastefulness and inefficiency.

Consult: Myers, *History of Tammany Hall* (New York, 1901); Blake, *History of the Tammany Society or Columbian Order* (ib., 1901), written from the Tammany standpoint; a chapter by Talcott Williams in *Historic New York*, vol. i. (ib., 1899); several chapters in defense of Tammany in Thompson, *Politics in a Democracy* (ib., 1894); a chapter in Bryce, *The American Commonwealth* (ib., 1895); an article by Davis, "The Most Perfect Political Organization in the World," in *Munsey's Magazine*, vol. xxiv. (ib., 1901); Jernegan, *Tammany Societies in Rhode Island* (Providence, 1895); and Cabeen, "The Society of the Sons of St. Tammany of Philadelphia," in the *Pennsylvania Magazine of History and Biography*, vols. xxv., xxvi., and xxvii. (Philadelphia, 1901, 1902, and 1903).

TAMMERFORS, tăm′mer-fôrs. The principal manufacturing city of Finland, Russia, situated in the Government of Tavastehus, close to the falls of Tampereenkoski and 125 miles northwest of Helsingfors by rail (Map: Russia, B 2). It is a modern town with extensive cotton, paper, and iron mills and various other manufacturing establishments, whose motor power is supplied chiefly by the near-by rapids. Population, in 1898, 28,725.

TAM′MUZ. A deity of Babylonian origin whose cult is referred to by the prophet Ezekiel (viii. 14), who describes his horror at seeing women sitting in the north gates of the temple and weeping for Tammuz. The worship of Tammuz (under the form Dumu-zi) may now be traced back to the oldest period of the Babylonian religion. He appears to have been originally an agricultural deity, whose seat of worship may have been at Eridu on the Persian Gulf. In the developed Babylonian mythology, however, he became the symbol of the decay of vegetation after the close of the summer season, pictured as slain by the goddess Ishtar after she has secured him as her husband. The death of Tammuz gave rise in Babylonia to the mourning ceremonies described by Ezekiel and from Babylonia as a centre the cult spread to the West. Among the Canaanites and Phœnicians, Tammuz was known as *Adonai*, 'the lord,' and this name survives under the form Adonis (q.v.). Among the Phœnicians the chief temple and worship of Adonis was at Byblus (or Gebal), and from Phœnicia the Adonis cult was carried to Cyprus and Greece, where he was connected with Aphrodite. His festivals were partly the expressions of joy, partly of mourning. In the latter the women gave themselves up to the most unmitigated grief over the 'lost Adonis,' shaved off their hair, and sacrificed their chastity in his temples. The days of mourning were completed by a solemn burial of an image of the god. This period was followed by a succession of festive and joyful days, in honor of the resurrection of Adonis. The river Adonis (Nahr Ibrahim), which once a year 'ran purple to the sea' from the Lebanon, was supposed to be tinged by the blood of the god; and a vessel sent off from Alexandria, and carried by the tide to Byblus, used to inform the mourners by letter that he had been found again. These feasts were celebrated during the summer solstice. The fourth month in the Babylonian calendar, known as Tammuz and adopted by the Hebrews, preserves the name of the god and furnishes a valuable testimony as to the time when his festival was celebrated, since the Babylonian year began in the spring. Adonis of Byblus was identified at a later period with Osiris, and the myth underwent various transformations in thus passing from one people to the other. Consult: Robertson Smith, *Religion of the Semites* (London, 1894); Frazer, *The Golden Bough* (London, 1900).

TAM O' SHANTER. One of the best known poems of Robert Burns, based on the popular belief that no evil spirit can pass the middle of a running stream. The hero is pursued by 'Cutty Sark' for disturbing a dance of imps at Alloway Kirk, and succeeds in crossing the River Doon in safety.

TAM′PA. A port of entry and the county seat of Hillsboro County, Fla., 240 miles south by west of Jacksonville, at the mouth of the Hillsboro River, on Tampa Bay, and on the Atlantic Coast Line and the Seaboard Air Line railroads (Map: Florida, F 4). There is also steamship connection by way of Port Tampa with the principal Atlantic and Gulf ports. Tampa is favored with an attractive situation and a healthful climate, and has become a famous winter resort. Noteworthy are the Tampa Bay Hotel, one of the largest tourist hotels in America; De Soto Park, the scene of the encampment of the United States Volunteers during the Spanish-American War: the old Government reservation; and the Convent of Holy Names. Tampa is an important shipping point through Port Tampa for phosphate, fruits, vegetables, turpentine, rosin, lumber, fish, cattle, and wheat flour. Tobacco is imported extensively. In the year ending June 30, 1901, the total trade of the customs district amounted to $2,834,871, including exports to the value of $1,321,419. The industrial interests of the city are confined chiefly to the manufacture of cigars, the output of which in 1902 was valued at nearly $10,000,000. Fishing also is largely carried on. Under the charter of 1899, the government is vested in a mayor, chosen biennially, and a unicameral council. Tampa was settled in 1848 as an army post, and was incorporated in 1886. In the latter year it became a port of entry. During the decade 1890-1900 the city had a very rapid growth, the population, in 1890, being 5532; and in 1900, 15,839.

TAMPA BAY. An inlet of the Gulf of Mexico on the west coast of Florida (Map: Florida, F 4). It is about 40 miles long, and from 6 to 15 miles in width, the northern part being divided into Old Tampa and Hillsboro bays. Its entrance is protected by a line of keys, or low islands, and it forms an excellent harbor with a depth of 22 feet in the main entrance. It contains a number of small islands.

TAMPAN. A tick (q.v.), of Southern Africa, remarkable for its very poisonous bite, found in Angola, and southward, and described by Livingstone in his *Travels*. It attacks by preference the parts between the fingers or toes, attains the size of a pea, and when filled with blood is dark-blue, and so tough that it cannot be burst by squeezing with the fingers. The first effect of the bite is a mingled sensation of pain and itching, which ascends the limb until it reaches the abdomen, and soon causes either violent vomiting and purging, or fever. The tingling sensation lasts for a week.

TAMPICO, tȧm-pē′kȯ. A Mexican seaport in the State of Tamaulipas, 206 miles northeast of the City of Mexico, on the Pánuco, near its mouth (Map: Mexico, K 6). The town lies only 25 to 50 feet above sea level, and is surrounded by lagoons, which make it very unhealthful. It has broad streets and squares, the largest of the latter, the Plaza Constitución, having a public garden in its centre. The most notable building is the parish church of the Jesuits. The harbor has been improved by the construction of a breakwater and jetty, so that the trade in wool, hemp, hides, honey, drugs, Cuba wood, and mining ores, in exchange for manufactured articles, now surpasses that of Vera Cruz. The Monterey and Mexican Gulf and the Mexican Central branch of the San Luis Potisí railroads connect the town with the interior States of Northern Mexico, of which it is the chief outlet. Its population in 1895 was 11,912. Tampico was an Aztec city. In 1683 it was destroyed by the pirate Lorencillo and was not rebuilt till 1823. It received the name Santa Ana de Tamaulipas in 1834, and was the scene of a Mexican victory over the Spanish in 1827.

TAMSUI, täm′sōō′ė (Chin., Freshwater). A port on the north coast of Formosa, opened to foreign residence and trade by the treaty of Tientsin (1858), and continued as such by the Japanese. It stands at the mouth of the Tamsui River, 13 miles from Jai-peh. The principal exports are tea, rice, sugar, camphor, coal, flax, hemp, jute, etc., chiefly to China, Hong Kong, British India, and the United States, and the imports are salt, flour, kerosene oil, cotton and woolen goods, lead, and other metals, tobacco, joss-sticks, etc. The population is estimated at over 6000.

TAM-TAM (Hind., drum, onomatopoetic in origin). An Indian or Chinese musical instrument. It consists of a metal disk concave in the middle and is suspended by a loop. The tone is produced by striking the disk with a stick having a soft knob made of felt or leather.

TAM′WORTH. A municipal borough and market town, on the borders of Staffordshire and Warwickshire, England, at the confluence of the Tame and Anker, 13 miles northeast of Birmingham (Map: England E 4). Its chief buildings are the castle built on the site of a Saxon fort and the Church of Saint Editha, founded in the eighth century. It acquired in 1897 the historic castle which had descended through the female line of the Marmions to the Marquis of Townshend. Market gardening, brickmaking, brewing, dyeing, wool-stapling, and manufactures of tapes and small wares are carried on. From the beginning of the eighth century Tamworth was the chief Mercian royal residence. Burned by the Danes in 911, it was rebuilt by Ethelfleda, daughter of Alfred the Great. Population, in 1901, 7271. Consult Palmer, *History of Tamworth* (London, 1871-75).

TANA, tä′nȧ. A river in British East Africa (Map: Africa, H 5). It rises in numerous headstreams in the southwestern slope of Mount Kenia, and flows southeast after making a long detour to the north, emptying into the Indian Ocean in latitude 2° 47′ S. Its length is over 500 miles. Its upper course down to Hameye is that of a mountain stream, full of falls and cataracts. Below that point it runs 360 miles through alluvial plains and is navigable for light-draught vessels in the rainy season. Its importance as a waterway into the interior of Africa is considerably diminished by the bar which obstructs its entrance.

TANAGER (from Neo-Lat. *Tanagra,* from Brazilian *tangara,* the native name of the bird). The popular name for the Tanagridæ, a family of birds having a conical beak, triangular at the base, the upper mandible notched toward the tip, and its ridge arched. The family is closely related to the finches and about 350 species are known, all American and nearly all tropical. Only five species occur as far north as the United States and only two of these reach Canada. They are all birds of moderate or small size, six to eight inches long or less, but of surpassingly gaudy plumage, though the brilliancy is frequently confined to the male sex. They are arboreal birds, feeding on fruit and insects, and have little power of song, but a few species are musicians of some merit. The best known of the three North American forms is the scarlet tanager (*Piranga erythromelas*), the most brilliant bird of the Northern United States. The male is bright scarlet with black wings and tail; the female light olive-green above and greenish yellow beneath. The immature males are like the females, but have the black wings and tail, and the adult male assumes this plumage in winter. The scarlet tanager breeds as far north as New Brunswick and as far west as Kansas, but winters in Central and South America. It builds its nest near the end of a horizontal limb; the nest is a rather loose, shallow structure of twigs, weeds, and rootlets. The eggs are pale bluish with numerous reddish-brown spots. The scarlet tanager is not a notable musician, but its song is pleasing. From New Jersey southward there is found from April to September the summer tanager (*Piranga rubra*), which is rose-red, brighter below, the wings fuscous margined with rose. The female is orange olive-green above, buffy yellowish green below. In habits, nesting, and song it resembles the scarlet tanager. From the eastern foothills of the Rockies to the Pacific there is found in summer a beautiful bird, the Louisiana or crimson-headed tanager (*Piranga Ludoviciana*). The male is bright yellow, with the whole head crimson or scarlet, and the back, wings, and tail black. The female is exactly like the female scarlet tanager, except for the white or yellowish markings on the wings. In nesting and other habits this exquisite bird resembles the others. Consult Ridgway, *Birds of North and Middle America,* part ii. (Washington, 1902). See Colored Plate of Song Birds.

TAN′AGRA (Lat., from Gk. Τάναγρα, modern Gremada). An ancient city in eastern Bœotia close to the Athenian border. It did not play any part in ancient history, but near it was fought an important battle between the Athenians and Spartans in B.C. 457. Through the treacherous desertion of the Thessalian cavalry the Athenians were defeated, but later in the same year at Œnophyta in the same district they won a great victory which made them masters of Bœotia. During the Hellenistic and Roman periods Tanagra was a flourishing agricultural community, said to produce the best wine in Bœotia. It is now deserted, though the line of ancient walls is marked by mounds of rubbish, and there are remains of the theatre and other ancient buildings. The chief fame of the town is due to its extensive necropolis, first opened in 1874, and since then the scene of countless open and clandestine excavations. The tombs or graves have yielded the long series of graceful and charming terra-cotta statuettes, known as Tanagra figurines. In many cases these were broken before being cast into the grave and their significance has caused much discussion, in which an occult symbolism has not been proved. The high value attached to these little figures has led to much modern forgery and it is often hard even for an expert to detect the imitations.

TA′NAIS. The ancient name of the Don.

TANANA, tȧ-nä′nȧ (South American name). One of the singing grasshoppers of the genus Locusta, common in Brazil, whose music is much admired by the natives, who keep it in little cages much as the Japanese keep crickets.

TANANARIVO, tȧ-nä′nȧ-rē′vō. The capital of Madagascar. See Antananarivo.

TAN′AQUIL. The wife of Tarquinius Priscus.

TANAUAN, tȧ-nä′wȧn. A town of Leyte, Philippines, situated 10 miles from Taclobân (Map: Philippines, J 8). Population, 18,500.

TANAUAN. A town of Luzon, Philippines, in the Province of Batangas (Map: Luzon, F 10). It is situated on the principal highway from Batangas to Manila, about 27 miles north of Batangas. The town was founded in 1584, on the shore of Lake Taal, but was destroyed in 1754 by an eruption of the volcano Taal (q.v.), and later rebuilt in its present position not far from the lake. Population, over 21,000.

TAN'CRED (c.1050-1112). Prince of Antioch, a hero of the First Crusade. The first authentic information respecting him is that he joined his cousin Bohemund in the First Crusade in 1096. They landed in Epirus, and took the oath of allegiance to the Greek Emperor, Alexius (q.v.). Tancred's exploits on the way to Syria; his quarrel with Baldwin for the possession of Tarsus; his valor before Antioch, where he took an oath that as long as he had forty knights he would never withdraw from the expedition to Jerusalem; and the praises of his biographer, Radulph of Caen, have given him a fictitious importance. After the conquest of Jerusalem he became Prince of Galilee. A quarrel with Baldwin, after Godfrey's death, caused him to give up his possessions in the Kingdom of Jerusalem. While Bohemund was in captivity he ruled over Antioch. When Bohemund died in 1111, Tancred became Prince of Antioch, where he died in 1112. Tancred has been made famous by Tasso in his *Gerusalemme Liberata.* For the actual facts during the most important period of his life, consult Kugler, *Boemund und Tankred* (Tübingen, 1862).

TANCRED AND GISMUNDA. A tragedy played before Queen Elizabeth in 1586, published by Robert Wilmot in 1591. Its title page explains that it was "compiled by the Gentlemen of the Inner Temple, and by them presented before her Majestie." The authors were probably five in number. It was founded on a story by Boccaccio, the substance of which makes the plot of Tale 39 in Painter's *Palace of Pleasure* (London, 1566-67). It was originally written in rhymed quatrains, which Wilmot, however, changed to blank verse on publication.

TANCRED OF HAUTEVILLE, ōt'vēl'. A Norman noble, father of several sons who established by force of arms the Norman power in Southern Italy and Sicily. The most celebrated of the brothers were Robert Guiscard and Roger I. (qq.v.).

TANDOLANO, tän'dō-lä'nō. A wild Malay tribe in Palawan Island. See Philippine Islands.

TAN'DY, James Napper (1740-1803). An Irish agitator, born in Dublin. During the American Revolution he took an active part in the effort to prevent the use of English goods in Ireland; was an enthusiast in the 'volunteer movement;' on May 27, 1782, commanded the corps of artillery that guarded the approaches to the Irish Parliament when that body met to receive the answer of the Ministry to the demand for legislative independence; and was one of the foremost in the volunteer convention of November, 1783. Ten years afterwards when he was about to be tried for writing a seditious pamphlet called "Common Sense," he fled to the United States. In 1798 he went to Paris and was put in command of a vessel for an invasion of Ireland. He remained on Irish soil, however, but eight hours, and then went to Bergen, and from there by land to Hamburg. At the latter place he was seized and was delivered to the English, and upon his arrival in Ireland was condemned to death. Bonaparte, however, brought such pressure to bear in his favor that the prisoner was released. He soon after went to France and was made a general of division. He was the hero of the famous ballad, "The Wearing of the Green." Consult: Lecky, *History of England in the Eighteenth Century* (London, 1878-90).

TANERA, tȧ-nā'rȧ, Karl (1849—). A German military writer and novelist, born at Landshut, Bavaria. He entered the Bavarian army in 1866, took part in the campaign of 1870-71, and was severely wounded during the siege of Paris. Having frequented the Kriegsakademie in Berlin, in 1877-80, he was detailed to the department of military history in the great general staff, in 1882, but retired as captain in 1887 to devote himself exclusively to his literary work. To the collective work *Der Krieg von 1870-71, dargestellt von Mitkämpfern* (1888-91) he contributed vols. i., iii., v., and vii.; and next published *Deutschlands Kriege von Fehrbellin bis Königgrätz* (1891-94). His novels, military sketches, essays and reminiscences of his extensive travels in the East and North Africa include: *Durch ein Jahrhundert, Drei Kriegsgeschichtliche Romane* (1892); *Schwere Kämpfe* (1897); *Aus zwei Lagern, Kriegsroman* (1899); *Die Eurasierin* (1900); *Ernste und heitere Erinnerungen eines Ordonnanzoffiziers* (1887, 8th ed., 1902); *Offiziersleben in Krieg und Frieden* (1889); *Heiteres und Ernstes aus Altbayern* (1895); *Aus drei Weltteilen, Reiseskizzen* (1898); *Deutschlands Kämpfe in Ostasien* (1901); and *Eine Weltreise* (1902).

TANEY, tą'nĭ, Roger Brooke (1777-1864). An eminent American jurist, Chief Justice of the United States Supreme Court. He was born in Calvert County, Md.; graduated at Dickinson College, Pa.; studied law at Annapolis; and in 1799 was admitted to the bar. In 1823 he removed to Baltimore, where he succeeded William Pinkney and Luther Martin as head of the Maryland bar. In 1827 he was elected Attorney-General of the State, and, having become a Democrat and a supporter of Andrew Jackson, was appointed Attorney-General of the United States in 1831. In this capacity he became one of Jackson's most trusted counselors, encouraged him to remove the United States Bank deposits, and upon the refusal of William J. Duane, then Secretary of the Treasury, to obey Jackson's orders to this effect, was appointed in Duane's stead, though his appointment was never confirmed by the Senate. Taney promptly removed the deposits and thus further won the confidence of his chief. In 1836 he succeeded John Marshall as Chief Justice of the United States Supreme Court. In this capacity he sustained in the main the high reputation of his distinguished predecessor for legal learning and acumen, though as a result of the passions engendered by the approaching civil strife some of his opinions were severely criticised. He wrote the opinion of the court in many important cases, the most notable being that of Dred Scott. (See Dred Scott Case.) During the Civil War Chief Justice Taney gave opinion in the noted case of *Ex-parte Merryman* in answer to an application for a writ of *habeas corpus* in behalf of a citizen of Baltimore who had been arrested by a United States officer on a charge of treason, denying in strong and vigorous language the right of the President to suspend the writ of *habeas corpus* and affirming that that power was vested in Congress alone. A memoir of Taney's life, in part an autobiography, was published in 1872 by Samuel Tyler.

T'ANG, täng. One of the seven most celebrated dynasties of China. It lasted from 618 to 907 and was founded by Li Yuan, a soldier and a descendant of one of the princely houses, who, after a reign of eight years, during which many reforms were introduced, abdicated in favor of his second son, Li Shih-min, the real unifier of the Empire and the most illustrious of the T'ang rulers (627-649). With the twelfth Emperor decay began to set in and in 907 the line came to an end. In 923 a descendant of one of the T'ang emperors established the Posterior T'ang, which came to an end in 936 under its fourth Emperor.

The T'ang is undoubtedly one of the most brilliant periods of Chinese history. The Empire was extended to the Caspian Sea and China itself was divided into fifteen provinces. In 628 a maternal uncle of Mohammed visited China and built the mosque at Canton, and a century and a half later 4000 Mohammedan soldiers, whose descendants now form an important element of the population, settled in the country. Learning and literature were fostered, the Hanlin Yuan (q.v.) had its beginning, and Buddhism, Taoism, and even Nestorian Christianity flourished under Imperial patronage. Paper money was then first used and the Peking *Gazette* was founded.

TANGANYIKA, tän′gȧn-yē′kȧ. A large lake in Central Africa, extending from latitude 3° 16′ to 8° 48′ S., and from longitude 29° 20′ to 31° 20′ E. (Map: Africa, H 5). Its northern end is 175 miles southwest of the Victoria Nyanza, and its southern end 190 miles northwest of Lake Nyassa. It lies in the western branch of the Great Rift Valley (q.v.), which is interrupted at the south end of the lake by a plateau, but continued farther to the southeast as the basin of Lake Nyassa. Tanganyika extends in a north and south direction, with a length of 400 miles and a breadth of 20 to 40 miles. Its area is estimated at over 12,000 square miles. Its basin, which includes a narrow strip of fertile lowland along either shore, is bounded by the high and steep sides of the Rift Valley, which in some places form precipitous rocky cliffs, and reach a height of 4200 feet above the level of the lake, which is 2700 feet above the sea. The depth is very great, ranging in the greater portion from 500 to over 2000 feet, and the lake is remarkably free from shoals, reefs, or islands. There are, however, floating islands of vegetation, the shores being often very densely forested with palms. Navigation is also rendered dangerous by severe hurricanes and tornadoes to which the basin is subject. The lake is fed by numerous small streams from the surrounding plateau, and discharges into the Congo through the Lukuga, which leaves it near the middle of the western shore. This discharge, however, is intermittent, and the level of the lake is subject to periodic fluctuations, each of which may range over a series of years. The fall of the lake level in recent times has amounted to two feet annually. Though the water is, as a whole, fresh, it has in some portions a tendency to become brackish. The fauna of the lake is very rich and peculiarly interesting. Besides the usual fresh-water fish, crocodiles, and hippopotamuses, all of which are abundant, there are a number of peculiar isolated groups of deep-water mollusks and crabs which are asserted to be of marine origin. This fact points to the theory that in Jurassic or Cretaceous times the lake was an arm of the sea which became isolated by subsequent upheavals.

Politically the west shore belongs to the Congo Free State, the east shore to German East Africa, and the south shore to the British colony of Rhodesia. All three powers have trading and mission stations on the shores, and several steamers have been launched on the lake. Of the numerous native towns the largest is Ujiji, on the east shore. Lake Tanganyika was discovered in 1858 by Burton and Speke, and later explored by Livingstone, Cameron, Stanley, and others. Consult Peters, *Das deutsch-ostrafrikanische Schutzgebiet* (Munich, 1895).

TANGENT (Lat. *tangens*, pres. part. of *tangere*, to touch; connected with Goth. *tēkan*, Icel. *taka*, AS. *tacan*, Eng. *take*). An unlimited straight line which meets a curve in but one point, without cutting it. The point is called the point of contact or point of tangency. A tangent may be thought of as the limiting position of a secant, the point of tangency being the point in which the points of intersection of the secant with the curve coincide. In the circle there is but one distinct tangent at any point in the circumference, and this is perpendicular to the radius at that point. The segments of two tangents to a circle from an external point, limited by the point and the points of contact, are equal. If the point moves up to the circumference, the segments become zero and the tangents coincide; if the point moves inside the circumference, the tangents become imaginary. (See CONTINUITY.) All conic sections being of the second class (see CURVE) admit of but two tangents from any point. Curves belonging to higher classes admit of a greater number, depending upon the class. Tangents are of different orders of contact (see CONTACT) according to the number of coincident points at the point of tangency, and thus serve to distinguish various singularities of curves. (See CURVE.) In coördinate geometry the projection, upon the X-axis, of the segment of the tangent between the point of contact and the X-axis is called the subtangent. An important class of tangents are known as asymptotes (q.v.). In the geometry of surfaces the tangent plane corresponds to the tangent line of curves. The extensive list of properties involving tangents is best obtained from works on analytic geometry.

TANGERMANN, täng′ẽr-män, WILHELM (1815—). A German Old-Catholic theologian, known as an author by the pseudonym Victor Granella. He was born at Essen-on-the-Ruhr and studied theology at Münster and Munich. In 1846 he became priest at Neuss and afterwards held several prominent positions in his Church. In 1870 he was deprived of his offices because of his having refused to acknowledge the Vatican's decrees, and afterwards he was prominently identified with the Old-Catholic movement. From 1872 to 1888 he was in charge of the congregation at Cologne. His numerous writings include: *Wahrheit, Schönheit und Liebe, Philosophisch-ästhetische Studien* (1857); *Philosophie und Christentum in ihren Beziehungen zur Kultur und Religionsfrage* (1875); and *Natur und Geist* (1894).

TANGERMÜNDE, tăng′ĕr-mṳn′de. A town in the District of Magdeburg, Prussia, 63 miles west of Berlin, on the Elbe. The town still retains its old walls, gates, and towers, its twelfth-century Church of Saint Stephen, an ancient castle, now the district building, and the old council house. There are a large sugar refinery, mills for manufacturing rape-seed oil and bone meal, and boat-building establishments. Population, in 1900, 11,524.

TANGHIN (Malagasy name), *Cerbera Tanghin.* A tree of the natural order Apocynaceæ. The kernel of its fruit was formerly used in Madagascar, where the tree is native, to determine the guilt or innocence of persons charged with witchcraft and like odious crimes. If guilty of anything the fear of the accused was often so intense that fatal results followed the taking of even minute quantities of the powdered kernels and sometimes also when innocuous substances were substituted; but if innocent the accused would generally be fearless and eat freely, in which case an emetic action followed by no serious after effects would result.

TANGIER, tăn-jēr′, or **TANGIERS.** The chief seaport of Morocco, and the capital of the Province of Haábat, on the Bay of Tangier, in the Strait of Gibraltar, 8 miles east of Cape Spartel and 35 miles southwest of Gibraltar (Map: Africa, D 1). It is a healthful town in spite of wretched sanitary conditions. It is fortified and surrounded by ancient ruins of walls and by gardened areas. It is picturesquely Oriental and its life is highly interesting. The white Moorish houses, amid towers and gates, rise above one another from the sea in the form of an amphitheatre, the highest point being crowned by a castle. The houses are of one story; the streets, steep, and too narrow for wagons or carriages. The main street leads from the harbor on the east to the new market and to the Socco de Barra on the southwest. It passes the Great Mosque, whose handsome gate and tower are noteworthy. Near by is the Small Socco, with its interesting bazaars—the business centre of the town. The Kasba, or castle, dating from the fifteenth century, stands on the plateau in the northern part of the city. The plateau extends from the lofty Marshan toward the sea, and furnishes a superb view. The castle or citadel is a dilapidated mass of buildings. The adjacent palace of the Sultan and the residence of the Governor are imposing edifices. The North American Mission and the Gospel Union of Kansas have their headquarters in Tangier, and there are a Catholic chapel, several synagogues, and a hospital. Tangier is lighted by electricity. The harbor is the best in Morocco, although it is both small and shallow. The annual exports are about $1,300,000. The imports are about $1,500,000, largely represented by cotton. The shipping entered in 1900 was 424,000 tons. The famous Morocco leather is made here. Population, about 30,000, including 6000 Christians and 7000 Jews.

Tangier is the Roman Tingis, and was the capital of a Roman province. It was held in turn by the Vandals, Byzantines, Arabs, and Portuguese, who obtained possession of it 1471. It came to the English in 1662 as part of the dowry of Catherine of Braganza, wife of Charles II., but was abandoned by them to the Moors in 1684.

TANGLEWOOD TALES, THE. A volume of stories for children by Hawthorne (1853). The stories are old Greek myths told in an attractive style, and supposed to be brought to the author by Eustace Bright, the assumed narrator of the stories contained in the *Wonder Book.*

TA′NIS. The Tyrian name of the goddess Astarte (q.v.).

TANIS (Lat., from Gk. Τάνις, Egyptian *Za'net,* Hebrew *Zo'an*). A city of ancient Egypt in the northeastern corner of the Delta. It was situated on the right bank of the Tanitic branch of the Nile, near the site of the modern fishing village of San. Tanis was the capital of the fourteenth nome of Lower Egypt, and was a place of importance in very early times. The kings of the Sixth Dynasty founded there a great temple which was subsequently restored and enlarged by their successors of the Twelfth and Thirteenth Dynasties, and the city was for some time the capital of the Hyksos rulers. Under the Nineteenth Dynasty it was strongly fortified as a base of military operations against Palestine and Syria, and Rameses II., who established his residence there, restored the ancient temples and greatly embellished the city. The Twenty-first Dynasty, of Tanitic origin, made the city the capital of Egypt, and at the time of the Assyrian invasions in the seventh century B.C. it was the seat of a prince. Until the founding of Alexandria it was one of the chief commercial cities of Egypt, but the silting up of the Tanitic mouth of the Nile diverted its trade to the new capital of the Ptolemies, and it gradually fell into ruins. Excavations of the site, conducted by Mariette in 1860, and by Petrie in 1883-84, brought to light the remains of extensive temple buildings, many statues and sphinxes, and no less than fourteen obelisks. Tanis is undoubtedly the Biblical Zoan, which in Numbers xiii. 22 is said to have been built seven years later than Hebron, and it is identified by many Egyptologists with the city of Raamses, which the Israelites were obliged to fortify (Ex. i. 11). Consult: Petrie, *Tanis* (London. 1885-88); Budge, *A History of Egypt* (New York, 1902).

TANISTRY (from *tanist,* from Ir., Gael. *tanaiste,* lieutenant, lord, governor, heir apparent). An ancient Celtic law of succession, common to both Ireland and Wales, by which property or political power descended not to the children of the deceased, but to the oldest or most powerful of his collateral relatives. The rights thus transferred were felt to be vested rather in the tribe than in the individual.

TANJAY, tȧn-ʜī′. A town of Negros, Philippines, in the Province of Western Negros, situated 19 miles from Dumaguete (Map: Philippines, H 10). Population, in 1887, 10,293; now, 12,400.

TANJORE, tăn-jōr′. The capital of a district of Tanjore, in the Province of Madras, British India, 48 miles west of Negapatam, in the valley of the Kaveri River, one of the richest agricultural sections in India (Map: India, C 6). The large temple, dating from the eleventh century, is one of the finest examples of the Pagoda style of architecture in existence. There are several concentric rectangles, the outer measuring 415 by 800 feet. The leading architectural features are the great gopura, a pyramidal tower 200 feet high, and the handsome embellished shrine of Kaxttikeya. Another striking edifice is the palace of the Raja, constructed in 1550. It has many sculptures and pictures, together with a library containing valuable Sanskrit manuscripts. Schwartz's Church, the English Church, Saint Peter's College, the Prince of Wales Medical School, and People's Park are also of interest. Tanjore has manufactures of jewelry, carpets, copper utensils, and objects in repoussé work. Population, in 1901, 57,870. Tanjore was the capital of a Hindu principality until the overthrow of the Chola dynasty by the Mahrattas in 1678. During its early history it was one of the most important cities in Southern India. The English obtained control in 1799.

TANKAGE. A name applied to a product, used mainly for fertilizing purposes, which is prepared from the residue resulting from the treatment of abattoir and slaughter-house refuse with steam and hot water in closed tanks for the removal of fat, a process commonly known as 'tanking'. Tankage is variable in composition, depending upon the materials used in its preparation and the process of manufacture, but is generally rich in nitrogen, and it is this element which mainly determines its value as a fertilizer. According to Voorhees, two distinct kinds of tankage are ordinarily prepared, (1) concentrated tankage, containing from 10 to 12 per cent. of nitrogen with very small percentages of phosphoric acid; and (2) crushed tankage, of which there are several grades, containing from 4 to 9 per cent. of nitrogen, and 3 to 12 per cent. of phosphoric acid. Products containing more than 12 per cent. of phosphoric acid are known as bone tankage, and are properly classed with bone fertilizers (q.v.). The term tankage is also sometimes applied to the product obtained by drying, and in some cases partially charring, city garbage. This garbage tankage is more variable in composition and less valuable as a fertilizer than true tankage, although, like the latter, its value as a fertilizer depends mainly upon its nitrogen. The nitrogen of meat and bone tankage of good quality has been found to be about 60 per cent. as effective as plant food as that of nitrate of soda, which is taken as the standard. Tankage is therefore one of the most valuable sources of organic nitrogen for fertilizing purposes. Tankage is also beginning to be used with very promising results as a concentrated feeding stuff, especially for feeding hogs. When used in combination with corn it supplies the deficiencies, from a feeding standpoint, of that grain in protein and ash constituents and thus furnishes a better balanced ration.

TAN′NAHILL, Robert (1774-1810). A Scottish poet. He was the son of a silk weaver of Paisley. He was apprenticed to his father and passed most of his life in Paisley at the loom. He early showed a talent for verse and studied Burns, Fergusson, and Ramsay. He became an active member of a literary club at Paisley, for which he wrote some of his best songs. To a local Burns club he also contributed three remarkable birthday odes. As a song writer he possessed a spontaneity akin to that of Burns. Among his best songs, known throughout Scotland, are "Bonnie Wood o' Craigielee," "Sleepin' Maggie," "Braes o' Gleniffer," "Gloomy Winter's noo awa'," and "Jessie the Flower o' Dunblane." They all show a genuine lyrical gift, much tenderness of sentiment, and a true eye and feeling for the simple effects of nature. Suffering from melancholia, Tannahill drowned himself in a canal near Paisley. In 1874 the centenary of his birth was observed; and in 1883 a bronze statue was erected to his memory in the Paisley Abbey burying ground. Consult the complete edition of *Poems*, ed. Semple (Glasgow, 1873); selections in Miles's *Poets and Poetry of the Century* (London, 1891, et. seq.).

TAN′NER, Henry Ossawa (1859—). An American historical painter. He was born at Pittsburg, Pa., the son of a bishop of the African Methodist Church, and studied in the Pennsylvania Academy of Fine Arts under Thomas Eakins. Later he went to Paris, where he remained, feeling there to a less degree his racial disadvantage. He studied under Jean Paul Laurens and Benjamin Constant; and in 1900 he was awarded the Lippincott prize at Philadelphia and a medal at the Paris Exposition. His pictures are landscapes and religious themes and in them he exhibits a Southern heartiness of emotion under a judicious restraint, a realism of presentation, and especially a rich mastery of color. His "Raising of Lazarus" hangs in the Luxembourg. The "Christ and Nicodemus" and the "Annunciation" are in Philadelphia, one in the Academy of Fine Arts, the other in Memorial Hall, Fairmount Park.

TANNER, Henry S. (1786-1858). An American geographer, born in New York City. He studied engraving and settled in Philadelphia, where, with his brother Benjamin, he established an extensive business in publishing maps, atlases, and geographical works. He became widely known as an authority on geography and was elected to membership in both the London and Paris Geographical Societies. His publications included: *New American Atlas* (1817-23); *Map of the United States of Mexico* (1825); *Map of Philadelphia* (1826); *Map of the United States of America* (1829); *View of the Valley of the Mississippi* (1832); *American Traveller* (1836); *Description of the Canals and Railroads of the United States* (1840).

TANNER, Thomas (1674-1735). An English antiquary, born at Market Lavington, in Wiltshire, where his father was vicar, and educated at Queen's College, Oxford. He was ordained deacon in 1694 and was appointed chaplain of All Souls' College in 1695. Besides various other preferments, he became canon of Ely (1713), canon of Christ Church, Oxford (1724), and Bishop of Saint Asaph (1732). He is known chiefly for *Notitia Monastica, or a Short History of the Religious Houses in England and Wales* (1695) and the *Bibliotheca Britannico-Hibernica,* a valuable account of the authors that flourished in the three kingdoms up to the seventeenth century (posthumous, 1748). With him Anthony à Wood (q.v.) left additional 'lives,' which appeared in the second addition of *Athenæ Oxonienses* (1721). Tanner bequeathed a large body of manuscripts to the Bodleian Library at Oxford.

TANNERY, tȧ'ne-rē', Paul (1843—). A French scholar, born at Nantes. He was educated in the Paris Polytechnic School; engaged in the tobacco industry; and devoted his leisure time to studying the history of science and of philosophy. For two years he gave a course in the Sorbonne on the history of arithmetic, and for five years filled Professor Lévêque's chair in the history of Greek and Latin philosophy in the College of France. Aside from a great number of articles in periodicals and other publications, he published: *Pour l'histoire de la science hellène* (1887); *La géométrie grecque* (1887); *La correspondance de Descartes dans les inédits des fonds Libri* (1893); and *Recherches sur l'histoire de l'astronomie ancienne*.

TANNHÄUSER, tän'hoi-zẽr. A German knight and minnesinger of the thirteenth century, probably a Bavarian by birth, who enjoyed the favor of Duke Frederick II. of Austria. Little is known historically of his career, and he disappears entirely after the death of Conradin (1268). His verses are in the main mocking and sensuous. One of the latest of them, a penitential song, may have led to his identification with the hero of the old Teutonic legend of the Venusberg or Hill of Venus. This was a region within a mountain near the Wartburg, in the Thuringian Forest, where Venus reigned, and whence no one save Tannhäuser ever escaped. Here Tannhäuser, in the legend, lived with her until conscience smote him. He escaped, with the aid of the Blessed Virgin, and set out on a pilgrimage to Rome, to obtain pardon for his grievous sin. According to the story, Pope Urban IV. refused to pardon the sin until the staff in the Pope's hand should sprout. Tannhäuser returned to the Venusberg, but the wand meantime put forth green leaves by a miracle, to show the extent of the divine mercy. Modern versions of the legend were made by Tieck, Heine, and Geibel; and in Swinburne's *Laus Veneris* Tannhäuser is conceived as having returned irredeemably to the Venusberg. But better known than any is the famous dramatic treatment by Richard Wagner in his opera *Tannhäuser* (1845), whose libretto follows Hoffmann in identifying Tannhäuser with Heinrich von Ofterdingen and introducing him into the contest of the minstrels on the Wartburg. The works of the historic Tannhäuser were first edited by Von der Hagen in his *Minnesinger* (1848). For these consult: Oehlke (Königsberg, 1890) and Siebert (Berlin, 1894); for the legend, Baring-Gould, *Curious Myths of the Middle Ages* (London, 1884), and Grässe, *Der Tannhäuser und der ewige Jude* (2d ed., Dresden, 1890).

TANNIN (from *tan*, OF., Fr. *tan*, oak-bark for tanning, from OHG. *tanna*, Ger. *Tanne*, fir, oak; probably connected with Skt. *dhanvan*, bow). Tannic Acid, Gallotannic Acid, or Digallic Acid, $C_6H_2(OH)_2COOC_6H_2(OH)_2COOH$. An odorless and almost colorless substance, soluble in water, alcohol, acetone, glycerin, and various oils, occurring in Turkish and Chinese gall-nuts and in various other plants. It has a bitter, astringent taste, and assumes a yellow coloration if exposed for some time to the action of light. It is used as an astringent in medicine, and as a mordant in dyeing, and also finds employment in the manufacture of ink and of gallic and pyrogallic acids. Solutions of tannin reduce silver carbonate to metallic silver; they also reduce Fehling's solution (q.v.), and certain other substances, and precipitate gelatin and albumen from their solutions. On the other hand, solutions of tannin may be precipitated by the addition of various salts and acids, including common salt, sal ammoniac, the acetate as well as the sulphate of potassium, hydrochloric and sulphuric acids, etc. Tannin is made by extracting the powdered gall-nuts, which contain it in larger quantities, with a mixture of alcohol, ether and water; the layer of water then contains practically all the tannin; it is separated, purified by shaking with an excess of ether, and evaporated at a gentle heat. The residue thus obtained may be purified by dissolving in a dilute solution of common salt, and reprecipitating from this by adding an excess of salt in the solid state. With ferric salts tannin produces the well-known precipitate which is the coloring substance of ordinary black ink.

The names tannin and tannic acid are also applied to a variety of other substances of vegetable origin and having properties more or less similar to those of gallotannic acid: they are all astringent, transform hide into leather, give a blue or green coloration with salts of iron, etc. Some of the more important of these substances may be briefly noticed here under their special names.

Alder Tannin, $C_{22}H_{20}O_{11}$. This is a reddish-brown substance soluble in dilute alcohol and quite soluble in hot water; its solutions give a green precipitate with ferric salts. It may be prepared by extracting sawdust from *Alnus glutinosa* with boiling water, precipitating the extract with lead acetate, and decomposing with sulphureted hydrogen; the precipitate, which now contains both the tannin and lead sulphide, is extracted with alcohol, and thus the tannin is isolated.

Caffetannic Acid, $C_{15}H_{15}O_8$. This is found in coffee-berries and in certain other vegetable products. It is soluble in water and in alcohol and its solutions give a green coloration with ferric salts. It may be prepared by extracting coffee-berries with alcohol, diluting with water, filtering, boiling the filtrate and precipitating it with lead acetate; the precipitate thus obtained is shaken up with alcohol, in which it is caused to dissolve by decomposing with sulphureted hydrogen, and then the caffetannic acid is isolated by filtering and evaporating the solution to dryness.

Fraxitannic Acid, $C_{26}H_{32}O_{14}$. This is found in the leaves of the ash-tree. From these it may be obtained by extracting with water, precipitating the extract with lead acetate, and dissolving the precipitate in boiling aqueous acetic acid. The tannin is then isolated by a somewhat elaborate process, involving fractional precipitation with ammonia, treatment of the purest fractions with sulphureted hydrogen, etc. (Consult *Monats-*

hefte für Chemie, vol. iii., p. 745.) Pure fraxitannic acid is a golden-yellow powder, whose solutions give a dark-green coloration and precipitate with ferric salts.

QUERCITANNIC ACID. This is a substance, or perhaps several very similar substances, of uncertain composition, found in the leaves, bark, and wood of the oak. It is also probably contained in tea. Extracts containing quercitannic acid are largely used in tanning. From these extracts the acid may be isolated by diluting with water, allowing to settle, filtering, precipitating the filtrate with hydrochloric acid, washing and drying the precipitate, dissolving it in strong alcohol, and mixing the alcoholic solution with somewhat more than an equal volume of water; the precipitate thus produced is rejected; on filtering, the liquid is evaporated to dryness, the reddish-white residue being practically pure quercitannic acid—a substance soluble in dilute alcohol and sparingly in cold water.

QUINOTANNIC ACID, $C_{14}H_{16}O_9$. This is a light-yellow substance, found in cinchona bark. It is soluble in water, alcohol, and ether, and its solutions give a green precipitate with ferric salts. It may be prepared by extracting cinchona bark with water, adding burnt magnesia, filtering, precipitating the filtrate with lead acetate, decomposing the precipitate with aqueous sulphureted hydrogen again filtering, precipitating this filtrate with basic lead acetate, dissolving the precipitate in dilute acetic acid, adding ammonia, treating this last precipitate with sulphureted hydrogen, and, finally, evaporating the resulting solution to dryness in vacuo.

ARTIFICIAL TANNIN. A number of substances similar in composition and properties to the natural tannins have been obtained synthetically by Löwe, Schiff, Böttinger, and others.

Consult: Trimble, *The Tannins; a Monograph on Their History, Preparation, etc. With an Index to the Literature of the Subject* (Philadelphia, 1892-94).

TANNING. See LEATHER.

TANN-RATHSAMHAUSEN, tän-rät′säm-hou′zen, LUDWIG SAMSON, Baron von und zu der (1815-81). A German general, born at Darmstadt. He entered a Bavarian regiment of artillery in 1833, was transferred to the general staff in 1840, and, becoming aide-de-camp to Crown-prince Maximilian in 1840, was soon afterwards promoted to the rank of major. In 1849-50 he took a conspicuous part in the Schleswig-Holstein campaign, and after his return to Bavaria was again aide-de-camp to King Maximilian, was made major-general in 1855 and commanding general at Augsburg in 1861, and subsequently at Munich. In 1866 he was chief of staff of Field-marshal Prince Charles, commander-in-chief of the South German contingents, and having been appointed general of infantry and commander of the first army corps in 1869, led it with distinction in the campaign of 1870, at Wörth, Beaumont, and Sedan. Giving command over the combined forces operating on the Loire, he reduced Orléans, afterwards fought victoriously under the Grand Duke of Mecklenburg in several bloody engagements and rejoined the besieging forces before Paris. For his biography consult Helvig (Berlin, 1882), and Zernin (Darmstadt, 1883).

TANREC. See TENREC.

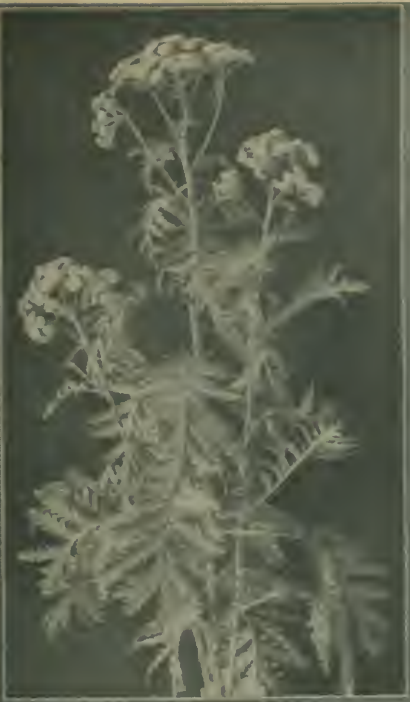
TANSILLO, tän-sĭl′lō, LUIGI (1510-68). An Italian poet, born at Venosa, province of Potenza. He early entered Court service and in 1535 became one of the bodyguard, formed of one hundred nobles, of Don Pedro de Toledo, the Spanish Viceroy of Naples, with whom and with whose son, Don Garcia, he stood in great favor. He accompanied them on their expedition against the Turks and fought with conspicuous bravery. Subsequently he held the post of Capitano di giustizia at Gaeta and died at Teano. His ingenious but rather lubrical poem *Il vendemmiatore* (1534), trans. by Mercier as *Jardin d'amour*, 1798), established his literary reputation, but was the cause of all his writings being placed on the Index by Paul IV. To atone for it, Tansillo afterwards resumed his religious epic *Le lagrime di San Pietro*, begun in 1539, but left it unfinished. Of his didactic poems *La balia* (trans. by William Roscoe) and *Il podere*, the latter is one of the best of its kind in Italian literature. His lyrics, inspired by his impassioned love for a high-born lady, are replete with fervor and fine descriptions of nature. In the *Stanze a Don Pedro di Toledo* (1547) he depicts with consummate art the luxurious gardens of the Viceroy by the sea. An edition of *Poesie liriche edite ed inedite*, with biography and commentary by Fiorentino appeared at Naples (1882); also *Capitoli giocosi e satirici*, ed. by Volpicella (ib., 1870).

TANSY (OF. *tanasie, tanesie, tanaisie, tanasie*, Fr. *tanaisie*, Sp., Port., It. *atananasia*, from ML. *athanasia*, tansy, from Gk. ἀθανασία, immortality, from ἀθάνατος, *athanatos*, immortal, from ἀ-, *a*-, not + θάνατος, *thanatos*, death, from θνήσκειν, *thnēskein*, to die), *Tanacetum*. A genus of plants of the natural order Compositæ, natives of the temperate parts of the Old World.

TANSY.

Common tansy (*Tanacetum vulgare*), a perennial, has long been cultivated in gardens and is naturalized in many parts of North America.

TANSY, ETC.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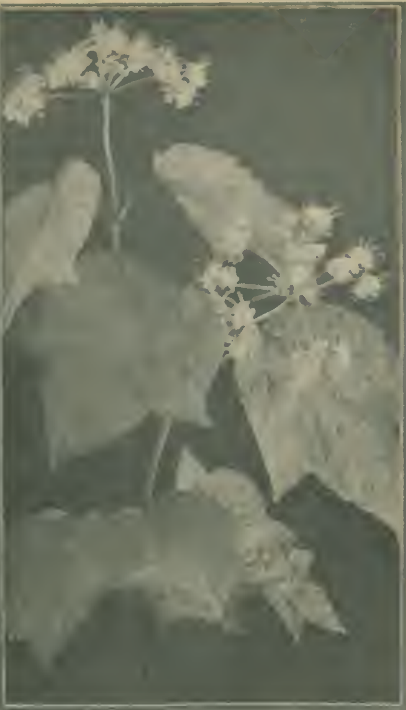
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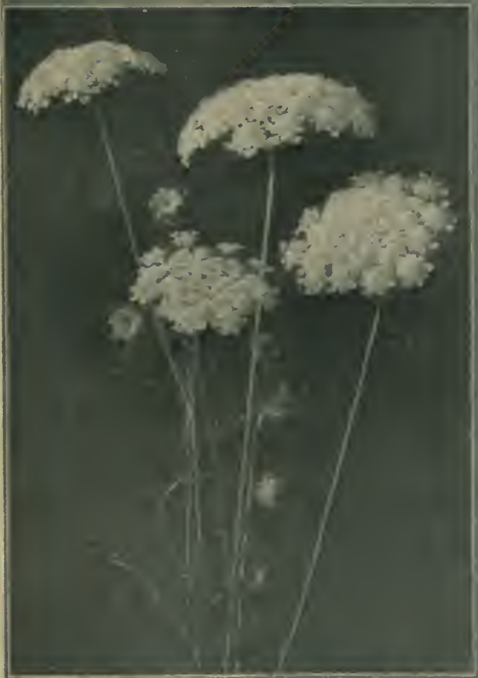

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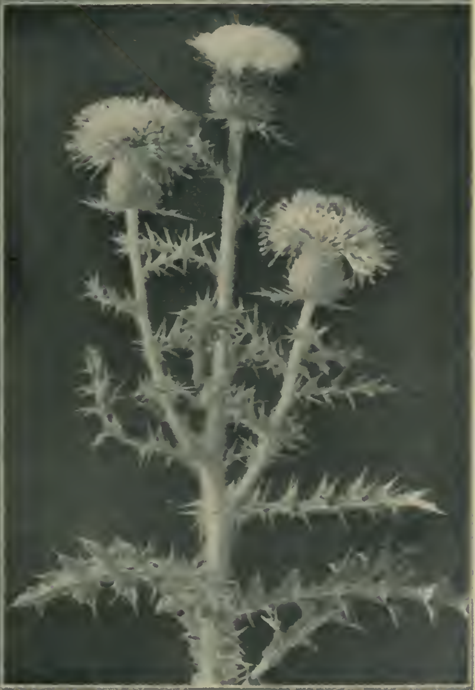


1. TANSY (Tanacetum vulgare).
2. WILD CARROT (Daucus Carota).
3. ARROW-WOOD (Viburnum acerifolium).
4. THISTLE (Cnicus lanceolatus).

The deep green leaves and yellow flowers have a strong aromatic smell and a bitter taste. The leaves contain a volatile oil and the younger ones have been used for flavoring puddings, cakes, omelets, etc., and were formerly used in medicine, but are rarely used even in domestic practice. Some curious Easter customs linger in many parts of England connected with the use of tansy cakes and puddings which were originally intended to represent the use of bitter herbs at the paschal feast. See Chambers's *Book of Days.*

TANTA, tän′tȧ, or **TANTAH.** The capital of the Province of Gharbieh, Lower Egypt, situated in the Delta, about 60 miles north of Cairo (Map: Egypt, E 2). It has a palace of the Khedive and a fine mosque, and is noted for its fairs and festivals, which are visited by thousands of Moslem pilgrims and traders. Population, in 1900, 35,000.

TANTALITE (from Neo-Lat. *tantalum,* tantalum). A mineral iron tantalate crystallized in the orthorhombic system. It has a submetallic and often brilliant lustre, and is brown to iron-black in color. It occurs in granitic and feldspathic veins in the form of crystalline granules and cleavable masses, and is found in Finland, Bavaria, Italy, Western South America, and Greenland, and in the United States at various localities along the Appalachian Mountain system, in Colorado, and in the Black Hill region. The iron in this mineral is frequently replaced by manganese, giving rise to a variety known as *manganotantalite.*

TANTALUM (Neo-Lat., from Lat. *Tantalus,* father of Niobe; so called from its close resemblance to the metal niobium). A metallic element discovered by Ekeberg in 1802. It occurs associated with columbates in the rare minerals columbite, tantalite and yttrotantalite. Its separation is by a long and complicated chemical method, and the product obtained is believed to be an impure mixture of oxides. Tantalum (symbol, Ta; atomic weight, 182.84) is a black powder that assumes an iron-gray metallic lustre under a burnisher, and when gently heated ignites in the air and burns, forming the oxide. It also combines with oxygen to form a pentoxide, which in turn combines with bases to form a series of salts called *tantalates.*

TAN′TALUS (Lat., from Gk. Τάνταλος). In Greek legend, King of the region about Mount Sipylus in Lydia, son of Zeus and father by Dione of Pelops (q.v.), Broteas, and Niobe (q.v.). He was a favorite of Zeus and was admitted to the gatherings of the gods, but offended grievously in some way and was in consequence visited with extreme punishments, so that he became one of the typical figures in Tartarus. There Tantalus was plunged into a deep pool, whose waters receded whenever he stooped to drink, while over his head hung clusters of fruit which were ever kept just beyond his reach. Another version represented him as poised in the air, beneath a huge rock which constantly threatened to fall and crush him.

TANTIA TOPI, tän′tē-ȧ tō′pē (c.1812-59). An Indian military commander, conspicuous in the Sepoy mutiny of 1857-58. He was born at Bithur, near Cawnpore. He became the chief lieutenant of Nana Sahib (q.v.) in 1857. After the defeat of Nana Sahib by Havelock, Tantia Topi conducted the campaign alone until the flight of his superior into Oudh and Nepal made communication impossible. He then acted under the orders of Rao Sahib, nephew of Nana Sahib. It was due to his generalship alone that the rebellion continued after the capture of Gwalior by Sir Hugh Rose and the death of the Rani of Jhansi, in June of 1858. For nine months he baffled the English in Central India, suffering his first serious reverse at Sikar in January, 1859. The rebels were finally dispersed in March, 1859, and Tantia Topi, who had taken refuge in the jungles of Paron, was betrayed (April 7) to Major Meade by his own friend and late associate Man Singh. He was tried by court martial at Sipri and hanged there on April 18, 1859.

TANTRA, tän′trȧ (Skt., ceremony, woof, from *tan,* to stretch, to weave). The Sanskrit term for a ceremony or a ceremonial treatise, and thus for a systematic treatise of any kind. The word is used in English, however, only as the designation of a late class of Sanskrit works which are related to the Puranas (see PURĀṆA) on the one hand, and to the magic literature in general on the other (see the section *Atharvaveda* under VEDA). The Tantras are in the main the sacred works of the worshipers of the androgynous Siva (q.v.), or of Sakti, the female principle itself (see SAKTAS). They deal with the creation and destruction of the world, the worship of the gods, the attainment of all objects, magical rites for the acquirement of six superhuman faculties, and four modes of union with spirit by meditation. Prayers to the gods, especially Siva, some few of great beauty, are comparatively rare. Their place is taken by a condensed form of invocation of the divinity by means of a great variety of honorific epithets, one class, the 'thousand-name prayers,' forming a division by itself. There are also prayers in the form of amulets, which contain magic and invocation in their very form, and are therefore regarded as especially efficacious. Numerous other subjects are introduced into many Tantras, while certain ones are limited to a single topic, as the mode of breathing in certain rites, or the language of birds and beasts, Siva and his wife, Devi, Uma, or Parvati, are the chief divinities of the Tantras, which are nearly always composed in the form of a dialogue between them, in which the goddess questions the god as to the mode of performing various ceremonies, and the *mantras* or prayers and incantations to be used in them. These he explains at length, and under solemn cautions that they involve a great mystery, not to be divulged to the profane. The followers of the Tantras consider them as a fifth Veda, and attribute to them corresponding antiquity. This claim is entirely imaginary; they are mentioned in some of the Puranas, and are probably later than the lexicographer Amarasinha (q.v.), who lived several centuries after the beginning of the Christian Era. No less than sixty-four Tantras are mentioned by the Hindu commentator Sankara (q.v.), yet this important branch of Sanskrit literature has been scarcely studied by Western scholars, nor is there, even in India, any edited text or translation of a single work of this class.

TANTUM ERGO. The last two stanzas of the hymn *Pange lingua,* which are invariably sung at benediction in the Roman Catholic Church.

TANZIMAT, tän-zē′mȧt (Ar. *tanzimat*, pl. of *tanzim*, regulation, inf. of second form of *nazama*, to arrange in order). The organic laws in accordance with which the administration of the Turkish Empire is in theory carried on. They were the result of the reform movement introduced by Mahmud II. The organic laws, known as the *hatti sherif* of Gulhane, were promulgated on November 3, 1839, by Mahmud's son, Abdul Medjid (q.v.), soon after his accession. They established the equality of civil rights for all subjects, limited the power of the Government officials, guaranteed the free practice of religion, and introduced radical reforms in the administration of finance, justice, and the army. In 1856 the Sultan found it necessary to publish a new ordinance, in which the complete carrying out of the Tanzimat in all respects was commanded. Other attempts in 1868 and 1876 to make the Constitution effective were unsuccessful. Consult Engelhardt, *La Turquie et le Tanzimat* (Paris, 1882-84). See TURKEY.

TAOISM, tä′ô-ĭsm (from Chin. *tao*, path, way, proper method, word, principle, reason). A religion in China which must have existed there since prehistoric times and has even at present a very strong hold upon the people. The term *tao* itself is clothed with a religious awe and always spoken of with great veneration, although it is frequently used in general literature in the sense of rationality, common sense, and sound judgment. The Taoists, called *Tao-Sse*, or teachers of the *Tao*, are a religious fraternity with temples, sacred books, and a definite ritual. Their most sacred book is "The Canon of Reason and Virtue" (*Tao-teh-King*), written by Li Urh, commonly called Lao-Tse (q.v.). It is a short treatise of about five thousand characters, but full of profound wisdom and sound ethics.

There must have been Taoism, however, before Lao-Tse, for he does not regard himself as the founder of a new faith, but quotes in his book many sayings of his predecessors and claims only to expound the obscure wisdom of the ancient sages. Apparently he refers to the popular traditional religion that existed at his time in China. The difference between Confucianism and Taoism corresponds to the respective characters of the two reformers. Confucius was an aspiring moral teacher and in the prime of life, while Lao-Tse was famed for his wisdom and about half a century the senior of Confucius. The ambition of Confucius was to educate the nation by teaching the people propriety, while Lao-Tse despised all externalities and ceremonies, insisting simply and solely on a regeneration of the heart. The moral doctrines of Confucianism rest upon the recognition of authority under the name *Hsiao* (filial piety), establishing in matters of government the principle of paternalism, but Taoism condemns all interference with the natural course of things and thus all statecraft, especially any and every rule by force, as contrary to the *Tao*, and preaches boldly the maxim of *Laisser-faire*. In a sense Confucianism remained victorious, for it became the officially recognized doctrine of China and the mandarins are all Confucian scholars. The two greatest disciples of Lao-Tse and the ablest expounders of Taoism were Lieh-Tse and Chwang-Tse, the former of the fourth and the latter of the third century B.C. The one is more metaphysical and speculative, the other popular and witty. Especially Chwang-Tse is very severe on the 'literati,' and does not shrink from ridiculing their great master, Confucius. Taoist ethics are best represented in the *Kan-Ying-P'ien*, or "Book of Rewards and Punishments," a production of the fifteenth century. It first came into prominence in the sixteenth century, when it was incorporated in the *Tao-Chang*, a collection of Taoist scriptures. It contains 212 moral maxims illustrated by stories and references to the history of the earlier Ming dynasty (A.D. 1368-1644). The distribution of this book is deemed a religious duty, and innumerable editions are published at the expense of pious Taoists. Among the great men who were professed Taoists, Chang-Liang (died B.C. 189) deserves special mention for the important part he played in history as a councilor of Liu Pang, the founder of the Han dynasty. Taoist legends attribute to him supernatural wisdom and tell of him many marvelous occurrences.

The word Taoism might be translated 'Rationalism,' were it not for the mystic tendencies of its adherents. Lao-Tse, Lieh-Tse, and Chwang-Tse are sometimes obscure, but they remain as sober as the transcendentalists of the nineteenth century. All later Taoists, however, are mystics. Either they claim to be in possession of magic powers, or are engaged in alchemy and other occult studies. One of them, Shang-Tao-Ling, became the recognized leader of the Taoist fraternity. He was said to have compounded and swallowed the elixir of life, whereupon he ascended visibly to heaven. He bequeathed his secrets to his descendants, thereby establishing an hereditary Taoist papacy. The head of the fraternity is regarded as the vice-gerent of God on earth and bears the title 'The Pearly Emperor of Heaven.' Through a host of priests and the great wealth at his disposal, he exercises an immense power throughout China, which the Imperial Government is bound to respect.

The Taoist priests of to-day know very little of Lao-Tse. They attend to the spiritual needs of the people, which are not very high. They tell fortunes, determine lucky and unlucky days, and regulate popular feasts. For divination, they use the Kwa, a system of trigrams of broken and unbroken lines which are determined with Shih sticks (see PAK-KWA), and for the determination of days they use an astrological device, called *lo-pan*, or table of the net, because it resembles a cobweb, in which certain symbols are arranged in concentric circles round a compass.

Consult: Julien, *Khan-Ing-Pien, Le livre des récompenses et des peines* (Paris, 1835); id., *Lao-tseu-Tao-Te-King, Le livre de la voie et de la vertu* (ib., 1842); Carus, *Lao-tze's Tao-teh-King* (Chicago, 1898); Douglas, *Confucianism and Taoism* (London, 1879); Legge, *Religions of China* (ib., 1881); id., "Texts of Taoism," in Müller, *Sacred Books of the East*, vols. xxxix., xl. (Oxford, 1891); Balfour, *Taoist Texts, Ethical, Political, and Speculative* (London, 1885); Harlez, *Textes Tâoïstes* (Paris, 1891); Rosny, *Le Taoïsme* (ib., 1892).

TAO KWANG, tou′ kwäng′ (1781-1850). The reign-title of Mien-ning, the sixth Emperor of the present Manchu dynasty of China. He came to the throne in 1820. The first years of his reign were comparatively tranquil, but disturbances and insurrections soon occurred in Turkestan, in Hainan, in Formosa, and in Kwang-tung. In 1834 the privileges of the British East India Company were abolished, and the misunderstandings which then arose, combined with the high-handed proceedings of Commissioner Lin, led in 1839-40 to war with Great Britain, the defeat of the Chinese, and the negotiation of the Treaty of Nanking in 1842. This treaty provided for the opening of Shanghai, Ningpo, Foochow, and Amoy besides Canton to foreign residence and trade, the cession of Hong Kong to Great Britain, and the payment of an indemnity of 21,000,000 taels, equal at that time to about $35,000,000. This large payment in addition to the costs of the war, coming on an impoverished treasury, created much discontent among the people, the secret societies became active, and swarms of pirates harassed the Government. Tao Kwang died in 1850, and was succeeded by his fourth son, who reigned as Hien Fung (q.v.).

TAORMINA, tä′ôr-mē′nȧ (Lat. *Tauromenium*). A town in the Province of Messina, Sicily, 30 miles by rail southwest of the city of Messina (Map: Italy, K 10). It is majestically situated on a rocky terrace 390 feet above the Ionian Sea, but is overhung by the ruins of the castle (1300 feet above the sea), and again to the northwest by Mola (2080 feet) and by Mount Venere (2834 feet). The theatre, founded by the Greeks, rebuilt by the Romans, and wrecked by the Saracens, was partially restored in 1748, and is of great interest. The ancient city was named after Mount Toro (ancient Taurus), on whose slope it lay, and was founded by the Siculi in B.C. 396, after the destruction of Naxos, near by, which was the oldest Greek colony in Sicily, having been founded in B.C. 735. Under the Roman Empire it was a city of importance. On account of its strong position, it was long able to keep out the Saracens, who finally captured it in A.D. 902, killed the people and burned the buildings. Being resettled, it was, in 962, again captured by the Saracens, from whom it was taken in 1078 by the Normans. Consult: Squillaci, *Taormina attraversi i secoli* (Catania, 1892). Population (commune), in 1881, 3128; in 1901, 4351.

TAO-TAI, or **TAU-TAI**, tou′tī′. A Chinese official who has the general supervision and control of the affairs, both civil and military, of a *tao* or 'circuit,' and usually styled by foreigners the 'Intendant of Circuit'—a circuit consisting of two or more fu or departments. A foreign commissioner of customs ranks with the tao-tai, and all foreign consuls have the rank of tao-tai.

TAPAJOS, tȧ-pä-zhôs′. A south tributary of the Amazon, flowing entirely within Brazil (Map: Brazil, F 4). It rises in the western part of the State of Matto Grosso, near the Bolivian frontier, and flows north and northeastward till it enters the Amazon at Santarem after a course of about 1100 miles. Its sources are on a low and flat divide which separates its basin from those of the Paraguay and the Guaporé. The upper course lies on the great Brazilian frontier, from which it descends to the forest plains of the Amazon in a series of falls and rapids which completely obstruct navigation. The last 200 miles only are navigable for large vessels. Near its mouth it expands into a large lake 70 miles long and 12 miles wide, but contracts again just before entering the Amazon.

TAPE GRASS, Eel Grass, Wild Celery. Popular names for Vallisneria spiralis, an aquatic grass-like plant which grows in slow waters, being common from New England to Minnesota and south to Florida and Texas.

TAPESTRY (ME. *tapecery*, *tapecerye*, from OF. *tapisserie*, tapestry, from *tapisser*, to furnish with hangings, from *tapis*, tapestry, carpet, from ML. *tapetium*, from Gk. ταπήτιον, diminutive of τάπης, *tapēs*, figured cloth, tapestry). A decorative textile fabric formed by a process intermediate between embroidery and true weaving. It differs from embroidery in that the design is not applied to an existing fabric, but, by being woven in and out of warp threads, forms a part of the fabric. It differs from ordinary weaving in that the filling thread, instead of being shot back and forth continuously with a shuttle through a shed formed by the heddles (see Weaving), is worked in and out a few stitches at a time with a thread held in the hand. Tapestry weaving is the simplest and appears to have been the earliest form of weaving. The Saracens introduced it into Europe and for a long time the fabric was called *Sarrazinos*.

Toward the end of the twelfth century tapestry weaving was begun in Flanders and Artois, and here it was continued for many centuries. The productions of Arras, in particular, became so famous, both for quality and numbers, that the name of the town was given to the fabric.

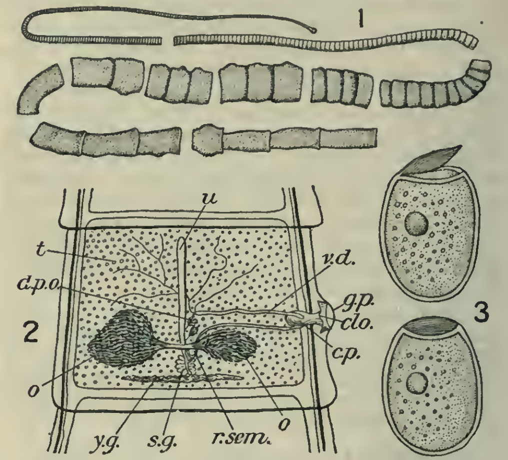
Tapestries were, during the Middle Ages, produced chiefly for State and ecclesiastical purposes and for the decoration of royal palaces. They were used as curtains, wall-coverings, and less frequently as coverings for tables, beds, and floors. The scenes portrayed on them were usually based on Scriptural stories or historical events. The famous *Bayeux tapestry* (q.v.), which, by the way, is not true tapestry at all, but embroidery, was contemporaneously executed to record the events connected with the conquest of England by William of Normandy.

The Saracenic tapestries were ornamented with flowers and geometric figures only, but the Flemish people sought to enrich them with historic subjects. So important did this art become that the most eminent masters in painting, from Raphael downward, bestowed some of their greatest efforts upon cartoons to serve as copies for the tapestry-workers. After its introduction into France by Henry IV. at the beginning of the seventeenth century, the art of making tapestry does not appear to have made much progress until the middle of that century, when a small establishment founded by the brothers Canaye on the premises formerly occupied by Jean Gobelin, a Parisian dyer of wool, was commenced. It was afterwards carried on by a Dutchman named Gluck and his assistants with such success that it was suggested by Colbert, the minister of Louis XIV., that it should be taken under the King's patronage; in consequence of which the establishment was bought, and constituted a royal manufactory in 1667, under the management of M. Lebrun, who was the first director. A royal carpet manufactory had been previously established in 1615; this was called La Savonnerie, from the previous use of the buildings for the manufacture of soap. The Savonnerie and the Gobelin factories were both carried on with great spirit by successive sovereigns. They were formed into one establishment in 1826, when the works of the Savonnerie were removed to the Gobelins. During the seventeenth century two other royal factories were established, one at Beauvais and one at Aubusson, and these factories are still maintained by the State. In 1619, during the reign of James I., tapestry looms were set up at Mortlake, England, and during the following reign were under the direction of the painter Francis Crane. Charles I. introduced skilled weavers from Belgium. This factory was closed in 1703. In 1872 another royal factory was established in England, this time at Windsor, but it was closed in 1888.

Two kinds of looms are used in making tapestry: The high-warp vertical looms (*haute lisse*) and the low-warp horizontal looms (*basse lisse*). The former is the kind upon which the finest tapestries are woven and is used exclusively in the Gobelins. In the high-warp loom two uprights of wood or iron support two movable cylinders (*ensouples*), one at each end, on which the warp threads are stretched at will. The weaver works at the back of the loom, where the design is sketched on the warp threads. He places the cartoon behind him, using it to get the design and to match his colors. Occasionally he steps around to the front to get the effect on the right side. The threads are woven in and out like basketwork, a little patch of color at a time, the different colors being wound on different spindles. Each distance must be traversed twice, as only alternate threads are covered on the right side. Thus tapestry is a double cloth. When the thread has been woven only one way it is called a *half-pass;* when it is turned and woven back the other way, completing the covering of the warp, it is called a *woof.* When the weaver has finished using a given color he does not break the thread, but leaves the spindle hanging at the back till he shall require the same color again. It will readily be seen that in the vertical lines of a design, in weaving the colors, open slits will be left which must be afterwards sewed together. For this reason many of the Oriental tapestries have no lines running in the direction of the warp, but only zigzags. On the low-warp looms the threads are moved by heddles, connected with treadles, leaving both hands free for the work. Hence the work can be done more rapidly; but it is not as satisfactory, since the workman can see it but imperfectly till it is completed.

Most tapestries are made of wool on cotton warp. Silk and gold and silver threads are also used to heighten the effect. The dyeing of the multitudes of tints required in this work is in itself an art requiring no little skill. Consult: Muntz, *Short History of Tapestry*, trans. by Davis (London, 1885); also Cole, *Tapestry and Embroidery* (ib. 1888).

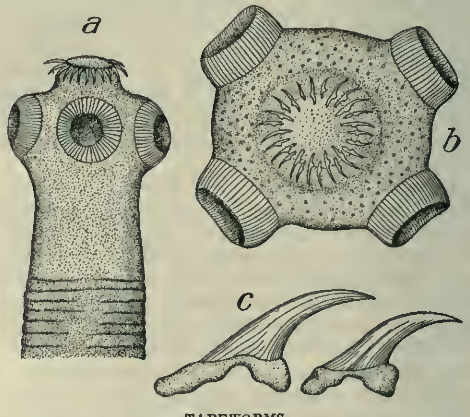
TAPEWORM. Any worm of the group Cestoda, but popularly used for the Tæniidæ or the Bothriocephalidæ. Nearly 200 species of cestoid worms have been described, of which the majority fall into one of the two families just named. (See CESTODA.) These worms have no intestine, and are without cilia, but have testes and ovaries in each segment, together with frequent yolk-glands. They belong to the order Polyzoa or segmented individuals. They are all endoparasites, and secure nutrition from the digestive tract of the host in which they live, absorbing digested food through their body walls.



TAPEWORMS.

1, Tænia saginata; 2, segment of tænia solium (showing generative organs): *u*, uterus; *t*, testes; *o*, ovary; *d.p.o.*, detached portions of ovary; *y.g.*, yolk gland; *s.g.*, shell gland; *r.sem.*, receptaculum seminis; *v.d.*, vas deferens; *g.p.* genital papilla; *clo.*, cloaca; *c.p.*, cirrhus pouch; 3, lidded ova of Bothriocephalus latus.

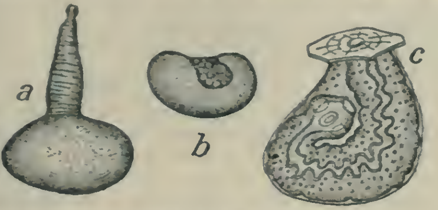
TÆNIA. A tænia consists of a scolex, or head, and detachable segments, or proglottids. Within the scolex is the brain; on the outer surface of the scolex are four sucking disks as well as a ring of hooks. Fixation is secured through the suckers and hooks. In each proglottid is an albumin gland; and a uterus and a vas deferens end in openings on the side of the proglottid. New proglottids grow behind the head, by division of its posterior part. The farther from the head, the larger is the proglottid. The distal proglottids separate from time to time and are excreted with the fæces of the host. But the head must be removed to secure freedom from the parasite.



TAPEWORMS.

a, head of *Tænia solium*; *b*, apical surface and circle of hooks of *Tænia solium*; *c*, hooks of *Tænia solium*—larger, anterior; smaller, posterior.

The embryonic stages of tapeworm are hydatids (measles, cysticerci) or *cysticercoidi*. When a *Tænia ovium* with mature embryo is swallowed and reaches the human intestine, it migrates through the blood vessels or lymphatics into the tissues and develops into a hydatid. In man or pig the embryo of *Tænia solium* becomes a measle (see CYSTICERCUS); while the embryo of *Tænia saginata* becomes, similarly, a measle in the cow.



BLADDER WORMS OF PIG.

a, *Tænia solium* (evaginated head) b, *Tænia solium* (invaginated head) c, *Cysticercus cellulosæ* (head formation completed).

If a cysticercus be ingested by a man, it develops in his intestine into a complete tænia. In the human digestive tract a *Cysticercus cellulosæ*, or bladder worm, obtained from measly pork, becomes a *Tænia solium* in six to ten weeks. The *Tænia canina* develops in man from a cysticercoid of the cutaneous parasites of the dog. *Tænia solium* was so named by Linnæus because it is generally found alone: but in many instances two or three are found together, and in rare instances as many as 30 or 40 have been expelled from one patient. The full grown tænia or *strobila* is from 10 to 35 feet in length, and may consist of from 800 to 1000 proglottids. The sexually mature proglottids begin at about the four hundred and fiftieth segment. The breadth of the worm is about one-third of an inch at the widest. The head is very small and globular, or pear-shaped, is about the size of a small pinhead, and is dark with pigment. The crown of hooks numbers about 22 to 28 in each double row. The neck is very narrow and about one-half of an inch in length, and merges into the wider, segmented part. The impregnated eggs, when discharged into the intestine, do not mature there. They require the second host; such as, for example, the pig, who eats the expelled proglottids or the ova. The exception to this general rule is met when a cysticercus is found together with a tapeworm in a human digestive tract. This is, necessarily, a source of grave danger: for the cysticercus may traverse the body as it does in the hog, and cause threatening or fatal conditions. Hence the imperative necessity of securing the expulsion of the entozoa as soon as their presence is known. When fully mature, the measle resembles a pea or a small kidney bean, being about one-third of an inch in diameter. Its great vesicular portion consists of a caudal extremity, inflated like a bladder, while the head, neck, and body may be drawn out in vermiform style.

The great source of tapeworm is measly pork, eaten uncooked, or but partly cooked. The preventive is to have pork, ham, bacon, and sausage always very thoroughly cooked. It is also possible to ingest the embryo of the tapeworm with lettuce or other uncooked green food which has grown where a filthy stream flows over it, or which has been watered with liquid manure. Very scrupulous washing will prevent danger in these vegetables.

Tænia saginata (or *mediocanellata*) has no circle of hooklets and is about 25 feet in length. In its case, cattle instead of hogs constitute the intermediary hosts. It is transmitted through imperfectly cooked veal or beef. *Tænia echinococcus* is, in its larval condition, probably more fatally injurious to the human race than all the other species of entozoa put together. In its mature (strobila) condition, in which it is found only in the dog and wolf, it seldom exceeds the fourth of an inch in length, and develops only four segments, including that of the head. The final segment, when sexually mature, equals in length the three anterior ones, and contains as many as 5000 eggs. The proscolex or embryo forms large proliferous vesicles, in which the scolices or larvæ (known also as acephalocysts, echinococci, echinococcus heads or vesicles, pill-box hydatids, etc.) are developed by gemmation internally. The eggs develop in their interior a six-hooked embryo, and these embryos are introduced into our bodies with food or water into which the eggs have been carried. It finds its way into the liver, and later is carried by the blood current to other organs, including the lungs, the kidneys, the brain, and the bones. It grows slowly, many months elapsing after the ingestion of tapeworm eggs or embryos before the echinococci appear.

In some countries in Europe hydatids are very prevalent. It is reported that the disease is endemic in Iceland to such an extent that one-sixth of the population suffer from it. The cause may be found in the great number of dogs harbored by the Icelanders. *Tænia saginata* is increasingly frequent in France, England, Italy, and Germany, as well as in Abyssinia, Senegambia, Algeria, and the Cape Colonies, Syria, Siberia, the East Indies, and the Punjab. It is claimed by investigators that it (and not *Tænia solium*) is the common tapeworm in North America, as well as in Brazil, Peru, and the Argentine Republic.

The presence of a tapeworm in the intestines may be suspected only from the occurrence of pieces of the entozoön in the dejecta, resembling flat segments of macaroni. But in most cases it gives rise to a series of anomalous symptoms, including vertigo, noises in the ears, impairment of sight, itching of the nose and anus, salivation, dyspepsia, and loss of appetite, colic, pains over the epigastrium and in different parts of the abdomen, palpitation, syncope, the sensation of weight in the abdomen, pains and lassitude in the limbs, and emaciation. In the treatment of tænia, prophylaxis is important. All meat must be so thoroughly cooked that the centre of each piece is subjected to great heat. Beef is the principal host of the entozoön. Rare beef must therefore be avoided. The medicinal treatment consists in causing the patient to fast for twenty-four hours and then administering the oleoresin of *Filix mas* (male fern), which must be followed by a brisk calomel purge. Santonin is also a reliable anthelmintic. The head must be sought in the excrement of the patient and medication must be repeated till the head is evacuated.

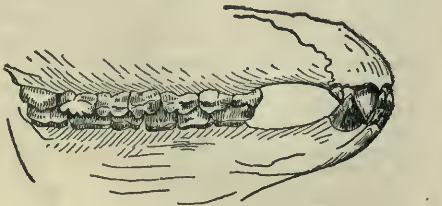
Tapeworms, although rare among horses and cattle, are common in dogs and sheep, causing irritability of the bowels, and an unthrifty appearance. For dogs no remedy answers so well as powdered areca nut, of which 30 grains suffice for a dog weighing about 20 pounds. It is best given after ten or twelve hours' fasting, in a little soup or milk, and should be followed in a few hours by a dose of castor oil. Neither areca nor any of the approved remedies used in men prove effectual in sheep; and one of the best prescriptions for them consists of 40 drops of oil of turpentine, a dram of powdered green vitriol, and an ounce of common salt, given mixed in a little milk or gruel, or, where their bowels are confined, in linseed oil. A daily allowance of linseed cake and sound dry food should likewise be given with the grass or roots, and pieces of rock salt left within the animal's reach.

Among other varieties of tæniæ are *Tænia cucumerina*, which infests the dog and cat, and whose cysticercus is harbored by the flea; *Tænia nana*, which is the smallest tapeworm found in man, and which is frequent in Egypt and Sicily; and *Tænia diminuta*, first seen in Italy, rarely found in man. The last named infests rats and mice, and its cysticercus inhabits caterpillars and certain of the Coleoptera. The largest tapeworm, rare in America, but common in Central and Eastern Europe, is *Bothriocephalus latus*. It is sometimes 25 feet long, nearly an inch broad and with 4000 joints.

Consult: Cobbold, *Entozoa* (London, 1864), and *Parasites* (London, 1879); Braun, *Die thierischen Parasiten des Menschen* (Würzburg, 1903).

TAPIOCA. See CASSAVA.

TAPIR (Sp. *tapiro*, from Tupi Brazilian *tapyra*, tapir). A tropical ungulate mammal of the family Tapiridæ, allied to the horses and rhinoceroses. It has a bulky form, with moderately long legs; the front feet four-toed, the hind feet three-toed; the skin thick, the hair short; the tail very small; the neck thick; the ears short; the eyes small; the muzzle elongated; the nose prolonged into a short, flexible proboscis; 6 incisors, 2 canine teeth, and 14 molars in each jaw. The family includes only five living species, with a very peculiar geographical distribution, as two species are found in South America, two in Central America, and one in the Malayan region. The best known is the 'American' tapir (*Tapirus Americanus* or *terrestris*), which is about the size of a donkey, and is common throughout the wooded parts of South America, east of the Andes. Its color is uniform deep brown, but the young (as is the case with the other species) are beautifully marked with yellowish fawn-colored stripes and spots. The skin of the neck forms a thick rounded crest on the nape, with a short mane of stiff hair. The tapir inhabits deep recesses of the forest, and delights in plunging and swimming in water. It feeds chiefly on young shoots of trees, fruits, and other vegetable substances, and sometimes commits great ravages in cultivated grounds. It is inoffensive, never attacking man; but when hard pressed by dogs, shows great cunning, and if brought to bay, makes a violent resistance, and inflicts severe bites. It is very easily tamed, and becomes extremely familiar. Its hide is useful, and its flesh is eaten.



DENTITION OF A TAPIR.

The hairy tapir (*Tapirus Roulini*) occurs only on high levels on the Andes, up to 7000 or 8000 feet. The skin is uniformly covered with hairs an inch long. There are white marks on the head and the sides are bluish hazel instead of brown. The 'hog' tapirs of Central America (*Tapirus Bairdi* and *Tapirus Dowi*) are smaller than the other species, and differ from them in having the nasal septum ossified. They are brownish black above, dirty white on the throat and chest, and more or less rufous on the head.

The Malayan tapir (*Tapirus Indicus*) is found in the Malay Peninsula, Java, Sumatra, and other large islands. It is larger than the American tapir, and its proboscis is rather longer in proportion. The neck has no mane. The color is glossy black, except the back, rump, and sides of the belly, which are white. The colors do not pass gradually one into the other, but the line of separation is marked, giving the animal a very peculiar appearance. The habits of this species are not well known, but seem to be similar to those of the American tapir, and it is equally capable of domestication. The young are striped and spotted as in that species.

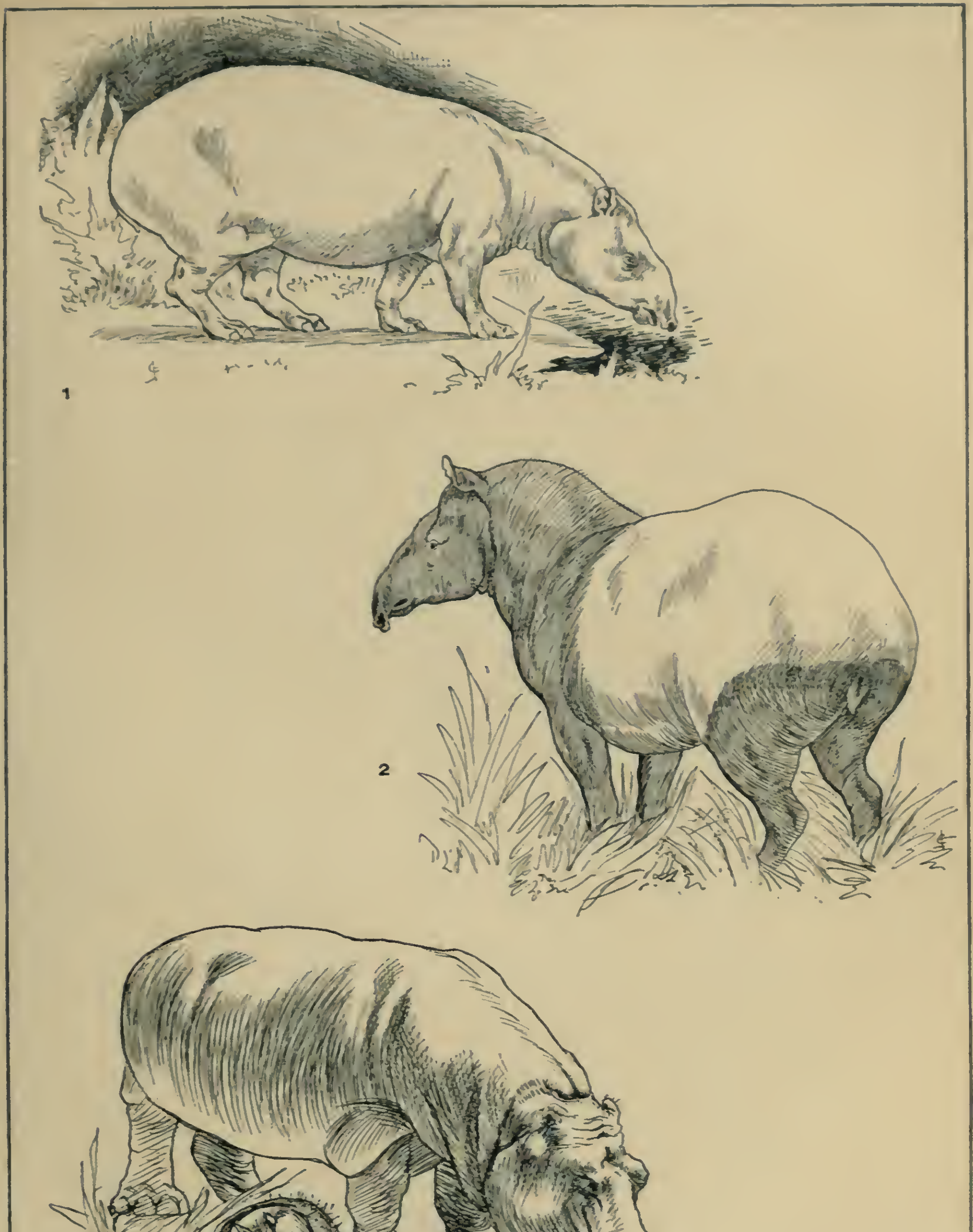
Fossil tapir-like forms are known from the Eocene onward, and most of them have been placed in the family Lophiodontidæ; but many species are hardly separable from the modern family Tapiridæ.

Consult: Beddard, *Mammalia* (London, 1902); Blanford, *Fauna of British India; Mammals* (ib., 1875); Alston, "Mammals," in *Biologia Centrali-Americana* (ib., 1879-82); Ridley, article in *Natural Science*, vol. vi. (ib., 1895); and general works. See Plate of TAPIRS AND HIPPOPOTAMUS.

TAP'LEY, MARK. The faithful servant of Martin Chuzzlewit, in Dickens's novel of that name. He accompanies his master to America, nurses him in his illness, and makes himself everywhere loved for his high spirits and joviality under the most adverse circumstances.

TAP'PAN, ARTHUR (1786-1865). An American merchant, philanthropist, and reformer, the brother of Benjamin and Lewis Tappan, born at Northampton, Mass. He entered business in Portland, Maine, removed to Montreal, Canada, and after the War of 1812 established himself in the importing business in New York City. In 1827 he associated with himself his brother Lewis in the publication of the *Journal of Commerce*. He was largely interested in various religious, educational, and philanthropic institutions. It is as an Abolitionist, however, that he will be longest remembered. He became interested in the American Colonization Society at its organization, but having become convinced that the society was being used by the pro-slavery party to rid the country of free negroes, in order to establish slavery more firmly, he withdrew from it. In 1830 he paid a fine which secured the liberation of William Lloyd Garrison

TAPIRS AND HIPPOPOTAMUS



1. AMERICAN TAPIR (Tapirus Americanus). 2. MALAYAN TAPIR (Tapirus Indicus).
3. HIPPOPOTAMUS (Hippopotamus amphibius).

from imprisonment in Baltimore, and the acquaintance which followed led to Tappan's identifying himself completely with the Abolition cause. In 1833 he was one of the organizers of the New York Anti-Slavery Society and of the American Anti-Slavery Society, of both of which organizations he became the first president. In 1840 he became president of the New American and Foreign Anti-Slavery Society, which was organized by those anti-slavery men who disagreed with the Garrison party, and believed in carrying the slavery question into politics and forming a political party for that purpose. He was therefore much interested in the Liberty, Free-Soil, and Republican parties. He spent the latter years of his life in retirement in New Haven. Consult Lewis Tappan, *The Life of Arthur Tappan* (1871).

TAPPAN, Lewis (1788-1873). An American merchant and reformer, brother of Arthur and Benjamin Tappan, born in Northampton, Mass. He became largely interested in cotton manufacturing and calico-print works in Boston, but in 1827 he removed to New York City. Thereafter his career was closely identified with that of his brother Arthur. In 1827 they established together the *Journal of Commerce*, of which Lewis Tappan became the sole proprietor in 1829. In 1833 he was one of the organizers of the New York (City) Anti-Slavery Society. In July, 1834, his house was sacked by an anti-slavery mob. The firm of Tappan & Co. failed for upward of a million dollars in the financial crisis of 1837, and although they afterwards paid their indebtedness, Lewis Tappan retired from the firm and in 1841 established 'Tappan's Mercantile Agency,' one of the earliest and best known organizations of this kind in the country. With his brother he was one of the organizers of the American and Foreign Anti-Slavery Society, and wrote and spoke in favor of a more rational and conservative attitude on the part of the reformers. He published *A Life of Arthur Tappan* (1871).

TAPPAN BAY, or Tappan Zee. An expansion of the Hudson River, in New York, lying immediately north of Irvington. It is about 11 miles long, and over 3 miles wide at the widest point.

TAP'PEN, Frederick D. (1829-1902). An American financier, born in New York City. He graduated at New York University in 1849, and in 1850 became a clerk of the National Bank of New York, of which in 1868 he was chosen president and director. During the great loans in 1873 and 1874 he was chairman of the loan committee. In 1896 he induced the New York banks to loan $20,000,000 in gold to the United States. In May, 1901, he formed a pool of $20.000,000 for loans and broke the 60 per cent. and 75 per cent. rate for call money. Again in the last week of June his efforts to preserve the credit of a tottering clearing-house bank succeeded in calming the market although the bank, as he had predicted, failed.

TAPPERT, Wilhelm (1830—). A German writer on music, born at Ober-Thomaswaldau, near Bunzlau, Silesia. After teaching for several years, he studied music (1856-58) under Kullak and Dehn in Berlin, where he settled permanently in 1866, and became professor of the history of music at the new academy. His name is favorably known in the musical world through numerous contributions to periodicals and the following publications: *Musik und musikalische Erziehung* (1867); *Musikalische Studien* (1868); *Das Verbot der Quintenparallelen* (1869); *Wagner-Lexikon* (1877); *Richard Wagner, sein Leben und seine Werke* (1883); and *Wandernde Melodien* (1890).

TAP'PERTIT, Simon. A locksmith's apprentice in Dickens's *Barnaby Rudge*. He is in the employ of old Varden and is very much in love with Dolly, his master's coquettish daughter, whom, owing to his position as captain in the Gordon Riots, he is able temporarily to kidnap.

TAPTI, täp'tė. A river of the Bombay Province, British India (Map: India, B 4). It rises in the mountains of the western part of the Central Provinces, and flows westward, emptying into the Gulf of Cambay, 160 miles north of Bombay, after a course of about 450 miles. The greater part of its course is followed by a railroad, but the river is unnavigable above Surat, a few miles from its mouth.

TAPUYA, tȧ-po͞o'yȧ (alien). A collective designation for a group of tribes holding an extensive area in Eastern Brazil, constituting a distinct stock, and apparently more ancient in occupancy than any of the surrounding tribes. Their general territory extends from latitude 5° to 20° S., and from the Atlantic coast inland to the Xingu River. They are sometimes also known as *Cren* or *Gueren*, the 'Ancient People.' The Tucano (q.v.) and several other tribes upon the Uaupes and Yapurá, on the Brazil-Colombia border are also thought to be of the same connection. The Tapuya tribes, among which the Botocudo (q.v.) are the most noted and typical, have every characteristic of an ancient primitive race. They are believed to have been the authors of the numerous shell mounds along the adjacent Atlantic coast, and it is even held that skulls and other human bones found in caves within their territory, in connection with bones of animals now extinct, are of the peculiar type belonging to this people. In physique the Tapuya are of middle stature, with long arms and short legs, broad faces, small deep-set eyes, retreating foreheads, and projecting lower jaws. Their features are frequently disfigured by huge labrets in the lower lip. Their culture is of the lowest. In their native forests they go absolutely naked and have no other dwellings than temporary shelters of brushwood. They make no pottery, build no canoes, have no dogs, and apparently have no tribal organization. Before interfered with by the Brazilian Government, they were cannibals. On the other hand, they are skillful hunters with the bow and arrow, make polished stone axes, and weave baskets of rushes. The men have but one wife at a time. They are much in fear of ghosts wandering in the night, and are fond of dances to the accompaniment of a flute which is played with the nose. Their language, of which specimens have been published by Ehrenreich, is difficult in its phonetics, with a marked tendency to simple word forms rather than agglutination. The Indians of Tupi descent about Pará and on the Lower Amazon are incorrectly called Tapuya.

TAR (AS. *tearo*, *tearu*, *teru*, *tyrwa*, Icel. *tjara*, Dutch *teer*, Ger. *Teer*, Hessian Ger. *Zehr*, tar; connected with Lett. *darwa*, tar, Lith. *darwà*, resinous wood, especially that of the fir-tree, and ultimately with Eng. *tree*). A term applied to the oily, dark-colored products obtained in the destructive distillation of peat, wood, coal, bones, and other materials of organic origin. Bone-tar is described under Dippel's Animal Oil (q.v.). Coal-tar is likewise described in a special article. (See Coal-Tar.) Wood-tar is commonly made from the resinous roots and wood of various pines. The wood is heaped into a conical stack depressed at the centre, covered with earth, and fired. The tar runs to the centre. This distillation may be more economically conducted in retorts. Wood-tar is largely used for water-proofing, preservative, and antiseptic purposes. In doses of one or two grains it is considered a good remedy in diseases of the mucous membrane of the respiratory passages. See Acetic Acid; Acetone; Methyl Alcohol, etc.

TARA, tä′rȧ. A hill in County Meath, Ireland, about six miles east of Trim and nearly the same distance southeast of Navan. It is noted as the site of the palace of the ancient kings of Ireland from the prehistoric Firbolgs (q.v.) down to the middle of the sixth century. It was here that Saint Patrick began his great apostolate by preaching to King Laoghaire or Leary in 432. The site was finally abandoned in 565 on account of a curse pronounced against the reigning King by Saint Ruadhan. The lines of the ancient palace may still be traced in the mounds and earthworks which crown the summit of the hill. Although the 'harp of Tara' has been thus silent through so many centuries, the place remains a focus and rallying point for Irish national aspiration. Here O'Connell, the liberator, held the greatest of his monster meetings during the Repeal agitation, and here also some forty years later Parnell erected the monument, which now stands out prominently above the landscape, to the memory of the Croppy insurgents who fell in an engagement near by during the rebellion of 1798.

TARA (Polynesian name), or **TARO** (*Colocasia antiquorum*, var. *esculenta*.). A plant of the natural order Araceæ, cultivated for its roots, which are a leading article of food in the South Sea Islands. The roots, which are from 12 to 16 inches in length, are washed to remove their acidity, and cooked like breadfruit, the rind being first scraped off. See Cocco.

TARA (*Colocasia antiquorum*).

TARABLUS, tȧ-rä′bo͞o-lo͞os. A town of Syria. See Tripoli.

TARAFA, tä-rä′fȧ (Ar. *Ṭarafa 'Amr ibn al-Abd al-Bakri*) (c.560). An early Arabian poet. He lived at the Court of the King of Hira in Northeastern Arabia. In consequence of his satires on royalty, the King had him put to death. He ranks as one of the six great pre-Islamic poets of Arabia, and is the author of one of the seven *Mu'allakāt*, or prize poems, of that period, which remain the classic models of Arabic poetry. The Arabic text is in Ahlwardt, *Divans of the Six Ancient Arabic Poets* (London, 1870); there are translations by Rückert, in *Sieben Bücher der morgenländischen Sagen und Geschichten* (Stuttgart, 1837), and by Vandenhoff, *Nonnulla Tarafæ carmina* (Berlin, 1895).

TARA FERN (*Pteris aquilina*, var. *esculenta*. A species of brake (q.v.), the rhizome of which was one of the principal articles of food in New Zealand before the settlement of the islands. The root is cut in pieces about 9 inches long, placed in stacks, and carefully protected from rain.

This fern is also distributed in Australia, Japan, and the Hawaiian Islands. In Japan the cut rhizomes are macerated to remove the starch.

TARAI, tȧ-rī′, or **TERAI**. A low, moist, and unhealthful region stretching along the southern base of the Himalayas nearly throughout their length, from Assam in the east to the Punjab in the northwest. In spite of its unhealthful nature, it is densely populated by tribes who seem to be immune from malarial diseases.

TARANTELLA, tä′rȧn-tĕl′lȧ (It., tarantula). An Italian dance, written in $\frac{6}{8}$ time, contantly increasing in speed, and alternating between the major and minor modes. It is accompanied by castanets and a tambourine. During the Middle Ages the dancing of the tarentella was thought to be a cure for a form of insanity which was induced by the bite of the largest of European spiders, the *Lycosa tarantula*. From the fifteenth to the seventeenth century a peculiar nervous disease, called tarantism, existed in Italy, whose only effective cure was the music of the tarantella. Of the many songs used for this purpose but few exist. Specimens are given in Jones's *Maltese Melodies* (London, 1805); Smith's *Musica Antiqua* (London, 1812); and Mendel's *Lexicon* (Berlin, 1870-83). The tarantellas written by modern composers bear little resemblance to their prototypes in either form or rhythm. They are written in $\frac{3}{8}$ or $\frac{6}{8}$ time, and, owing to their great rapidity, have become favorites for brilliant solo pieces. See Dancing Mania.

TARANTISM. A dancing or leaping mania supposed to be due to the bite of a spider, the tarantula (q.v.), and especially prevalent at Taranto, in Apulia, Italy. The disease was essentially a form of contagious emotional or hysterical excitation. The gesticulations, contortions, and cries somewhat resembled those observed in Saint Vitus's dance and other epidemic nervous diseases of the Middle Ages. The victims were supposed to have a passion for bright colors, music, and the dance, and a class of tunes called *tarantella* were composed for the cure of the disease. To these the patient danced until he was exhausted, and although the sufferers were subjected to other and extraordinary methods of treatment such as burial up to the neck in earth, none was so successful as the tarantella (q.v.). Not only dancing but catalepsy was one of the symptoms, and the disease appears to have affected all classes, ages, and both sexes. The disease spread over Italy and Southern Europe, and affected large numbers of people.

TARANTO, tȧ-rän'tô (Lat. *Tarentum*, from Gk. *Τάρας, Taras*). A town of South Italy, in the Province of Lecce, at the northern end of the Gulf of Taranto. It is situated on a rocky islet, formerly an isthmus, between the Mare Piccolo (Little Sea), an extensive harbor on the east or landward side of the town, and the Mare Grande (Great Sea), or open gulf, on the west. The harbor is one of the finest in Italy, and can be entered safely by the largest vessels. The principal buildings are a cathedral, dedicated to Saint Cataldo; a fine episcopal palace; a castle and fortifications, erected by Charles V.; and two hospitals. The streets are as narrow and dark as those of an Oriental city. Taranto has manufactures of velvets, linens, and cottons, and carries on some commerce in wheat, oats, and olive oil. The Mare Piccolo is famous for its abundance of shell-fish, and a considerable portion of the population derives its subsistence from the oyster and mussel fisheries. Population, about 40,000.

Ancient Tarentum was one of the most splendid cities of Magna Græcia. It was founded, according to very doubtful tradition, about B.C. 707 by the Parthenians, a body of Laconian youth. It rapidly grew in wealth and power, extending its trade even to the Po, and supplying much of Southern Italy with pottery. It seems to have steadily reduced its Messapian neighbors till B.C. 473, when a bloody defeat was followed by the fall of the aristocratic government and the establishment of a pure democracy. About B.C. 400 Tarentum appears as the leading Greek city in Italy. When in B.C. 281 the Tarentines came into collision with Rome, they invited to Italy Pyrrhus (q.v.) of Epirus. After his departure, his general, Milo, surrendered the town to the Romans, B.C. 272, who treated it leniently. During the Second Punic War it was captured by Hannibal, with the exception of the Acropolis, and when in B.C. 209 it was retaken by the Romans, it was sacked and 30,000 of the inhabitants sold into slavery. It continued to be inhabited and later was the seat of a prosperous Roman colony. Under the Empire it was quite overshadowed by Brundusium, on the Adriatic, but rose again during the Gothic wars, which left it in the hands of the Byzantine Empire. It was captured in A.D. 661 by the Lombards, and later passed into the hands of the Saracens, who sacked it in 927, and of the Greeks, from the latter of whom it was wrested by Robert Guiscard, the Norman, in 1063. Later it shared the fortunes of the Kingdom of Naples. Few relics of the classic Tarentum are extant, the chief being bits of an amphitheatre and traces of a Doric temple, which from its form must be one of the early monuments of that style.

TARANTULA (from It. *tarantola, tarantella*, from *Taranto*, Lat. *Tarentum*, Gk. *Τάρας, Taras*, a city in Southern Italy, where the spider is common). A famous species (*Tarantula fasciventris*) of European wolf-spiders (Lycosidæ), the bite of which was supposed to be fatal or at least to be followed by very serious symptoms. As a matter of fact the bite of this spider is not dangerous. The name tarantula is generally applied in the United States and elsewhere to certain of the large bird-spiders, or so-called American tarantulas of the family Theraphosidæ. These are large, hairy spiders occurring in the Southwestern United States, Central America, and South America, which possess large, hard polished fangs which move vertically and are thus used to pin down their prey. They feed upon insects and all sorts of small animals. *Aname Hentzii* is a large species of this group which has the most northern distribution of any of the so-called American tarantulas. It has a bite which is quite painful but not dangerous, and never fatal, so far as accurate records go. These creatures are nocturnal, usually hiding during the day in long silken tubes in cracks in the ground or under thatched roofs or in similar places. Some of the Central American species are occasionally brought into the Northern States in bunches of bananas and on board vessels containing tropical fruit.

THE TRUE TARANTULA.

TARANTULA KILLER. A large and conspicuous wasp (*Pepsis formosa*) common in the Southwestern United States and in Central America, which preys especially on 'tarantulas' (q.v.). It is more than two inches long. The head, thorax, abdomen, and long, spiny legs are black, while the wings are bright reddish brown with black spots at the tips. It stings the spider, the result of the stinging being complete paralysis, deposits an egg upon it, then buries it in a hole five inches deep after the manner of other mud-wasps (q.v.).

TARAPACÁ, tä'rȧ-pȧ-kä'. A northern province of Chile, bounded by Tacna on the north, from which it is separated by the Camarones, Antofagasta on the south with the Loa River as the dividing line, Bolivia on the east, and the Pacific on the west (Map: Peru, D 8). Its area is 19,306 square miles. The coastland is occupied by a mountain range rising to 6000 feet, and the eastern part belongs to the region of the Bolivian Andes. The interior is an elevated arid plain known as Pampa de Tamarugal. The wealth of the province consists chiefly in the immense deposits of nitrate, which are worked on a very extensive scale. Agriculture is carried on to some extent along the rivers, and there are silver mines near the capital, Iquique (q.v.). There is a railway line connecting the capital with Pisagua, the chief seaport, and the interior. Population, in 1885, 45,086; in 1895, 89,751. Tarapacá was taken by Chile from Peru in 1880 and was formally ceded in 1884.

TARARE, tȧ′rȧr′. A manufacturing town in the Department of Rhône, France, at the foot of Mont Tarare, 20 miles northwest of Lyons (Map: France, L 6). In 1756 the manufacture of muslins, for which it has since become famous, was introduced from Switzerland. The chief products of its mills are muslins, tarletans, silks, silk plush, and velvets. Population, in 1901, 12,334.

TARASCO, tȧ-räs′kō. An ancient nation of Michoacan, Mexico, constituting a distinct linguistic stock. According to their traditions they migrated from the north about the same time as the Aztec tribes (see NAHUATLAN STOCK), and about the year 1200 established their kingdom in Michoacan, maintaining their independence against the Aztec, whom they excelled in many culture characteristics. Their principal buildings, especially in their capital city of Tzintzuntzan, were of cut stone laid in mortar. Many of the ruins are still unexplored. Their calendar was nearly the same as that of the Aztec, and they had also a pictograph system. Their principal god was Curicaberis, the sun. The dead were cremated and both their funerals and their religious ceremonials were accompanied by human sacrifices. They were famous for their beautiful and durable fabrics of woven feathers as well as of cotton, and were skillful in the working of gold and silver. They surpassed all other native tribes in their defensive armor, which consisted of helmet, cuirass, and limb protectors, all of wood covered with plates of copper or gold. In physique they were considered the tallest and handsomest people of Mexico. They still constitute the bulk of the population of central Michoacan, and number about 200,000, and although they have lost the art of feather weaving, they maintain their reputation for the weaving of beautiful rebosos and belts with figures of birds and animals, and for their lacquer work. The language is vocalic and euphonious. Despite the fact that they offered no resistance to the Spanish invasion of Mexico, their last King, Tangaxoan, was tortured to death by Nuño de Guzman. In 1810 they were the first to revolt against the Spaniards, and thus, under Hidalgo, began the Mexican War for Independence.

TARASCON, tȧ′rȧ′skôɴ′. A town in the Department of Bouches-du-Rhône, France, 13 miles southwest of Avignon, on the Rhone River (Map: France, L 8). It is connected with Beaucaire on the opposite bank by a suspension bridge. The twelfth-century Church of Saint Martha, a composite of the Romanesque and Gothic, occupies the site of an old Roman temple. It was rebuilt during the fourteenth and fifteenth centuries. It has a tenth-century crypt, and the tombs of Saint Martha and Louis II. of Provence. Other objects of interest include the old Gothic castle completed in the fifteenth century, and the town hall. The leading industries are silk-spinning and the manufacture of hats. Population, in 1901, 8885. Tarascon is the ancient *Tarasco.* (See TARASQUE.) Daudet received here the inspiration for his *Tartarin de Tarascon.*

TARASP, tȧ′räsp′. A village of Switzerland, in the Lower Engadine, Canton of Grisons, situated on the Inn, at an altitude of 3910 feet, 36 miles from Chur and 28 miles from Saint Moritz. It is a health resort, frequented for its mineral baths. Population, in 1900, 275.

TARASQUE, tȧ-rȧsk′. A monster prominent in the local folk-lore of Tarascon, France, said to have been subdued by Saint Martha in early Christian days. The myth was in existence at least as early as the twelfth century, when the cathedral was built in memory of the event. On the fête 'La Tarasque,' an effigy of the beast is carried in procession about the streets of Tarascon and also at Beaucaire.

TARAXACUM. See DANDELION.

TAR′BELL, EDMUND C. (1862—). An American painter, born in West Groton, Mass. He was a pupil of Boulanger and Lefebvre. Light and air are what he seems to seek in his out-of-doors work, and he achieves this, not only through truth of color, but by a certain freeness and fragility of touch which contribute much to the sense of mobility and life in his landscapes and figures. His color is pure, and at times full of strength.

TARBELL, IDA MINERVA (1857—). An American author, born in Erie County, Pa. She graduated at Allegheny College in Meadville, Pa., and from 1883 until 1891 was associate editor of *The Chautauquan.* From 1891 until 1894 she was in Paris, studying at the Sorbonne and at the Collège de France. On her return she became an associate editor of *McClure's Magazine.* Her publications include: *Short Life of Napoleon Bonaparte* (1895); *Life of Madame Roland* (1896); *Early Life of Abraham Lincoln* (in collaboration with J. McDavis, 1896); *Life of Abraham Lincoln* (1900); and *History of the Standard Oil Company* (1903).

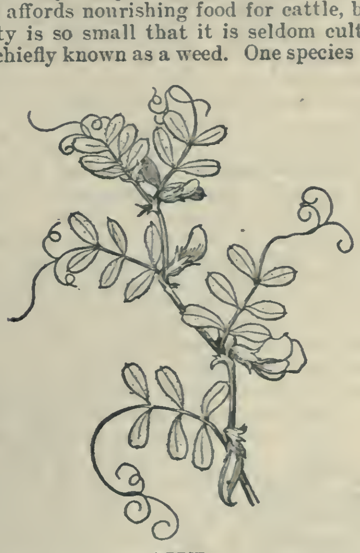
TARBES, tärb. The capital of the Department of Hautes-Pyrenées, France, on the left bank of the Adour, 32 miles by rail northeast of Pau (Map: France, G 8). The cathedral, dating from the twelfth century with a fine octagonal lantern tower, and the prefecture, formerly the episcopal palace, are the most noteworthy buildings. The town has also a library (22,000 volumes). It is well known for a breed of light horses, and has manufactures of woolens, machinery, and cannon. The town became a bishopric in 420 and in mediæval times was the capital of the County of Bigorre. It was occupied for forty years by the English during the fourteenth century. Population, in 1901, 26,055.

TARDE, tärd, GABRIEL (1843—). A French sociologist and criminologist. Born at the little town of Sarlat (Dordogne), he passed nearly twenty years there as magistrate and *juge d'instruction.* In 1880 he began to contribute to the *Revue Philosophique,* and gradually won his way to reputation, which was assured after the publication of his *Lois de l'imitation* in 1890. He is now professor of modern philosophy at the Collège de France in Paris. In a large number of books and articles, Tarde has elaborated a complete and original theory of society. It is essentially a psychological theory. In Tarde's view, to study society is to study how the minds of men act, and how they influence one another. The essence of society, he holds, is that one man should be so affected by another that the two should be brought to greater similarity of thought or action. Social life is a round of invention and imitation; an 'invention' being a new thought or act of any kind whatever, and 'imitation' any thought or act of copying or making after a model. Imitation obeys certain laws which Tarde makes it his business to investigate. Thus it is usually the inferior who copies the superior, the lower class the upper class; it is generally true that a new idea has prestige because of its novelty, though if it be taken up as a permanent institution it will also come to prestige through the tradition of age. Circles of imitation spread from different inventions as do the ripples around stones thrown on a pond; the circles interfere, oppose, or combine, in complicated ways which Tarde seeks to analyze. The essentials of his theory were presented in the *Lois de l'imitation*, and were much elaborated five years later in his *Logique sociale*, in which extensive illustrations were given from the whole range of social development. Along with his sociological theory, Tarde has gradually developed a philosophical system, best summarized in his *Lois sociales* (1898). His psychological point of view is carried over into his criminological work. *La criminalité comparée* (1886), his first book, emphasized the purely social influences upon crime, with much criticism of the anthropological school of Lombroso. *La philosophie pénale* (1890) is a more systematic presentation of his ideas. Tarde's other works include: *Etudes pénales et sociales* (1892); *Les transformations du droit* (1893); *Essais et mélanges sociologiques* (1895); *L'opposition universelle* (1897); *Etudes de psychologie sociale* (1898); *Les transformations du pouvoir* (1899); *L'opinion et la foule* (1901); *Psychologie economique* (1902); in English translation, *Social Laws* (New York, 1898).

TARDIEU, tär′dyẽ′. A French family of engravers. Nicolas Henri (1674-1749), born in Paris, was a pupil of Lepautre and the Audrans. He became Court engraver, and executed a portrait of the Duc d'Antin (after Rigaud, 1720); "Constantine Exhibiting the Cross" (1742); and "The Battle Between Constantine and Maxentius" (1745). His son and pupil, Jacques Nicolas (c.1716-c.1791), succeeded him as Court engraver, and was also appointed engraver to the electoral Court of Cologne.—Jean Charles (called Cochin) (1765-1830), a son of the preceding, was an historical painter, pupil of Regnault, took the second Prix de Rome (1790), and was favored by Napoleon. For the latter he painted "The Queen of Prussia at Tilsit in 1807," and two other pictures (Versailles).—Jean Baptiste Pierre (1746-1816), a grand-nephew of Nicolas Henri, was the first to raise the art of geographical engraving to great perfection, and was ably followed in its practice by his brothers Pierre Alexander (1756-1844) and Antoine François (1757-1822), as well as the latter's son Ambroise (1788-1841), who was equally successful with portraits and architectural subjects.

TARDIGRADA (Lat., slow-going). A group of little animals of uncertain affinities, represented by the bear-animalcules. They are minute, slowly moving, soft-skinned animals, not more than a millimeter in length, and are often referred to the class Arachnida, as distantly related to the mites. The body is short and thick, not divided into segments, the head slightly separated from the trunk. The mouth is provided with a sucking proboscis, and is surrounded by papillæ. The digestive canal opens by a muscular pharynx into a narrow œsophagus, which leads to a capacious stomach, succeeded by a short intestine. There are two eye-like spots, and the nervous system consists of a brain succeeded by a ventral nerve-cord of four ganglia. There are no heart, blood-vessels, nor any respiratory organs; and the animals are hermaphroditic. The segmentation of the egg (which is very large) is complete and regular. Tardigrades are not uncommon in bog-moss (Sphagnum), or in fresh and salt water, and are capable of revivifying after being apparently dead and dried up, if placed in water.

TARE (of uncertain etymology; possibly connected with ME. *tare*, brisk, eager). Various leguminous plants, especially species of Vicia, weak climbing plants, natives of the temperate parts of the Northern Hemisphere. One of these, the wild vetch (*Vicia hirsuta*), has very small flowers and pods, pinnate leaves, and small leaflets. It affords nourishing food for cattle, but the quantity is so small that it is seldom cultivated and is chiefly known as a weed. One species (*Vicia sativa*), with an upright branching habit, is cultivated in some parts of Europe for its herbage, which is thought to be rich enough to compensate for its small quantity. The plant thrives well in poor sandy soils, where it is valuable for green manure. (See Vetch.) The tare of the New Testament is supposed to be darnel.



VETCH.

TAREN′TOLA (It., Tarentine, from *Taranto*, from Lat. *Tarantum*, from Gk. *Τάρας*, *Taras*, a city of Southern Italy), or Tarente. One of the commonest geckos (q.v.), or lizards, of the Mediterranean region (*Tarentola Mauritanica*), grayish brown with indefinite markings, and about six inches long. It has been introduced by ships into Southern France, and when it takes up its abode inside a house becomes almost domesticated. Some other geckos are also mistakenly called by this name. An interesting account of their habits may be found in Gadow, *Amphibia and Reptiles* (London, 1901).

TAREN'TUM. See TARANTO.

TARENTUM. A borough in Allegheny County, Pa., 21 miles northeast of Pittsburg; on the Allegheny River, and on the Pennsylvania Railroad (Map: Pennsylvania, B 3). It is primarily an industrial centre, being interested largely in the manufacture of plate glass and bottles. Other products include brick, lumber, steel and iron novelties, steel billets and sheets, sack and wrapping paper, etc. Coal is mined in the vicinity. The government, under the charter of 1842, is vested in a burgess, elected every three years, and a council. The electric light plant is owned and operated by the municipality. Population, in 1890, 4627; in 1900, 5472.

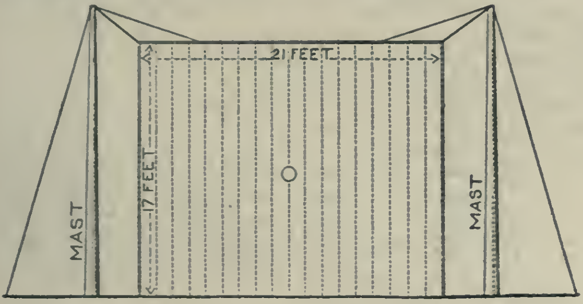
TARGET and **TARGET PRACTICE.** By target practice is meant the method by which proficiency is attained in marksmanship. In its military aspect, target practice is designed to give a thorough individual training to every soldier in the fighting use of his rifle. The prescribed course of instruction usually includes (a) preparatory instruction, embracing the construction, nomenclature, and mechanism of the rifle, the theory of fire, principles of aiming, pointing and aiming, judging or estimating distance, gallery practice, and blank cartridge firing; (b) range practice, in which the distances are known, and accuracy and steadiness of aim are developed; (c) demonstration firing; (d) collective or volley firing at long range; and (e) field or combat firing. Throughout Continental Europe generally, the school target consists of a wooden frame covered with jute cloth on which the paper targets are pasted. The centre band is white and the two outer vertical bands light blue or gray. The bull's-eye is in the centre of the target and usually there is also outlined an oval which represents the limit of dispersion of correctly aimed shots, aiming at 200 and 300 paces at the lower part, and at 400 paces at the upper part.

Figure targets are frequently colored to show details, otherwise they are plain light blue in color. Figure and section targets are used as fixed, moving, and disappearing targets. For firing at long ranges large groups of targets are used representing lines and columns in battle form; cavalry, guns, caissons, etc., arranged as in action being made to move or disappear so as to show different phases of a battle.

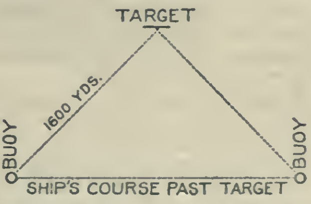
Typical of European practice are the permanent German Army ranges which have various figures arranged as disappearing or moving targets, manipulated from covers not noticeable from the front. A target representing a line of infantry a hundred meters (330 feet) long may be erected in ten minutes by eight men, while but one man is necessary to work it. The figures are so constructed as to be capable of standing erect or lying on the ground at the will of the operator. To represent the reënforcement or thinning of a line two or more of such lines of targets are placed close to each other, the figures in the rear showing through the intervals between those in front.

Since the Boer War considerable ingenuity has been exercised in devising a new system of instruction in musketry and field firing in the British Army. The war proved the musketry regulations of 1898 practically worthless, so that a new course was devised which was completed in 1903. The ground used at Aldershot enabled one battalion to advance to the attack with as near an approach to the conditions of actual warfare as is possible. The battalion performing the exercise advances in column of route when fire is suddenly opened upon it by a single gun posted about 800 yards to the left front. It is required that development be made at once and the gun silenced. As the firing line reaches the crest of a long hill perpendicular to the front, they are able to recognize the first position of their supposed enemy about 900 yards distant. The advance of the firing line is subjected to artillery fire from a battery about 2500 yards away. The targets representing the enemy are movable and can hardly be distinguished, as only the heads and shoulders are exposed, and that only occasionally. As the advance continues the enemy is supposed to have retired about 800 yards to a position which has a deep ravine in its front, through which runs a main railway line. The enemy's object is to destroy this line before the advance can occupy it, and with this object in view an armored train is dispatched to cover a party of men sent down to blow up the tracks, which they are supposed to succeed in doing. The advance continues beyond the railway and up the hill where the enemy is found to have taken his last position near the guns already mentioned. The battalion thus makes three positions, covering about 3500 yards. The targets are merely dummy figures of the crudest construction. They are all worked by men in pits by means of ropes and springs, with the exception of the armored train and the wrecking party. An elaborate system of telephones is installed, which connects all the pits and enables the commander of the range to be in constant connection at every stage of the firing. The ground is under close observation of the umpires, who are stationed in covered pits where they can see the advance by means of mirrors, in all its movements.

Greatly increased interest has been taken in the target practice of the various combatant branches of the United States Army. In 1877 the Creedmoor target with its method of scoring hits was introduced by General Ord, an innovation which was rendered doubly valuable by an increase of the ammunition allowance from 10 to 20 rounds a month for each soldier. In 1886 individual skirmish practice was introduced, the objective being in turn the figure of a standing man, a kneeling man, and a man lying down, followed by company instructions in field firing. Targets and materials differ according to the scheme of practice issued each year from the headquarters of the army. In the case of small arms practice the period selected for practice on a range is announced annually by department commanders and all orders containing instruction governing their preliminary methods or practice with a rifle, carbine, or revolver are issued each year from army headquarters. The education of the men in target practice is the direct responsibility of the company commander, although post commanders are required to exercise a close supervision also, and particularly over the skirmish and field practices. There is an inspector of rifle practice in each department selected for his special qualifications, whose duty it is to examine and report upon the target practice work of the troops in his department. The United States Government encourages the hunting for large game wherever practical. The small arms practice regulations for the National Guard of the State of New York are fairly representative of the best methods employed in the United States. The Creedmoor bull's-eye targets are employed for all classes except in skirmish fire, when the figures of men standing, kneeling, and lying down are used. To qualify as marksman, the soldier must obtain forty-five out of a possible seventy-five points, making fifteen out of a possible twenty-five at each of the following distances: 100 yards (standing); 200 yards (kneeling); 300 yards (prone). A sharpshooter is required in addition to make twenty-two points out of twenty-five at 500 yards and twenty out of twenty-five at 600 yards. The expert must make twenty out of twenty-five at 700 yards and at 800 yards must make a score sufficient to bring his total up to forty, for both ranges. A distinguished expert is required to make the same percentage and under the same conditions at 900 and 1000 yards. Skirmish firing is at different distances, and at figure targets. Shots on the prone figure count five each, and on the kneeling figure three each, while on any other place on the targets or on the standing target each shot counts one.



A NAVAL TARGET.



MOVEMENT OF SHIP IN TARGET PRACTICE

TARGET PRACTICE, Naval. On shipboard target practice is the culminating feature in the training of men who are to become gun-firers, or 'gun-pointers' as they are usually called. The men are first taught to aim accurately with small arms. The promising candidate is advanced to work with heavy guns—first simple aiming and then practice with aiming machines such as the Scott 'dotter.' This instrument has a target which can be given a vertical movement past the gun sights which simulates the movement of a ship or other object past these sights when the firing vessel rolls, and it has a pencil which records the point at which the sights are directed when the firing key is pressed. The next step is sub-calibre practice. A small-arm rifle is clamped to the gun or inserted in fixtures in the bore and fired at a target quite close at hand. Then larger sub-calibre guns or tubes are fitted in or on top of the large gun. In all sub-calibre work the regular sights of the large gun are used, an allowance being made for the difference in range (for a given elevation) of the two weapons.

Nearly one-half the crew are expected to become sufficiently good shots to receive instruction and practice in all forms of sub-calibre work, but only the most proficient are given a chance with full-calibre ammunition. The number of shots fired by each man depends upon the class of gun for which he is being particularly trained; the larger guns are fired only a few times each year, the medium and lesser calibres many more times.

For full-calibre practice the target now used in most navies is 12 to 20 feet high, and 20 to 60 feet long. It is of canvas, supported by two or more small masts, which are set in the timbers of a raft or float, as shown in the accompanying figure.

The target is anchored in a manner to keep it broadside on and buoys are anchored at certain distances from it. The ship steams past from buoy to buoy at a fixed speed (usually more than 6 and less than 12 knots). Firing begins as the first buoy is passed and stops when the last buoy is reached. See Gunnery; also, Guns, Naval.

TARGOVITZA, tär'gô-vĭt'sȧ, Confederation of. A union of Polish nobles under the leadership of Felix Potocki, formed at Targovitza (Russian Government of Kiev) on May 14, 1792, for the purpose of overthrowing the Constitution adopted in the preceding year. The organizers of the Confederation were entirely in the interests of Russia, and the adhesion of the Polish King to the Confederation was followed by the second partition of Poland (q.v.).

TARGUM (Aram. *targūm*, translation, explanation, from *targēm*, to interpret). The general term for the Aramaic versions of the Old Testament, sometimes less correctly referred to as the Chaldee Paraphrase. The origin of the Targum is to be looked for in the Persian period of the Jews, when Hebrew ceased to be the popular language and gave way to the Aramaic. The first indication of the practice of explanation is to be found in Neh. viii. 8, where it is said that Ezra read the Law to the people while his assistants "caused them to understand the reading." The custom grew and gradually there arose a class of Meturgemans (mod. dragoman, interpreter) and finally the system was regulated by the Rabbis. At first and indeed for many centuries the Targum from its very nature was not committed to writing, for the same reason that the oral law itself was never intended to become a definitely formulated written code. In the course of time, however, both yielded to circumstances and it was thought preferable to write them down rather than have them forgotten. Yet only a small portion of the immense mass of oral Targums that was produced survived. All that is now extant are three distinct Targums on the Pentateuch, one on the Prophets, and Targums on the Hagiographa, viz. on Psalms, Job, Proverbs, the five Megilloth (Song of Songs, Ruth, Lamentations, Esther, Ecclesiastes), on Chronicles, and on the apocryphal pieces of Esther.

The Targums are of little help for purposes of text criticism. Their main claim upon scholars rests upon the fact that in them there are to be found hints at the internal and external life of the people at the time when they were composed. The text is in a very corrupt condition, as might indeed be expected, since no proper care was taken to secure the purity of the text when the Aramaic began to decline as the spoken tongue of the Jews. A translation of the Targums on the Pentateuch into English was made by Etheridge (London, 1862-65). The *Editio Princeps* of Onkelos (q.v.) is that of Bologna (1482), of the Targum on the Former Prophets that of Leira (1494), and on the Latter Prophets that of Venice (1517-18). Targums on the Hagiographa appeared in the Rabbinic Bibles, but the Targum on Chronicles was not published until 1680. Recent editions of the Targum are: Pentateuch (Targum Onkelos) by A. Berliner (Berlin, 1884); Prophets (Prophetæ Chaldaice) by Lagarde (Leipzig, 1872); Hagiographa (Chaldaice) by the same (Leipzig, 1873).

TARIFA, tȧ-rē′fȧ. A seaport town of Spain, in the Province of Cadiz, on the coast, 21 miles west-southwest of Gibraltar (Map: Spain, C 4). It is the most southern town of Europe, is surrounded by tower-embattled walls, and communicates by a causeway with a small island, on which stand a fortress and lighthouse. The town is the most thoroughly Moorish in Andalusia; it is quadrangular in shape, and its streets are narrow and dark. Tunny and anchovy fisheries are actively carried on. Tarifa, the Carthaginian *Josa*, and the Roman *Julia Traducta*, received its present name from the Arabs, who are said to have called it after Tarif ibn Malik, who landed there to reconnoitre previous to the conquest of the country. It was successfully defended in 1812 by 2500 troops (mostly British) against a French force of 10,000 men, under Victor and Laval. Its population in 1900 was 11,730.

TARIFF (OF., Fr. *tariffe*, Fr. *tarif*, from Sp. *tarifa*, price-list, rate-book, from Ar. *taʿrĭfa*, *taʿrīf*, notification, inventory, from *ʿarafa*, to know). A schedule of duties or imposts levied upon goods as they pass from one State to another. A tariff may be levied upon foreign goods: (1) simply as a means of augmenting the revenues of a government, in which case it is a form of taxation (see TAX; FREE TRADE); or (2) as a means of retaliating upon foreign governments for similar restrictions imposed by them, in which case it becomes an instrument of warfare serving a temporary purpose and designed in the end to secure commercial reciprocity; or (3) as a means of fostering artificially particular industries by protecting them wholly or in part against foreign competition. See PROTECTION.

GENERAL HISTORY OF TARIFF LEGISLATION. Tariffs for revenue seem to have been usual among the civilized nations of antiquity. Among the Greeks, especially the Athenians, a tariff was regularly resorted to as a means of revenue. This tariff was laid upon both exports and imports, and an additional tax was collected from vessels engaged in foreign traffic for the use of the harbors in which they anchored. The regular export and import duty at Athens was 2 per cent., though in time of war, when the State was in pressing need of large sums of money, it was often considerably augmented.

Import and export duties were regularly levied by the Roman State also for revenue. The name for this tax used by the Latin writers is *portorium*, a name applied likewise to transit duties and bridge tolls. In the provinces and in newly conquered countries, duties were collected by Roman officials known as *portitores* and *publicani*, and the sums were transmitted to the Roman treasury. In some cases, however, the central Government, as a particular favor, allowed the subject State to make its own customs laws, stipulating only that Roman citizens should be exempted from paying any duties that might be imposed. In B.C. 60 all *portoria* were abolished by the Lex Cæcilia so far as concerned the ports of Italy; but Julius Cæsar soon after restored them. Augustus Cæsar still further increased the number of dutiable commodities, and a long list of those which under the later emperors were subject to the payment of a duty is given in the Digest of Justinian. The rate of duty at Rome seems generally to have been 5 per cent., but under the later emperors a duty of 12½ per cent. (*octava*) is mentioned as the ordinary tax on imports.

In the Middle Ages the feudal lords individually claimed and exercised the right of imposing transit duties levied on all goods that passed by or through their possessions. Hence, says a recent writer, "the rivers and high-roads were fairly lined with custom-houses and toll-gates." When feudalism gave way to monarchy and strong central government, the kings transferred to themselves the rights that had previously been exercised by the barons. They, too, erected custom-houses at all their frontiers, and even on the boundaries of their different provinces. So universal did these duties, local and national, become, that every Continental nation was covered with a network of customs lines. Various cities also had their local customs duties, of which the *octroi* collected at the entrance to several cities on the Continent, notably Paris, is a survival.

In England we first hear of a tariff for revenue under King Ethelred in or about the year 980. At that time duties on ships and goods were levied and ordered to be paid at Billingsgate, London. They were first acknowledged as a part of the King's revenue in the reign of Edward I., who received them by regular grant from Parliament, if we may accept the assertion of Sir Edward Coke, quoted by Blackstone. But wool, skins, and leather were taxable at the royal pleasure, these being the 'hereditary customs' of the Crown, known in the law-Latin as *custuma antiqua*. Subsequently, under the same King, special duties to be paid by foreign merchants only were levied (*custuma nova*), which were protective in their nature and not merely for revenue. The duty on ordinary goods in this reign was sixpence in the pound, which was raised to one shilling (5 per cent.) under Richard II., reduced to sixpence and again raised to eightpence, and finally fixed at the shilling rate, where it remained as late as the ninth year of the reign of William III. (1697). The King also had the right of *prisage*, i.e. of taking from every wine-importing vessel of twenty tuns two tuns for the royal use. This duty was called 'tunnage' to distinguish it from the other duties called 'foundage.' Customs duties were originally granted 'for the defense of the realm,' and especially for the protection of traffic on the high seas, and were at first given for a fixed period. To Henry VI., Edward IV., and their successors, they were given for life, until the reign of Charles I. whose unconstitutional levy of these duties without grant of Parliament formed one of the grievances against him. On the restoration of Charles II. the duties were again granted for life, and under William and Mary they were made perpetual and assigned to the payment of the national debt.

From an early period it was the custom in England to base tariff duties upon official valuations of imports and exports. A 'book of rates' containing such valuations is known to have been printed in 1545. The struggle between the first Stuarts and Parliament over questions of taxation was precipitated by the arbitrary action of James I. in raising the official rates without the consent of Parliament. In 1642 the latter body itself issued a book of rates without the assent of the sovereign. After the Restoration a new book of rates was issued in 1668 with the assent of both authorities. This enumerated as many as 212 articles for taxation 'outward' (i.e. export duties) and 1139 articles for import duties. Official valuations continued to be the basis for tariff purposes all through the eighteenth century, and this is one circumstance which makes it difficult to estimate correctly the value of England's exports and imports during that period. Another confusing practice which prevailed until as late a date as 1787 was that of assigning the proceeds from the duties on imports and exports to a variety of different purposes or 'funds.' As a consequence it was often very difficult even for customs officials to determine what was the aggregate rate to which a particular article was subject. Pitt's Customs Consolidation Act of 1787 did away with the separate funds by assigning all revenue from duties to the 'consolidated fund.' In this act some 1200 articles were rated for import duties and 50 for export duties. Another important achievement of Pitt's Ministry was the negotiation of a commercial treaty with France (1786) which went far toward freeing trade between the two countries from the restrictions by which it had long been hampered. The struggle against Napoleon caused the abrogation of this treaty, but it is no exaggeration to describe it as the first definite step in the direction of that free trade policy which England was to adopt some sixty years later. The next simplifications of the English tariff were those effected by Huskisson in 1824 and 1825, which consolidated some 450 trade and tariff acts into eleven and reduced the rates of duty on many articles, particularly exports. One of the most important results of the long struggle for the abolition of the Corn Laws (q.v.) was to simplify still further the English tariff. From 1842 to 1846, 390 duties, including all those on exports, were abolished and 503 were reduced; in 1846, 54 were abolished and 112 were reduced; in 1853, 123 were abolished, and finally, in 1860, 371 more were abolished and virtual free trade was achieved. An important incident of the latter year was the negotiation with France of a new commercial treaty which lowered the duty on wine and placed such important French products as silks, gloves, etc., on the free list. For both countries the treaty marked a long step in the direction of free trade, but in the case of France the policy appears to have lacked the support of public opinion and was followed after the Franco-Prussian War by a reaction toward protection. The reduction and abolition of duties continued in England after 1860, the next important change being the placing of sugar on the free list at a sacrifice of some £6,000,000 revenue in 1872. On the outbreak of the Boer War the English tariff included only nine principal items, cocoa, coffee, chicory, dried fruit, tea, tobacco, wine, beer, and spirits. The extraordinary revenue required in connection with that struggle led to the restoration of the duty on sugar, to the imposition of an export duty on coal, and finally to the restoration of light registration duties on grain and flour (3d. and 5d. per cwt. respectively).

In the tariff history of France the two commercial treaties with Great Britain that have been referred to stand out as prominent features. Down to the time of the first (1786) the tariff policy of the country had been dictated by extreme mercantilist views of trade. The importation of many commodities was prohibited altogether, while others were admitted only on payment of high duties. Nor was the tariff confined to foreign trade. Each petty province of France had its system of duties, with the result that it was not unusual for the prices of even such common articles as the grains and salt to differ by 100 per cent. or more on the same day in different parts of the country. It required nothing less than the Revolution (decree of 1790) to free the land from these restrictions on internal trade. The bitter national hostilities which grew out of the Revolution and the brilliant years of Napoleon's ascendency effectually stifled the aspirations for freer trade which ushered in the period. From 1815 until the negotiation of the second commercial treaty with Great Britain in 1860, the tariff policy of France was highly protectionist. The latter treaty was one of the fruits of the Anglomania of Napoleon III. and was followed by treaties drafted on equally liberal lines with the more important Continental States of Europe, including the German *Zollverein* (1865). These reduced the rates of duty on French imports to from 10 to 15 per cent. *ad valorem*. The same liberal policy was continued substantially until 1881, when an act was passed substituting specific for *ad valorem* duties and incidentally increasing somewhat the rates. Protectionist sentiment increased after 1881 and by 1892, when many of the commercial treaties negotiated at an earlier period expired, the country was ready for an out-and-out protectionist tariff, including not only high duties on agricultural products and manufactures, but also moderate bounties to producers of silk, flax, and hemp. At this time also the policy of providing maximum and minimum duties (see RECIPROCITY) was introduced. Since 1892 there has been no perceptible abatement in the demand for protection in France, and while French duties are moderate in comparison with those of the United States, she must be included among protectionist countries.

The tariff policy of the States now forming the German Empire first assumed definite form in the German *Zollverein* (q.v.). The importance of this early federation for tariff purposes in preparing the way for the German Empire is generally conceded. From the point of view of tariff history it is interesting because it enabled Prussia, which was inclined toward free trade during this period, to dominate the tariff policies of her smaller neighbors. A treaty negotiated with Austria in 1853 reduced the duties on trade between that country and the *Zollverein* and the even more liberal treaty with France, already referred to, secured the same result for trade with that country in 1865. On the eve of the Franco-Prussian War the tariff of the *Zollverein* was practically a tariff for revenue only. After the war a reaction toward protection set in. This is clearly indicated in the tariff adopted in 1879, by which the duties on both agricultural and manufactured articles were increased. The policy continued to be only moderately protective until 1902, when an act was passed which made very substantial concessions to the advocates of protection to agricultural interests. Among the most notable changes were an increase in the duties on grains (the duty on wheat was raised from 32 cents per cwt. to 90 cents) and on draught animals (the duty on horses valued at $250 or less was raised from $2.50 to $22.50).

The changes in the tariff policies of France and Germany that have been described have been paralleled pretty closely in the other countries of Continental Europe. England's example and other influences caused a movement in favor of free trade to extend all over Europe in the decade from 1860 to 1870. This was followed by a reaction toward protection in the more important countries, which has gained in volume until in Germany and Russia, at least, the movement is comparable with the protectionist movement in the United States.

Outside of Europe England's free trade example has been followed only by two or three of her own dependencies (e.g. India). Protective tariffs are found in Canada, in the Australian colonies, and in Cape Colony, and are well-nigh universal among the independent sovereignties. No country has, however, gone further in this direction than the United States.

HISTORY OF TARIFF LEGISLATION IN THE UNITED STATES. The earliest tariff in the history of the United States was that approved July 4, 1789. It is interesting to note that the preamble of the act establishing it states that one of its objects is "the encouragement and protection of manufactures," at this early period laying down a principle afterwards adopted as the tenet of a political party. In 1817, at the beginning of President Monroe's administration, Congress abolished the internal taxes that had been made necessary by the cost of the War of 1812, and in his message the President recommended the imposition of a protective tariff pure and simple. A temporary protective duty had in 1816 been laid upon cottons and woolens, and in 1818 this was continued for a period of eight years. The rise of the party of Loose Construction, headed by Henry Clay, was favorable to the principle of protection, as the Strict Constructionists held that Congress could impose a tariff only for revenue. In 1819 a protective tariff bill passed the Lower House, but was rejected by the Senate. The election as Speaker, in 1820, of John W. Taylor, of New York, a declared high-tariff man, gave great encouragement to the Eastern manufacturers, and indicates the increasing influence of the protectionists, although in 1822 the Strict Constructionists were able again to defeat bills embodying the protective principle. In 1824, however, the friends of that principle secured a working majority in Congress, and after a prolonged debate adopted a bill whose essential principle was the exclusion from the American market of such foreign goods as competed with those manufactured in the United States.

In 1827 a convention held at Harrisburg, Pa. (July 30th), discussed at length the principle of protection. Only four of the slave States sent delegates. The result of the convention was a petition to Congress praying for an increase of duties on certain articles then manufactured in the United States, a request which the Secretary of the Treasury made prominent in his report of the following December. By this time a strong party had been founded to support the protective system, or the 'American system,'-as it was popularly called. The famous 'Tariff of 1828,' adopted by Congress after a debate of six weeks, was the immediate result of this party's propaganda. This went further than any act had previously done in the direction of prohibitive duties. The chief articles on which protective duties were laid were woolen and cotton fabrics. At that time the value of the cotton goods annually imported from Great Britain was fully $8,000,000, and that of woolen goods about the same. The exports to Great Britain, on the other hand, of rice, raw cotton, and tobacco (the chief products of the South), reached the sum of $24,000,000 per annum. The Southern producers naturally feared that if the United States should by a high tariff practically prohibit the importation of a large proportion of British goods, retaliatory measures might lead to a diminution of the Southern exports to Great Britain. It was dissatisfaction with the tariff that led to the famous nullification movement in the South in 1832, in which year Congress, while modifying the act of 1828, distinctly recognized and retained the protective principle.

On March 3, 1833, the so-called Compromise Tariff, introduced by Henry Clay, was passed. It provided for the gradual reduction of the existing tariff until 1842, after which year the duties on all goods were to be 20 per cent. This measure for the time allayed the excitement in the South; but by the year 1842 it was seen that the financial consequences of the steady reduction of the tariff were extremely serious, since the Government revenues had decreased to such an extent as to be less than the expenses. A new tariff was manifestly necessary. The majority in Congress passed a bill which continued the duties imposed by the tariff of 1833, and provided for the division of any surplus revenue among the States. This was vetoed by President Tyler as being a violation of the compromise reached in 1833. A revenue tariff was also vetoed, because it contained the distribution clause, but on its being again passed, with this clause omitted, the President signed it (August 9, 1842). In 1846 a revenue tariff that eliminated altogether the principle of protection was passed, its aim being merely to provide an adequate revenue for the expenses of the Government. A still further reduction of duties was made by the tariff of 1857, which fixed them at the lowest figures shown by any tariff since that of 1816.

In 1861 the Republican Party passed the 'Morrill Tariff,' intended primarily to protect American manufactures. Twice in the same year (August 5th and December 24th) the duties were still further increased, less for protection, however, than in order to meet the expenses entailed by the Civil War.

The problems that were injected into politics by the war, and by the conditions resulting from it, relegated the tariff question to the background for many years. During this period duties were raised with little opposition to an unprecedented level. After the close of the war other questions still absorbed public attention, and it was not until 1880 that the tariff again became an important issue. The Republicans in nominating General Garfield embodied in their platform a strong declaration in favor of maintaining a scale of duties that should continue to protect American industries against foreign competition. The Democrats began to urge the expediency of modifying a tariff which had been framed to meet the conditions of a time of war, and which, they claimed, was not merely hampering commerce, excluding the United States from the markets of the world, but fostering monopolies by preventing healthful competition. They therefore declared for 'a tariff for revenue only,' which was afterwards explained as a tariff that should give 'incidental protection.' In 1882 provision was made by Congress for the appointment of a commission to report upon the expediency of a reduction of the tariff. This reduction became a question of pressing importance, since the revenues of the Government had so far exceeded its expenses as to accumulate in the treasury a very large and increasing surplus, which threatened to disturb seriously the financial system of the country. The Tariff Commission made its report, and in accordance with its recommendations the act of 1882, a distinctly protectionist measure, was passed. In 1884, the House being Democratic, the bill known as the 'Morrison Horizontal Reduction Bill' for lowering the tariff was hotly debated, but by a combination between the Republicans and the Democratic protectionists led by Mr. Randall, of Pennsylvania, it was defeated. The campaign of that year turned to some extent upon the tariff question, for the Democratic platform, while evading the question of protection, demanded a real reduction of tariff duties, as well as legislation to check the aggression of great corporations. The election of Mr. Cleveland appeared to show that the cry of 'free trade' had ceased to alarm the great body of voters, and that they were willing to hear argument upon the questions at issue. The new President's first message (December 16, 1885) recommended a reduction of the tariff, and his message in December, 1887, was devoted exclusively to this topic. In it he stated that the surplus in the treasury was nearly $140,000,000, demanded as a remedy the immediate abolition of the duties upon wool and other raw materials, and characterized the existing tariff laws as "vicious, inequitable, and illogical." In accordance with the views of this message a new tariff measure, the 'Mills Bill,' removing the duty on wool, and aiming at an estimated annual reduction of revenue of fully $50,000,000, passed the House. The Republican Senate offered a substitute repealing the tax upon tobacco and reducing the duty on sugar one-half, thus securing an estimated reduction of $65,000,000 per annum. Neither bill became a law.

The defeat of the Democrats in the Presidential election of 1888 was possibly due to the prominence of the tariff question, but as the majority of the popular vote was on their side, it was seen that a reform or, at any rate, a revision of the tariff was sooner or later inevitable. Therefore, the Fifty-second Congress took up the matter in earnest, with the result that the famous McKinley Bill passed both Houses of Congress and was signed by President Harrison (September, 1890). By its provisions the annual reduction of revenue was estimated to be some $66,000,000, of which $6,000,000 was due to a reduction of internal revenue taxes, chiefly on tobacco. A bounty was provided to compensate producers of raw sugar for the abolition of the duty on that commodity.

One very important feature of the McKinley Act was the section added through the influence of James G. Blaine, then Secretary of State, and known as the reciprocity section. This provided that whenever the President shall be satisfied that the Government of any country producing and exporting sugars, molasses, coffee, tea, and hides, or any such articles, imposes duties upon products of the United States which in view of the free introduction of such sugar, molasses, etc., into the United States, he may deem to be reciprocally unequal and unreasonable, he shall have the power to suspend by proclamation the free introduction into the United States of such sugars, etc., from the country in question. See CUSTOMS DUTIES; RECIPROCITY.

On the return of the Democratic Party to power in 1893, an effort was made to carry out its promise of tariff reform. A bill framed by William L. Wilson passed the House, and after much amendment by the Senate became a law without the President's signature, August 27, 1894. It made a considerable reduction in many duties, admitted wool free, and provided for an income tax. It was still in the main, however, a protective measure. As a revenue law this act was a failure, partly because the

Supreme Court declared the income tax feature unconstitutional and partly because of the business depression which began in the summer of 1893 and caused a marked falling off in imports. The dominant issue in the next Presidential campaign (1896) was the silver rather than the tariff question, but the election of the author of the McKinley Act was naturally construed as a popular verdict in favor of the policy with which his name was identified. A special session of Congress was called in March, 1897, and after prolonged debate the Dingley Act, copied closely in its leading provisions after the McKinley Act, became a law. The duties on wool, woolen goods, cutlery, pottery, and a few other articles were made even higher in this act than they had been in the act of 1890. Lumber was restored to the dutiable list, and hides, which had heretofore been admitted free, were taxed, out of deference to the wishes of the so-called 'Silver Republicans' in the Senate, who made this concession a condition to their adhesion. The sugar bounty provision of the McKinley Act was not revived, but the reciprocity provisions were, in modified form.

In 1898 (June 13th) the so-called 'War Revenue Law' was passed to supply the revenue required in consequence of the war with Spain. An interesting feature of this law was that it relied upon increased internal revenue duties and a purely revenue duty of ten cents a pound on imported tea rather than on changes in the general tariff to secure the additional revenue required. The war taxes were repealed by the acts of March 2, 1901, and April 12, 1902 (except those on 'mixed flour'). During the session of 1902 to 1903 earnest efforts were made in Congress by members of the Republican Party representing some of the States of the Middle West (e.g. Wisconsin) to effect a revision of those clauses of the Dingley Act supposed to be favorable to the 'trusts,' but without success.

Administrative Aspects of the Tariff. There is a marked difference in form between purely revenue tariffs, such as that of Great Britain, and protective tariffs like those of the United States and Germany. In the former only the few articles subject to duty are enumerated and unenumerated articles are admitted free. In the latter all articles that may claim free admission are expressly enumerated in the so-call 'free list' and other articles are subject to duty either under the special schedules or under the so-called 'drag-net clause,' which imposes a certain rate of duty on unenumerated articles. The German tariff of 1902 enumerated nearly one thousand different classes of commodities, while in the American tariff of 1897 the free list alone contains nearly two hundred and fifty separate items.

Another difference that has frequently characterized protective and revenue tariffs in the United States is that the duties in the former are mainly specific, that is based on the quantities or the number of units of the commodities imported, while in the latter they are mainly *ad valorem*, that is a certain per cent. of the value of the commodities imported. The preference of protectionists for specific duties is to be explained partly by the greater certainty of such duties, since they cannot be evaded by undervaluations, and partly by their conviction that since protection rather than revenue is the object sought, the ordinary canons of taxation, which prescribe that taxes shall be in proportion to the value of the property taxed, may be disregarded. The identification of specific duties with protection appears to be confined to the United States, since even in free-trade England all the duties now imposed are specific. The administrative advantage of such duties, which are practically self-assessing, need scarcely be dwelt upon.

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TARIJA, tȧ-rē′hȧ. A southern department of Bolivia, bounded by Argentina and Paraguay on the south, and Brazil on the east (Map: Bolivia, E 8). Its boundaries are ill defined. Area is estimated at 40,000 square miles. The surface in the western part (one-third of the area) is very mountainous, and in the east is flat, resembling the Chaco of Paraguay, of which it is a continuation. There are extensive forests and large stretches of grazing land. The chief river is the Pilcomayo. Agriculture and stock-raising are the main industries, but both are only slightly developed, on account of the sparse population. The civilized population, largely in the mountain region, was officially estimated, in 1898, at 65,000, including over 46,000 Indians. Capital, Tarija (q.v.).

TARIJA. The capital town of the Department of Tarija, Bolivia, on the upper course of the Vermejo, 180 miles south of Sucre, near the border of Argentina, with which it has extensive trade (Map: Bolivia, E 8). The climate is pleasant. Population, about 9000.

TARIK, tä′rēk, Ibn Ziad (?-c.720). The leader of the first Moslem invasion of Spain. He was a Berber, and had been converted to Mohammedanism by the Emir Musa, who made him governor of Tangier. It was probably on April 30, 711, that Tarik landed at Gibraltar (i.e. *Djebel-Tarik*, the hill of Tarik) with a force of twelve thousand men. He speedily overran Andalusia, and in July, 711, the Visigothic King Roderick was totally defeated at

Jerez de la Frontera. Musa, however, became jealous of his successful lieutenant, and joined him in the summer of 712 at Toledo with about twenty thousand men. There were frequent quarrels between Musa and Tarik, until finally both were summoned to Damascus by the Caliph Solyman. Musa was disgraced, while of Tarik nothing further is known. Consult Burke, *History of Spain*, vol. i. (London, 1895).

TARIM, tȧ-rēm′. The principal river of Chinese or East Turkestan (Map: Asia, H 4). It rises in the Karakorum Range in the extreme northern part of Kashmir, and flows north, east, and southeast through the great desert basin of Turkestan, emptying into the collection of lakes and marshes known as Lob Nor (q.v.) at the northern base of the Altyn-Tagh. Its length is estimated at over 1000 miles, including the upper course, which is generally called the Yarkand-Darya. After leaving the lofty glaciers of the Karakorum it pierces the Kuen-lun Mountains, and then descends to the plain, where it passes the city of Yarkand. Farther north it receives two large tributaries, the Aksu from the north and the Khotan-Darya from the south, below whose confluence the united stream is known as the Tarim proper. It soon divides into two arms, which flow parallel for a long distance. Receiving no more tributaries, it decreases rapidly in volume by evaporation and by being used for irrigation. A number of streams run down from the Kuen-lun toward the lower Tarim Valley, but they are lost in the great desert long before they reach the main stream. As the latter enters the Lob Nor region, however, it receives the Cherchen from the Tibetan Plateau and another large affluent from the north.

TAR′KINGTON, Newton Booth (1869—). An American novelist, born in Indiana, and educated at Princeton University, where he graduated in 1893. His first book, *The Gentleman from Indiana* (1899), attracted some attention, and his *Monsieur Beaucaire* (1900) is an artistically constructed romance of unusual charm. In 1902 he published *The Two Vanrevels*, less meritorious than his preceding works. He was elected to the Indiana Legislature in 1902.

TÁRLAC, tär′läk. A province of Luzon, Philippine Islands, bounded on the north by Pangasinán and Nueva Ecija, on the east by Nueva Ecija, on the south by Pampanga, and on the west by Zambales (Map: Philippine Islands, E 4). Area, 1295 square miles. The eastern part is level, while the western portion comprises the slope of the Cordillera de Cabusilán. The northern rivers drain into the Gulf of Lingayén, through the Agno, and the southern into Manila Bay, through the Pampanga. The main highway and the railroad traverse the province from north to south. Rice and sugarcane are the principal agricultural products, though some tobacco and corn are raised in the higher altitudes. The forests of the province are of great value; oranges, lemons, and bananas are produced in great variety. The languages are Tagálog, Pampango, and Pangasinán. The capital is Tárlac (q.v.). The population of the province, in 1901, was estimated at 89,339.

TÁRLAC. The capital town of the Province of Tárlac, Luzon, Philippines, on the right bank of the river of the same name, a tributary of the Agno, seventy-three miles northwest of Manila (Map: Luzon, D 5). It is on the Manila and Dagupán Railroad, and has excellent road connection with surrounding towns. Population, about 9,668.

TARLATAN (probably from Milanese It. *tarlantanna*, linsey-woolsey). A thin, gauze-like fabric of cotton. It is usually dyed or printed in colors, and is often of a rather coarse quality.

TARLETON, tärl′ton, Sir Banastre (1754-1833). An English soldier in the American Revolutionary War, born in Liverpool, and educated at Oxford. In 1776 he took part in Clinton's operations against Fort Moultrie (q.v.). Later in the year, under Sir William Erskine, he served in the successful operations in the vicinity of New York, and early in 1777 was with Cornwallis in New Jersey. With the army under Howe, the commander-in-chief, he took part in the battles of Brandywine and Germantown and the occupation of Philadelphia. In January, 1778, he was promoted captain, and in the following year was made lieutenant-colonel of 'the British legion,' a force of cavalry and light infantry, with which he very substantially aided the British cause in the South until the fall of Yorktown in September, 1781. He was an able and intrepid cavalry leader, but gained a reputation for cruelty until 'Tarleton's quarter' came to mean general butchery. Dispatched by Cornwallis, he defeated with great slaughter the superior force of Lieutenant-Colonel Burford at Waxham Creek, May 29, 1780; he routed a part of General Gates's force at Camden, August 16th, and defeated General Sumter at Catawba Fords, August 18th. Three months later he was defeated by Sumter, and, January 17, 1781, by General Morgan at Cowpens. He was with Cornwallis at the final surrender and returned to England in 1782. Representing the opposition, he was elected to Parliament in 1790, where he remained, excepting a brief interruption in 1806-07, until 1812. He was made major-general (1794), Governor in Berwick and Holy Island (1808), general (1812), and baronet (1815). He wrote a *History of the Campaigns of 1780 and 1781 in the Southern Provinces of North America* (1787), a work marred by vanity and partisanship.

TARL′TON, Richard (?-1588). A noted English comedian of Queen Elizabeth's time. Little is known of his life, but he is said to have been born in Shropshire and to have been at one time keeper of a public house. As an actor he became in 1583 one of the Queen's players who were called Grooms of the Chambers. A *platt* (or plot) exists of the second part of a play named *The Seven Deadlie Sinns*, as arranged by Tarlton, the dialogue of which was probably largely extemporized. He won such reputation for his constant jesting that his name was attached to many of the witticisms of the day, as well as to ballads and other pieces whose authors thus aimed to profit by his popularity. A collection of jokes called *Tarlton's Jests* was published a few years after his death; republished as edited by Halliwell for the Shakespeare Society in 1844, with *Tarlton's Newes out of Purgatorie*, which had appeared in 1590, in the form of a message from the dead actor in the other world.

TARN, tärn. A southern department of France, in Languedoc, bounded on the north by the departments of Aveyron and Tarn-et-Garonne (Map: France, J 8). Area, 2217 square miles; population, in 1891, 346,739; in 1901, 332,093. The surface is in general elevated and well wooded, and is watered by the river Tarn. In the south and southeast are offshoots of the Cévennes. Coal, iron, copper, and lead are mined and there are lucrative deposits of gypsum and porcelain clay. The vine is extensively cultivated, and there are manufactures of spirituous liquors, woolens, cottons and silks, iron, leather, and paper. Albi is the capital.

TARN-ET-GARONNE, â gȧ'rōn'. A southern department of France, formed mainly out of the old Province of Guienne (Map: France, H 7). Area, 1436 square miles; population, in 1891, 206,596; in 1901, 195,669. The surface is marked by plateaus with an average altitude of 1000 feet, the highest hills not rising above 1600 feet. The principal rivers are the Garonne and its affluents the Tarn and Aveyron. Cereals are raised in great quantities, and the grapevine and mulberry are extensively cultivated. Mules and poultry are raised; coal and iron are mined; marble is quarried, and there are manufactures of woolens, linens, silk, iron, cutlery, and beet sugar. Capital, Montauban.

TARNOPOL, tär'nō-pôl. A town of Galicia, Austria, 76 miles east of Lemberg, on the Sereth (Map: Austria, J 2). Among the industrial establishments are refineries for spirits, breweries, and steam mills. The population of the commune in 1900 was 32,082, about half Poles and half Jews.

TARNOVSKI, tär-nŏv'skĭ, STANISLAV, Count (1837—). A Polish historian of literature, born at Dzikov, Galicia. He studied in Cracow and Vienna, spent nearly two years in confinement, implicated in the revolt of 1863, was elected to the Galician Diet and the Austrian Reichsrat in 1867, then devoted himself entirely to literary studies, and in 1871 was appointed professor of Polish literature at the University of Cracow. In 1885 he became a member of the Austrian House of Lords, and in 1890 president of the Cracow Academy of Sciences. With Szujski he established the conservative *Przeglad Polski*, in which he published many of his literary monographs, distinguished by thoroughness, keen judgment and elegance of style. His writings include a *History of the Pre-Christian Era*, essays *On the Polish Novel in the 19th Century* and *On the Decadence of Polish Literature in the 18th Century, On the Comedies of Fredro, Schiller's Dramas, Shakespeare in Poland*, but above all his valuable principal work, *Studya do historyi literatury polskiéj* (Studies to the History of Polish Literature, 1886-92).

TARNOW, tär'nŏv. A town of Galicia, Austria, 137 miles west of Lemberg, on the Dunajec, near its confluence with the Biala (Map: Austria, G 1). The chief manufactures are of agricultural implements; there are steam, flour, and saw mills. The population of the commune, in 1900, was 33,974, of whom nearly two-thirds were Poles and the remainder Jews.

TARO. A popular name for Colocasia antiquorum, and especially for its variety esculentum, a native plant of India which is cultivated in warm climates, especially in the islands of the Pacific, where it forms a principal food. Its starchy, stem-like tuberous root is boiled or baked, made into bread or into poi, a fermented product. The young leaves and tender leafstalks are used respectively like spinach and asparagus.

TARPAN. The Mongolian name for the wild ass, kiang, or dziggetai, of the high plateaus of Central Asia. See ASS.

TARPEIAN (tär-pē'*yan*) **ROCK** (Lat. *Rupes Tarpeia*). The name applied to a portion of the southern part of the Capitoline Hill in Rome. According to tradition, in the time of Romulus, Tarpeia (a vestal virgin), the daughter of Tarpeius, governor of the Roman citadel on the Capitoline, covetous of the golden ornaments of the Sabine soldiery, and tempted by their consent to give her what they wore on their left arms, opened a gate of the fortress to the Sabine King, Titus Tatius, who had come to revenge the rape of the Sabine women. The Sabines crushed Tarpeia to death beneath their shields, and she was buried in the part of the hill which bears her name. From early times criminals were frequently put to death by being hurled from the Tarpeian rock. The whole southern end of the Capitoline is marked by scarped cliffs, the height of which has doubtless been much diminished by the accumulation of débris at the foot. It is impossible to determine precisely what portion of these cliffs is the true Tarpeian Rock.

TARPON (from the North American Indian name), or TARPUM. A great herring-like fish (*Tarpon Atlanticus* or *Megalops thrissoides*) of the West Indies and neighboring waters, which, with a few other species scattered about the tropical world, represents the isospondylous family Elopidæ. This fish is regarded by many anglers as affording sport with a rod and line superior to that given by any other fish. The tarpon (see Colored Plate of AMERICAN GAME FISHES, accompanying article TROUT) has something the shape of a salmon, and great power in swimming and leaping. It is often six feet in length and may weigh 100 pounds. It preys upon other fishes and small fry. The flesh is poor and not much valued as food, but the great silvery cycloid scales are much used in ornamental work. Another species of the family, the 'ten-pounder' (*Elops saurus*), is about half as large; it is abundant about all tropical coasts, and is known under a great variety of names.

TARPON FISHING. The sport of angling for tarpon (q.v.) with rod and line is the most skillful and exciting which America affords. The angler goes in a small boat some distance from shore, with an experienced man to row it, and uses a heavy rod, 7½ to 8 feet long, with a multiplying reel, 200-250 yards of linen line, and a spoon-bait. When a fish weighing perhaps 100 pounds seizes this, and begins those rushes and mighty leaps which have given the 'silver king' the just title of 'greatest of game fishes,' the power and science of the angler are both tested in the highest degree. Excellent tarpon-fishing may usually be obtained all around the southern coast of Florida and its reefs; and also along the coast of Texas. Consult American books mentioned under FISH; and ANGLING.

TARQUIN'IUS. The family name of two kings of Rome, with whose history, or rather with the legends regarding whom, the fortunes of the city are closely interwoven. Demaratus, a Corinthian noble, emigrated from Greece, and settled at Tarquinii, in Etruria, where he married an Etruscan wife. A son, Lucumo, married into a noble Etruscan family, and emigrated to Rome, where he was hospitably received and soon after admitted to the rights of citizenship. He took the name of Lucius Tarquinius, or, according to Livy, L. Tarquinius Priscus. The Roman monarch, Ancus Marcius, appointed him guardian of his children; and on the death of the King (B.C. 616), the senate and the citizens unanimously elected Tarquinius to the vacant throne. His reign was a glorious one. He waged successful wars, forcing the whole of the twelve sovereign cities of Etruria to recognize his supremacy and do him homage. To him, also, are ascribed the construction of the magnificent *cloacæ*, or sewers, the laying out of the Circus Maximus, and the building of shops (*tabernæ veteres*) on the Forum; the institution of the Great or Roman Games; and the foundation of the Capitoline temple. Tarquinius was assassinated after a reign of thirty-eight years (B.C. 578) at the instigation of the sons of Ancus Marcius, who considered themselves as best entitled to the throne. But their crime did not avail them, for Servius Tullius, his nephew, was elected to the vacant throne. —LUCIUS TARQUINIUS SUPERBUS, son of Lucius Tarquinius, having murdered his father-in-law, Servius Tullius, is represented in the legend as audaciously usurping the vacant throne (B.C. 534); but as the whole drift of his legislative policy was to abolish the reforms of Servius, there can be little doubt that the real significance of this part of his career lies in the fact that it indicates a successful reaction, on the side of the patricians, against the more liberal and progressive policy of the preceding age. That the younger Tarquinius, at least, is an historical character, seems to be pretty generally allowed. As far as we can gather from the ancient annals, the usurpation of Tarquinius was probably achieved by the help of an enterprising section of the nobles, who clung tenaciously to their privileges, and could not endure the constitutional recognition of the *plebs*. By means of subtle and unscrupulous intrigues he obtained or consolidated the Roman hegemony in Latium; offered sacrifice in the name of all the Latins at the Alban Mount; fused the contingents of the Latins with the Roman legion; put to death as traitors such of their chiefs as opposed him; and, at the head of the combined forces, successfully attacked the Volscians. On his return he completed the building of the temple of Jupiter Capitolinus, which the elder Tarquinius had begun, and deposited in the vaults the Sibylline books he had curiously acquired. (See SIBYL.) But his lavish expenditure both in war and peace necessitated the imposition of heavy taxes, and the patience both of plebs and patricians was beginning to give way. During a war against the Rutuli Tarquinius laid siege to the town of Ardea. Here in the Roman camp occurred the famous dispute between Sextus Tarquinius, the son of the King, and Collatinus, about the virtues of their respective wives, which led to the rape of Lucretia (q.v.). L. Junius Brutus (q.v.) carried the news of the outrage to Rome and called upon the people to rise against the tyrant, who was deposed by the senate; finally, the army before Ardea revolted. Tarquinius and his sons were obliged to flee, and an aristocratic republic was constituted at Rome (B.C. 509). Three different attempts were made to restore Tarquinius by force: first, by his own Etruscan kinsmen of Tarquinii; second, by Lars Porsena (q.v.) of Clusium; and third, by his son-in-law, Octavius Mamilius. All these, according to the legend, failed; and at length Tarquinius, utterly baffled and beaten, retired to Cumæ, where he died.

TARR, RALPH STOCKMAN (1864—). An American educator, born at Gloucester, Mass. He was educated at Lawrence Scientific School, Harvard, and was assistant professor of geology at Cornell University from 1892 to 1896, when he became professor of dynamic geology and physical geography in the same institution. Besides acting as associate editor of the *Bulletin of the American Geographical Society* and the *Journal of Geography*, he published: *Economic Geology of the United States* (1893); *Physical Geography of New York State* (1902); *New Physical Geography* (1903); and several text-books on geography.

TARRAGON. A garden herb. See ARTEMISIA.

TARRAGONA, tär'rȧ-gō'nȧ (L. *Tarraco*). A seaport of Spain, capital of the province of the same name, in Catalonia, situated on the Mediterranean at the mouth of the Francolí, 63 miles southwest of Barcelona (Map: Spain, F 2). On the land side it is bordered by the beautiful *Campo de Tarragona*, whose agricultural products form an important part of its trade. The local industries embrace manufactures of alcohol, liquors, soap, flour, silks, and paper, and salted fish. Since 1892 it has been an important port of entry. The town contains a normal school for both sexes, a museum of archæology, and several hospitals. The nucleus of the old city is situated on a steep hill, now crowned by the cathedral and the bishop's palace. Population, in 1900, 26,281. The city was probably founded as a Greek colony. Under the Romans it enjoyed a prominent position from the time of the Scipios, being at one time a residence of Augustus. It gave its name to the Province of Hispania Tarraconensis. From this period still survive a portion of the ancient wall, with 'cyclopean' remains, an amphitheatre, the ruins of the palaces of Augustus and of Pontius Pilate, and an aqueduct still in use. The city was destroyed by the West Goth Euric (475). It was taken by the Arabs in 713 and partially destroyed, but was restored by Abd-ur-Rahman (780). In the twelfth century it was taken by the Christians and became an archiepiscopal see. In 1811 it underwent a siege and sack by the French under Suchet.

TARRASA, tȧr-rä'sȧ. A town in the Province of Barcelona, in Catalonia, Spain, 22 miles northwest of the city of Barcelona, on the Barcelona-Lérida line of the Northern Railway (Map: Spain, F 2). It is an important industrial centre, with manufactures of cotton and woolen cloths. The Romanesque churches of San Pedro and San Miguel date from the Christian reconquest, but most of its structures are modern, including a large royal college, industrial schools, chamber of commerce, and two theatres. The population, in 1900, was 15,872.

TARRASCH, tär′räsh, Siegbert (1862—). A German chess master, born in Breslau. He was educated in medicine at the universities of Berlin and Halle, and practiced his profession in Nuremberg, where in 1883 he won his mastership in chess. His success in chess continued, and at the international tournaments in Breslau (1889), Manchester (1890), and Dresden (1892), he won the first prize with only a single game lost. At the tournament held in 1898 at Vienna he tied with the American, Pillsbury, for first prize, winning on the play-off; and he was sixth at the International Masters' Tournament held at Monte Carlo in 1902. He became distinguished for careful play and ingenious combinations. An edition of 300 of his games, edited and analyzed by himself, appeared in 1894.

TAR′RYTOWN. A village in Westchester County, N. Y., 25 miles north of New York City; on the east side of Tappan Bay, an expansion of the Hudson River, and on the New York Central and Hudson River Railroad (Map: New York, G 4). It is picturesquely situated on ground rising from the river and is an attractive residential place. The vicinity of the village, which has been made famous by Washington Irving (see Sleepy Hollow), is of great interest also through its connection with the history of the Revolutionary period. Irving's burial place is in the graveyard of the old Dutch Church, about three-fourths of a mile north of the village. The Dutch Church, dating from 1699, and the Philipse Manor House, built in 1683, are the most noteworthy of the older buildings. Other features of Tarrytown include Miss Mason's School, familiarly known as the 'Castle,' the Tarrytown Lyceum, with a library of more than 4000 volumes, the Institution of Mercy (Catholic), and Irving Institute. Drill works and mobile works are the leading industrial establishments. The government is vested in a president and board of trustees, who hold office respectively for one year and two years. The water-works are owned and operated by the village. Population, in 1890, 3562; in 1900, 4770.

The name Tarrytown is said to have been derived from the hypothetical first settler, one Terry, who came in 1645. In 1683 Vredryk Flypse (Frederick Philipse) moved here and ten years later secured manorial rights to the adjacent territory. Major André was captured here on September 23, 1780. About two miles south of the village, at Irvington, is Sunnyside, the home of Washington Irving. Tarrytown was incorporated in 1870. Consult: Bacon, *Chronicles of Tarrytown and Sleepy Hollow* (New York, 1897); and a sketch by Hamilton Wright Mabie in Powell's *Historic Towns of the Middle States* (New York, 1899).

TARSHISH, tär′shĭsh. According to the Old Testament, a region which was the resort of Phœnician commerce, and the source of valuable mineral products. The earliest mention is in Genesis x. 4, where it is associated with lands probably identical with Crete, Cyprus, and Rhodes. Its special trade was with Tyre, which seems to have had there a colonial factory (cf. Isa. xxii.; Ezek. xxvii. 12, 25). Certain texts, however, seem to oppose this western location. 'Ships of Tharshish' are mentioned as starting from Solomon's port at Ezion-geber (q.v.) on the Red Sea (I. Kings x. 22; xxii. 48); while the Chronicler (II. Chron. ix. 21; xx. 36-37) makes them go to Tarshish from that point. Hence has arisen the view that the Hebrews and Phœnicians circumnavigated Africa, or else that there was an Oriental land of Tarshish in addition to the Occidental one. 'Ship of Tarshish,' however, is now generally supposed to mean some kind of large vessel designed for distant voyages. It is also possible, as held by some, that Phœnician ships were transported across the Isthmus of Suez. No identification of this Western Tarshish has yet been accepted by scholars. The oldest view identifies it with the Tartessus of Herodotus (iv. 152), Strabo (ii. 158), and other Greeks, at the mouth of the Guadalquiver, near Cadiz; and the southern part of Spain in general is largely accepted as the region of Tarshish. The location in Spain would agree with the products assigned to Tarshish, silver, iron, lead, while the tin may have been brought thither from the British Isles. Also the jewel called the stone of Tarshish, or simply a tarshish (translated beryl in Exodus xxviii. 20, and elsewhere), may represent one of the numerous precious stones found in Spain. On the ground of etymological comparison, the Tyrrhenian or Etruscan region is accepted by some scholars, and it is to be observed that the term is always used vaguely. Consult: Bochart, *Geographia Sacra* (Caen, 1646); Ritter, *Erdkunde* (Eng. trans. *Comparative Geography*, vol. i., Edinburgh, 1886); Meyer, *Geschichte des Altertums*, vol. i. (Stuttgart, 1884); Renouf, in *Proceedings of the Society of Biblical Archæology*, vol. xvi.; Winckler, *Forschungen*, vol. i. (Leipzig, 1893); Cheyne and W. M. Müller, in *Orientalische Litteraturzeitung*, vol. iii.; Haupt, in *Proceedings of Thirteenth International Congress of Orientalists.*

TARSIA-WORK (It., from Gk. *ταρσός*, *tarsos*, frame of wickerwork). A beautiful kind of marquetry made in Italy. It is produced by inlaying pieces of tinted or natural woods, so as to represent figures and landscapes. That of Sorrento is very celebrated. It is usually applied to the decoration of cabinet-work, and was largely used during the sixteenth century.

TARSIER (Fr. *tarsier*, from Neo-Lat. *Tarsius*, from *tarsus*, from Gk. ταρσός, broad surface, primarily for drying, also ταρσὸς ποδός, *tarsos podos* flat of the foot, from τέρσεσθαι, *tersesthai*, to dry), or Malmog. A small East Indian animal (*Tarsius spectrum*), closely related to the lemurs, but set apart in a family Tarsiidæ, which inhabits trees in the Malayan and Philippine archipelago and has the general habits of a lemur. It is nowhere common, is nocturnal, and feeds upon insects and small reptiles. In size it is about as large as a rat, has a large, broad head, with very large eyes, teeth of a generalized type, very long half naked hind legs and short fore legs, and the long bony toes end in large pads beneath the terminal joints. The tail is long and tufted at the end. It moves about by long leaps from bough to bough. Compare

Galago and Mouse-Lemur; and consult authorities and Plate under Lemur.

TAR′SUS (Lat., from Gk. Ταρσός, *Tarsos*, Ταρσοί, *Tarsoi*). The chief city of ancient Cilicia, and of Eastern Asia Minor, situated on both sides of the navigable river Cydnus, in the midst of a beautiful and productive plain, about 10 miles from the sea. From its situation Tarsus commanded the pass over Mount Taurus, the Cilician Gates, which formed the only means of communication with Northern and Western Asia Minor, and in almost equal measure the route to Northern Syria and the East by the Amanian or Syrian Gates. The first mention of the place as Tarzi is on the Black Obelisk of Shalmaneser II., about the middle of the ninth century B.C., where its capture by the Assyrians is recorded. It was the capital of the Kingdom of Cilicia, which was long ruled, under Persian suzerainty, by a line of kings who bore the hereditary name of Syennesis, and later was the residence of a Persian satrap. With the conquest of Alexander the Great, it passed into Greek hands, and during the following period was usually in the power of the Seleucidæ of Syria. At the end of that century it passed under the Roman supremacy, and upon the organization of the Province of Cilicia (B.C. 64) it became the capital. Later, Mark Antony made it a free city, and it was here that in B.C. 38 he was visited by Cleopatra. Under the Empire the free city seems to have enjoyed a popular form of government with a property qualification for the franchise. This gives additional point to the claim of the Apostle Paul—a native of this place—to be a citizen of Tarsus, as that implied a certain social position. It was a place of consequence even in Byzantine times, but suffered from its proximity to the Syrian frontier. The modern town, though large, is dirty and mean, containing no vestige of its ancient splendor, and but few ruins. The most conspicuous ruin is the large concrete foundation of a Roman building, popularly called the Tomb of Sardanapalus.

TARTAGLIA, tär-tä′lyȧ, Nicolò (1500-1557). An Italian physicist and arithmetician whose real name was Nicolò Fontana. He was born at Brescia, lectured at Verona, and became professor of mathematics at Venice. Tartaglia first became generally known through his solution of cubic equations, and from his suggestions Cardan (q.v.) probably derived the solution known as Cardan's method. His work in physics is preserved in his *Nuova scienza* (1537; French trans., 1845-46), showing that he studied the theory of falling bodies and investigated the range of projectiles at various angles. His treatise on arithmetic, *General trattato de numeri et misure* (1556-60), is the chief authority on the Italian methods of his time. *Quesiti et inventioni dierse de Nicolò Tartaglia* (1546) is also well known.

TAR′TAK. According to II. Kings, xvii. 31, the name given to a deity worshiped by the Avites, who were transferred to Samaria by the Assyrian King after the destruction of the northern Hebrew kingdom. Jewish tradition represents Tartak as worshiped under the form of an ass (*Tal. Bab.*, *Sanhedrin* 63). No such deity as Tartak has been found in the Babylonian or Assyrian literature.

TARTAN (Fr. *tiretaine*, *tirtaine*, linsey-woolsey, from Sp. *tiritaña*, thin silk or woolen cloth, from *tiritar*, to shiver). A well-known cloth of checkered pattern, also called plaid. The Scottish Gaelic *tartan* is a loan-word from the English; the native name is rather *breacan*. These colored plaids have long been in great favor in the Highlands of Scotland, where each clan wears a particular kind as its distinctive dress. Consult: Skene, *The Highlanders of Scotland* (new ed. by Alexander Macbain, 1901); Grant, *Clan Tartans* (1886).

TARTAR (ML. *tartarum*, MGk. τάρταρον, tartar, probably from Lat *Tartarus*, from Gk. Τάρταρος, Tartarus, Hades; hardly from Ar. *durd*, *durdīy*, dregs, from *darida*, to loose the teeth, in allusion to the action of tartar on the teeth). A mixture of bitartrate of potash and tartrate of lime, deposited from wine and known in its crude form as argol.

TARTAR EMETIC. A name applied to the double tartrate of potassium and antimony, $K(SBO)\ C_4H_4O_6 + \frac{1}{2}H_2O$. It is prepared by making a paste of antimonious oxide, acid potassium tartrate and a little water, allowing to stand for several hours, then boiling the paste with water, and allowing the resulting solution to crystallize. Tartar emetic has a sweet taste, but leaves a disagreeable after-taste in the mouth. It is moderately soluble in water, but is insoluble in alcohol. It has a powerfully irritating effect on the alimentary canal, and thus readily causes vomiting; but vomiting is also due to the action of the compound upon the medulla, after being absorbed into the blood. Owing chiefly to its depressing effect on the heart and nervous system, it is now much less used than formerly.

TARTARIC ACID, $C_4H_6O_6$. An acid compound of carbon, hydrogen, and oxygen, of which four different modifications are known. Ordinary tartaric acid is usually seen in the form of colorless, transparent crystals, which are not affected by the action of the air, have an agreeable acid taste, and are soluble in water and alcohol. The crystals when gently warmed become strongly electric, the opposite sides of the crystals exhibiting the opposite forms of electricity. On heating tartaric acid to about 167-170° C. it fuses; and at slightly higher temperatures it becomes changed into *metatartaric*, *tartralic*, and *tartrelic* acids.

Tartaric acid occurs abundantly in the vegetable kingdom both in the free and combined states. It is, however, from argol (q.v.), a product of the fermentation of grape juice, that the tartaric acid of commerce is obtained. Argol, or crude tartar, is boiled with water and hydrochloric acid, and the solution is precipitated with lime. The insoluble tartrate of calcium thus obtained is purified by washing with water, then decomposed by treating with sulphuric acid. This transforms the tartrate into the sparingly soluble calcium sulphate, while tartaric acid goes into solution in the free state. The filtered liquid, when cooled and evaporated, yields crystalline tartaric acid.

Being a dibasic acid, tartaric acid can form both acid and neutral salts. The most important tartrates are the following: *Neutral potassium tartrate*, $K_2C_4H_4O_6$, a soluble salt, which crystallizes with half a molecule of water. *Acid potassium tartrate,* or *bitartrate of potash,* $KHC_4H_4O_6$, is prepared from argol by extraction with boiling water and filtering the solution thus obtained through charcoal. The salt crystallizes readily as the hot solution cools. The snowy white rhombic prisms which are thus deposited constitute *cream of tartar,* which is moderately soluble in cold water and but sparingly soluble in alcohol. It is an excellent saline purgative and diuretic and is therefore largely used in medicine. *Calcium tartrate,* $CaC_4H_4O_6 + 4H_2O$, is practically insoluble in cold water and but sparingly soluble in hot water. The insolubility of the acid tartrate of potassium and of the tartrate of calcium often helps to identify tartaric acid. *Tartar emetic* is described in a special article.

Tartaric acid has been known since the earliest times, in the form of tartar; Scheele was the first to obtain the acid in the free state and to determine its principal properties (1769). Like any other acid, tartaric acid promotes the secretion of saliva, and may therefore be used to allay thirst. When taken internally it is decomposed in the blood with formation of alkaline carbonates, which cause an increase of the alkalinity of urine.

A remarkable modification of tartaric acid is known as *racemic* or *paratartaric acid,* $C_4H_4O_6 + 2H_2O$. It is a frequent associate of tartaric acid, but is especially abundant in the grapes of the Vosges district. While in most respects it exhibits a close resemblance to tartaric acid, it crystallizes more readily from solution; contains two equivalents of water of crystallization; is less soluble in alcohol; and the racemate of lime is soluble in hydrochloric acid, and is precipitated unchanged on adding ammonia. Its most important difference, however, is that its solution does not rotate the plane of polarized light, while a solution of ordinary tartaric acid exerts a well-marked right-handed rotation. Pasteur proved that racemic acid is a mixture of ordinary tartaric acid (to which, from its optical property, he applies the term *dextro-racemic acid*) and of an acid which produces left-handed rotation, to which he gives the name *lævo-racemic acid.* (These acids are also known as *dextro-tartaric* and *lævo-tartaric acids*). He found that, by saturating racemic acid with soda and ammonia, and allowing this solution to crystallize slowly, two varieties of crystals are obtained, which may be distinguished by their form, in the same way as the image and the reflection of the image in a mirror differ, or as right-handed and left-handed. If the two kinds of crystals are separated, and then dissolved, each solution is found to act powerfully on polarized light, but in opposite directions. On separating these acids from their bases, and mixing equal parts of concentrated solutions of each, racemic acid is again formed, which exerts no action on a polarized ray.

Besides the three modifications mentioned above, viz., ordinary or dextro-tartaric acid, lævo-tartaric acid, and racemic acid, a fourth modification of the same chemical composition and constitution, known as *meso-tartaric,* anti-tartaric, or inactive tartaric acid, has been obtained. It may be prepared by heating, in a sealed glass tube, 30 grams of ordinary tartaric acid with 3 or 4 cubic centimeters of water, at 165° C., for about 48 hours. In the anhydrous state it melts at about 140° C.; usually, however, it is obtained in the form of crystals having the composition $C_4H_6O_6 + H_2O$. It is very soluble in water. Its acid potassium salt, too, is very soluble in water, and its calcium salt crystallizes with 3 molecules of water: $CaC_4H_4O_6 + 3H_2O$. The different modifications of tartaric acid have also been prepared synthetically. Their relation to one another has been explained stereo-chemically. See Stereo-Chemistry.

TARTARIN, tȧr′tȧ′răN′. The hero of three tales by Alphonse Daudet, *Tartarin of Tarascon* (1872), *Tartarin on the Alps* (1885), and *Port-Tarascon* (1890). The boastful, expansive, childlike Tartarin personifies the Gascon type, with which Daudet was intimately familiar.

TARTARS. See Tatars.

TAR′TARUS (Lat., from Gk. **Τάρταρος**). According to Homer, a deep and sunless abyss, as far below Hades as earth is below heaven, and closed in by iron gates. Into Tartarus Zeus hurled those who rebelled against his authority, e.g. Cronos and the Titans. It is to be noted that such typical sinners as Tityos, who offered violence to Leto, and after his death by the arrows of Apollo and Artemis was condemned to have his liver perpetually eaten by vultures, or Sisyphus (q.v.), Tantalus (q.v.), and Ixion (q.v.) are represented in the earlier poems as suffering in sight of the other shades. In the later conception, when the idea of a judgment in the other world and a separation between the good and bad had become well developed, Tartarus became the place of punishment for all sinners.

TAR′TARY (properly *Tatary*). The name which, in the Middle Ages, was applied to the central part of Eurasia. In later times a distinction was made between European and Asiatic Tartary, the former comprising that part of Russia which was once the Khanate of the Crimea. The term Asiatic Tartary, first applied to the whole of Central Asia, has gradually been confined to the independent portion of Turkestan.

TARTE, tärt, Joseph Israel (1848—). A Canadian statesman. He was born in the Province of Quebec, was educated at L'Assomption College, and was admitted to the bar in 1871. Afterwards he became editor of *Le Canadien* and then of *L'Evenement,* in Quebec. Politically he was a Conservative until 1891, but after that date he supported the Liberals. He was a member of the Legislative Assembly of Quebec in 1877-81, and became one of the active political organizers of his party in that province. As the avowed foe of jobbery and corruption in every form, he had already given dissatisfaction by his criticism of certain politicians and measures; but after his election to the Dominion House of Commons in 1891, as an Independent Conservative, he vigorously attacked the administration of Sir John A. Macdonald, his political chief, alleging corrupt practices by Ministers. This compelled him to sever his connection with the Conservative Party, and when the Laurier administration came into power in 1896 he was appointed Minister of Public Works. He held that position until 1902.

TARTINI, tär-tē′nê, Giuseppe (1692-1770). An Italian violinist, composer, and theoretician, born at Pirano, Istria. He discovered the combination tones, about 1714, and used them in making perfect purity of intonation. His fame rapidly increased and in 1721 he was made solo violinist and conductor of the orchestra at Sant' Antonio in Padua. From 1723 to 1725 he was chamber-musician to Count Kinsky at Prague. Afterwards he again took up his duties at Padua and founded a violin school there in 1728, which acquired a world-wide reputation. His compositions include numerous classical concertos, sonatas, and other compositions for the violin, and the best-known of his theoretical works are: *Trattato di musica secondo la vera scienza dell' armonia* (1754); *De' principj dell' armonia musicale contenuta nel diatonico genere* (1767); and *L'arte dell' arco*, reprinted in Choron, *Principes de composition*, vol. vi. (Paris, 1816). Consult Fayolle, "*Notices sur Corelii, Tartini,*" etc. (Paris, 1810).

TARTUFE, tȧr′tụf′, or **TARTUFFE**. The name of Molière's most celebrated comedy and of the chief character in it, who has become the type in all languages for a hypocritical scoundrel carrying out his evil designs under the cloak of religion. In the play, Tartufe ingratiates himself with a simple-minded gentleman named Orgon, and nearly ruins both him and his family before being discovered. Conflicting stories are given as to the original of the character. The name is said to have suggested itself to Molière on the occasion of a visit to the Papal Nuncio, where he saw the pious and solemn countenances of the Nuncio's courtiers suddenly lighted up with ecstatic animation by the appearance of a seller of truffles—in Italian, *tartuffoli*. *Tartufo* has also been found used in Italian figuratively for an ill-disposed person, in allusion to the fancy that truffles were a diseased product of the earth. The play was written in 1664, presented once in 1667, then prohibited, and it was not until 1669 that Molière succeeded finally in getting the King's consent, after which the piece had an uninterrupted run for three months.

TARUDANT, tä′r͞oo-dänt′. The capital of the Province of Sus, Morocco, situated between the base of the Atlas Mountains and the Sus River, 125 miles southwest of Morocco. The surrounding country is highly cultivated and the city, walled and defended by a citadal, contains many fine mosques, groves, and gardens. The streets are narrow and crooked and most of the houses have but one story. Copper, gold, silver, and iron ores are mined in the vicinity and the chief industries are the manufacture of copper articles for Central Africa. tanning, leather-dressing, and dyeing. Population of the town, about 8500; of the district, 30,000.

TARUMÁ, tä′r͞oo-mä′. A tribe of Arawakan stock (q.v.) on the headwaters of the Essequibo River, British Guiana. They came originally from the Rio Negro, Brazil. They are of medium stature, but well formed. Their language differs so much from the cognate dialects that it was formerly thought to constitute a distinct stock.

TARUMARI, tä′r͞oo-mä′rê. or Tarahumari. A numerous tribe of Piman stock (q.v.) occupying the Sierra Madre region of Central and Southern Chihuahua, and extending into the adjacent sections of Sonora and Sinaloa, Mexico. No reliable statement of their number can be given, but they are variously estimated at from 50,000 to 100,000. On account of the broken character of the country which they inhabit, there is no central organization, each little valley settlement managing its own affairs under a local chief or 'governor.' The language is spoken in several dialects and the people generally are classed by the Mexicans as Christians in the north and 'gentiles' or heathen in the south. Although peaceful and unwarlike in character, the Tarumari have several times revolted against the Spaniards and the Mexicans. In 1648 they rose up and destroyed all the missions, drove every Spaniard out of their territory, and maintained a successful resistance for four years under their chief Teporaca. In 1690 they again rebelled, destroyed the missions, mines, and haciendas, and massacred all the Spaniards, but were finally subjugated in 1692. A local insurrection in the neighborhood of Temosachic, northwest of Chihuahua City, in 1895, led by a native prophetess, was suppressed only after a bloody massacre by Mexican troops.

Physically, the Tarumari are very dark and rather undersized, resembling the Pueblo Indians, and, like them, they are of remarkable strength and endurance. They are fond of music and singing, make pottery and weave elaborate girdles of native cotton, although the men ordinarily go naked except for a cloth about the loins. They are sedentary and semi-agricultural, but depend largely also upon hunting, fishing, and wild products. Much attention is given to the corn crop, nearly all their ceremonial dances being more or less invocations or thanksgiving for rain. They have a feast of the dead a year after the funeral, and are devoted to the peyote rite, going hundreds of miles on foot to procure supplies of the cactus. Their houses are small thatched huts of logs or stones laid in clay mortar, and they frequently utilize the mountain caves for dwelling purposes.

TASCHEREAU, tȧsh′rō′, Elzéar Alexandre (1820-98). A Canadian prelate and cardinal, born in the Province of Quebec. He was educated at the Quebec Seminary, with which, after his ordination to the priesthood in 1842, he remained connected for nearly thirty years, first as professor of moral philosophy and from 1860 as director. In 1862 he was made vicar-general of the diocese. and archbishop in 1871. In 1886 he became a cardinal, the first Canadian member of the Sacred College.

TASCHEREAU, Jules Antoine (1801-74). A French author and statesman, born at Tours. He studied law at Orleans, and then entered journalism in Paris. He was for a time the editor of the *National;* served in the magistracy; and in 1833 founded the *Revue rétrospective*, devoted to the collection of documents upon history and literature (20 vols., 1833-37). In 1837 he was elected to the Chamber of Deputies. He sat in the Constituent Assembly, and then in the Legislative Assembly; supported the Empire, and was rewarded with a place in the National Library, of which he in time became director. Among his published works are: *Histoire de la vie et des ouvrages de Molière* (1825); and *His-*

toire de la vie et des ouvrages de P. Corneille (1829).

TASHKENT, tȧsh-kĕnt′, or **TASHKEND.** The capital of the Governor-Generalship of Russian Turkestan and of the Territory of Syr-Darya, as well as one of the most important cities of Central Asia, situated near the Tchirtchik, a feeder of the Syr-Darya, about 150 miles northeast of Samarkand (Map: Asia, F 4). It consists of the new Russian city, built up since the Russian occupation, and the old native city. The former is well laid out, abounds in private gardens, and compares favorably in regard to public buildings and educational institutions with most cities of European Russia. It has a library rich in works on Central Asia. The native city is still partly surrounded by walls and is Oriental in appearance, with its narrow crooked streets and low houses turning toward the street their blind walls. Tashkent manufactures leather goods, textiles, metal articles, and footwear. Agriculture and gardening are carried on. The trade has greatly increased in importance since the connection of the city with the Caspian Sea by rail. Population, in 1897, 156,414, consisting chiefly of Sarts, Tatars, Kirghizes. The Russians number about 25,000. The first trustworthy mention of Tashkent dates from the seventh century, although local traditions attribute to the city very great antiquity. The town has been in possession of Russia since 1865.

TASK, The. A descriptive and didactic poem in blank verse by William Cowper, written in the summer of 1783 at the suggestion of Lady Austin, who had jestingly proposed a sofa as a possible subject for the poet's muse and had thus started him upon his task. The six books are called "The Sofa;" "The Timepiece;" "The Garden;" "The Winter's Evening;" "The Morning Walk;" "The Evening Walk." It was first published, together with the *Epistle to Joseph Hill*, *Tirocinium*, and *John Gilpin*, in London, July, 1785.

TASMAN, täs′män, Ȧbel Janszoon (c.1602-59). A Dutch explorer. He was born at Lutgegast, near Groningen, and early went to sea. He made two important voyages of discovery in the Pacific. In 1642 he left Batavia in command of an expedition sent out by Van Dieman, Governor-General of the Dutch East India Company, to circumnavigate the Australian continent. During his voyage of ten months he discovered (November 24, 1642) Tasmania—which he called Van Diemen's Land—New Zealand, and the Friendly and Fiji Islands. After publishing an account of his voyage, which was reprinted in 1722 (2d ed. by Jacob Swart, 1860), he made a second voyage to New Guinea and New Holland and discovered the Gulf of Carpentaria. His life was written by Dozy, in his *Bijdragen tot de Taal-, Land-, en Volkenkunde van Nederlansch Indie* (1887), and by Walker (Hobart, 1896).

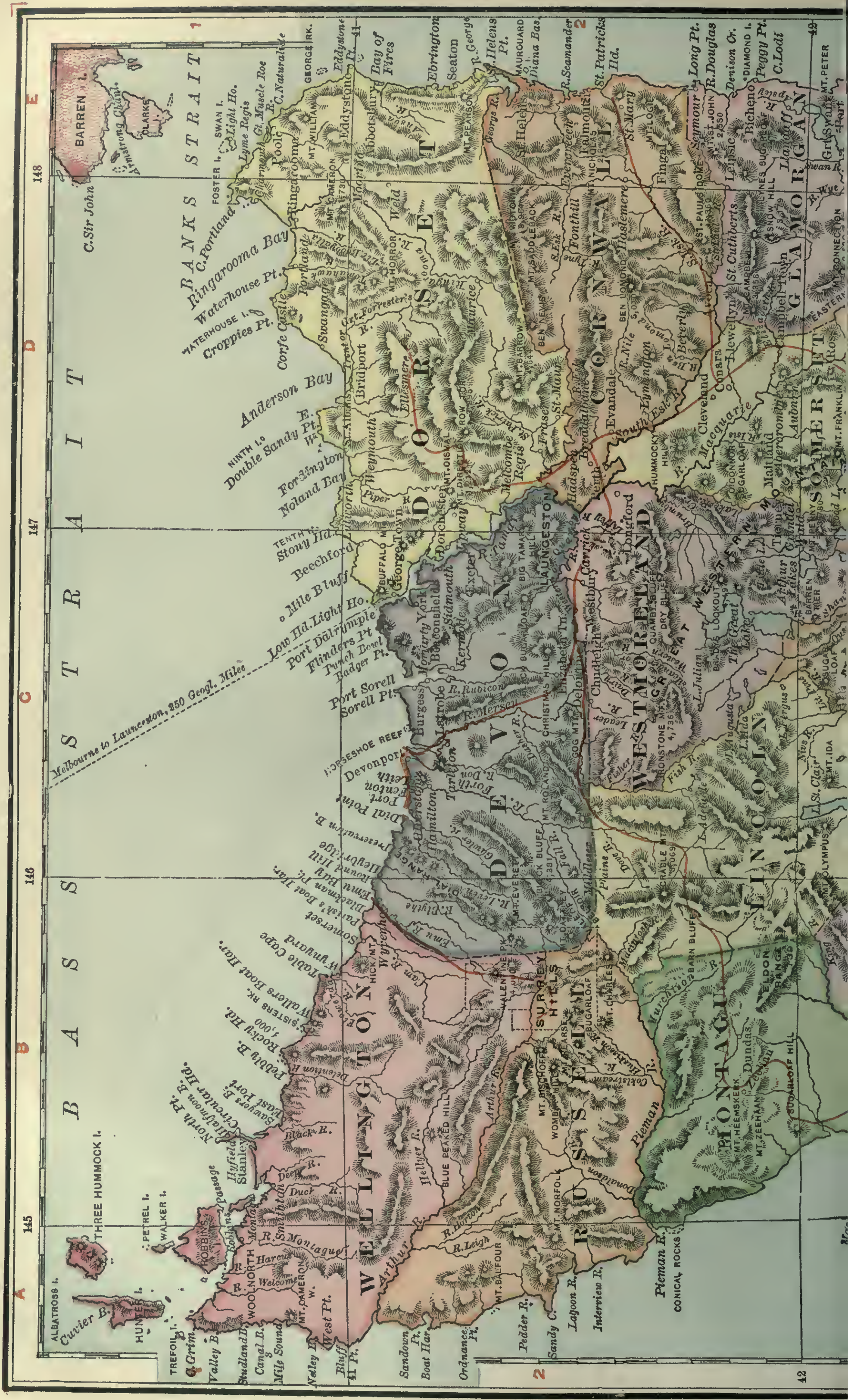
TASMA′NIA. A State of Australia occupying the island of Tasmania with its neighboring islands. The island of Tasmania, formerly called Van Diemen's Land, lies between latitudes 40° 33′ and 43° 39′ S. and longitudes 144° 39′ and 148° 23′ E. It is separated from the southeastern portion of the Australian continent, the coast of Victoria, by Bass Strait, 140 miles wide; the Indian Ocean bounds the island on the west and the Pacific on the east, the two meeting at its southern extremity. Tasmania is of nearly triangular shape, measuring 200 miles from north to south and 245 miles from east to west. The area of the main island is 24,331 square miles, and of the State, including the smaller islands, 26,385 square miles.

Tasmania is an ancient plateau which has been extensively and irregularly dissected by the action of running water. In the west central portion there still remains an extensive plateau region with a nearly uniform height of 3000 to 4000 feet, though some isolated peaks and ridges are scattered over it. In the northwest this plateau reaches an altitude of 5069 feet in Cradle Mountain, the highest point of the island. In the northeastern corner of the island there is a similar plateau remnant, but between the two there is a series of great valleys extending from the mouth of the Tamar in the north to that of the Derwent in the south and affording the route for the main railroad line. The remaining parts of the island are cut up into a maze of deep valleys and high ridges and peaks, often of a precipitous character. There are about 20 peaks over 4000 feet high scattered through nearly every part of the island. The coasts are generally bold, and in the southeast are irregularly indented with fiords and harbors suggesting, together with the generally lower level of the surrounding mountains and the outlying islets, a subsidence of the land in this direction.

The central plateau is studded with a number of mountain lakes of considerable size, most of which feed the Derwent River. The rivers of Tasmania are large and numerous considering the size of the island. The most important are the Derwent and Huon in the south, the Gordon in the west, and the Tamar in the north, all of which enter the sea through large, navigable estuaries.

The climate is more temperate and equable than that of the continent. At Hobart the mean temperature in summer is 62°, and in winter 47°, the extremes ranging to 100° and 29°. The rainfall varies greatly in the different localities, and depends largely on the degree of exposure to the west winds, which bring most of the moisture. In the east the general average is 22 inches, in the north 30 inches, and in the west 40 inches, though some western localities have had 100 inches of rain in a year. In the west and southwest, where the rocks are granitic and schistose, the soil is rather poor. In the central valley and in the northern and southeastern districts the Tertiary deposits have combined with volcanic detritus to form a very rich soil of a chocolate color.

The flora is essentially Australian, and closely related to that of Victoria. There are magnificent forests containing acacias and the gigantic eucalyptus, as well as other valuable timbers, such as the Huon pine (*Dacrydium Franklini*). The conifers are well represented, there being 9 species peculiar to the island, and of the 1100 species of angiosperms, or higher plants, over 250 are restricted to Tasmania. The fauna, though also distinctively Australian, includes several mammals unknown on the mainland. The most remarkable of these are two


BASS STRAIT
BANKS STRAIT
Melbourne to Launceston, 250 Geogl. Miles
WELLINGTON
DEVON
DORSET
CORNWALL
WESTMORELAND
RUSSELL
MONTAGU
LINCOLN
GLAMORGAN
SOMERSET
BARREN I.
CLARKE I.
ROBBINS I.
HUNTER I.
THREE HUMMOCK I.
ALBATROSS I.
C. Portland
Ringarooma Bay
Waterhouse Pt.
Anderson Bay
Port Dalrymple
Port Sorell
Devonport
Launceston
George Town
Westbury
Longford
Evandale
Campbell Town
Fingal
St. Helens
Bicheno
Stanley
Circular Hd.
Table Cape
Emu Bay
Pieman R.
Arthur R.
St. Clair
MT. OLYMPUS
MT. ZEEHAN
MT. HEEMSKERK
Dundas
Zeehan
CRADLE MT.
BEN LOMOND
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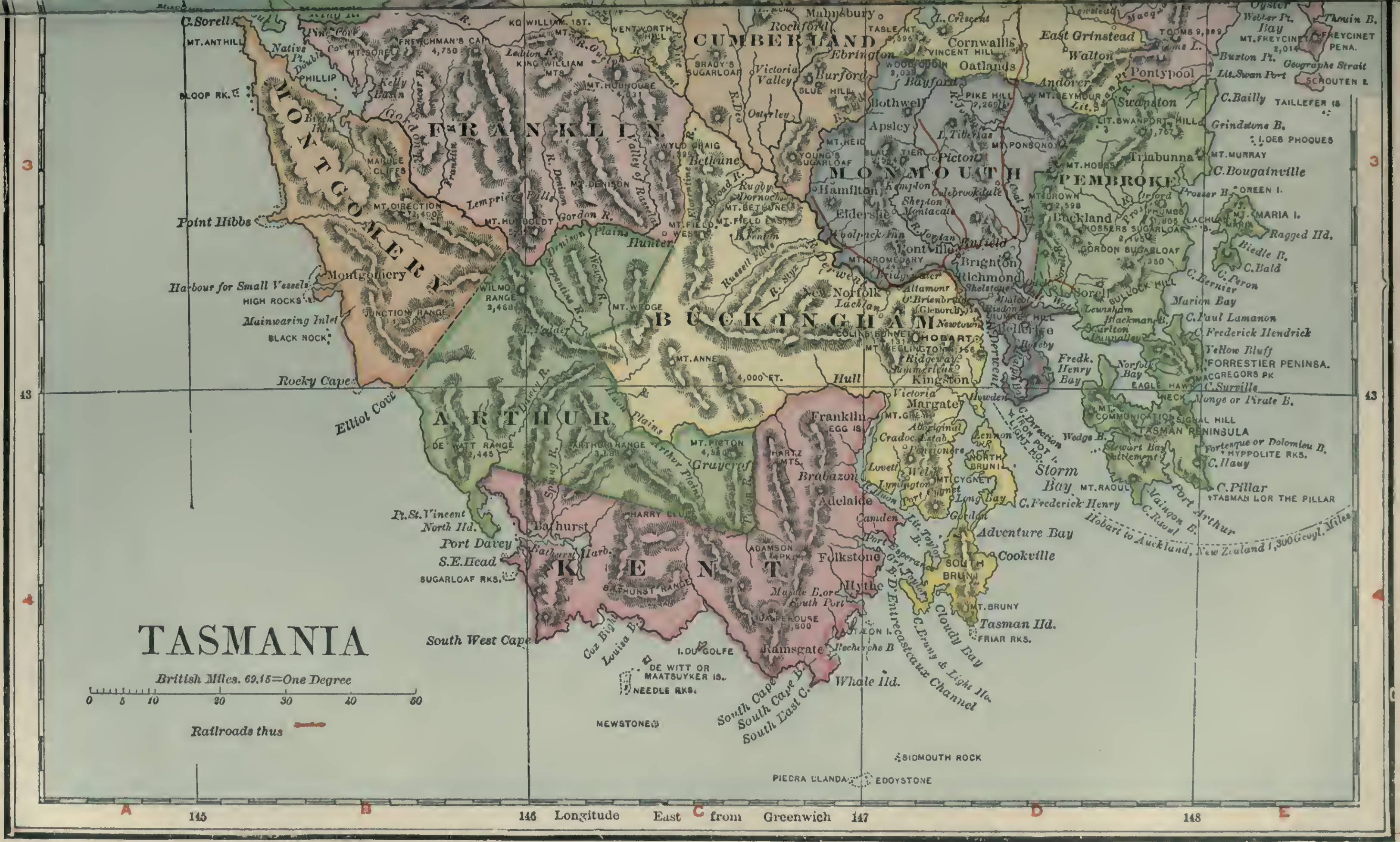

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carnivorous marsupials, the Tasmanian wolf and the Tasmanian devil. See DASYURE.

The central table land and the western and southern portions consist mainly of Archæan granites, crystalline schists, and quartzites overlaid by much eroded Paleozoic rocks. Toward the coast Mesozoic and Tertiary formations appear, chiefly as sandstones, while throughout, but especially in the east, there are extensive volcanic outpourings, dikes of porphyry and greenstone, and large fields of basalt of Tertiary age. The latter, capping and protecting the softer sandstones, are largely responsible for the rugged and irregular nature of the surface. Considerable beds of coal and lignite appear in the Paleozoic and Mesozoic formations. Rich iron ores occur along the north coast, and tin, lead, plumbago, and some gold have been found in various parts of the island.

Copper is predominant. Beginning in 1896, the copper-mining developed rapidly, until in 1900 the value of the blister copper mined was £907,288 and copper ore £63,589. The production of gold more than doubled between 1891 and 1900, being valued at £316,220 in the latter year. The yield of silver ore in 1900 was valued at £279,372, which was much in excess of the average annual yield. The value of tin mined for the same year was £269,833, and of coal £44,227. The tin production exceeds that of any other Australian State. The lode mines of Mount Bischoff have become famous, but elsewhere the tin is got from alluvial deposits.

The total area under cultivation in 1901 was 560,151 acres. The cereal crops included: wheat, 51,825 acres; oats, 45,073 acres; corn, 9839 acres; and barley, 4502 acres. There were also 23,068 acres of potatoes, 306,181 acres of green fodder, and 61,541 acres of hay. There was an average yield of 18.9 bushels of cereals per acre for the decade ending with 1901. The island is exceptionally well suited to temperate zone fruits, and in 1901 there were 7888 acres in apples alone. The State is well adapted to stock-raising, but the industry has not shown much progress for several years. In 1901 the number of sheep was 1,683,556, cattle 165,516, and horses 31,607.

At the beginning of 1901 there were 546 miles of railroad in operation. Of these 108 miles were private lines, and the remainder were in the hands of the Government. The imports in 1901 amounted to £1,969,199 and the exports to £2,945,757. The bulk of the trade is with Victoria, Great Britain, and New South Wales. Copper is the most important export, other exports being silver ore, tin, wool, fruit, and potatoes. In 1900 the tonnage of vessels entering Tasmanian ports aggregated 618,963. Hobart and Launceston are the leading ports. Strahan has a large export trade.

There is a Governor appointed by the British Crown, who is assisted by a Cabinet of six responsible members. The Legislature (Parliament) consists of a Legislative Council of 18 elected members and a House of Assembly of 38 elected members. The seat of government is at Hobart.

The total receipts from taxation in 1900-01 were £644,510, of which £466,218 were collected from customs duties and the remainder by excise taxes, land taxes, income taxes, etc. The land revenue for the same year was £67,498; the revenue from reproductive public works, £299,468; from other sources, £43,504; making a grand total revenue of £1,054,980. The interest on public debts, £320,151, was the largest item of expenditure. The debt of the State was £8,511,005, of which £7,480,250 was borrowed in London.

The population increased from 24,279 in 1830 to 145,290 in 1890, and to 182,509 in 1899, and then decreased to 174,233 in 1901. In the latter year there were 89,624 males and 82,851 females. Almost the whole of the population belongs to the British race. In 1900 the emigration was in excess of the immigration. In 1901 the population of Hobart was 31,317; Launceston, 21,046.

In 1901 the members of the Church of England numbered 83,812; Catholics, 30,314; Wesleyans, 24,961; Presbyterians, 11,523; besides these there were a number of minor sects. School attendance is compulsory between the ages of 7 and 13. Small fees are charged. Children who reside far from school are carried free over the State railroads. Religious instruction may be given only after school hours. In 1901 there were 319 primary day schools, with 18,693 in average enrollment, and 14,007 in average attendance. The State extends no aid for secondary education, but there are two State technical schools and a school of mines. The University of Tasmania has its headquarters at Hobart, but gives lectures also at Launceston.

ETHNOLOGY. The aboriginal inhabitants of Tasmania, who are now extinct, were of doubtful racial affinities, having been regarded by different authorities as being variously connected with the Papuan, Melanesian, and Australian races. They were of relatively low stature, with broad, prognathous faces, very flat broad noses, dark skins, and frizzly hair, the last named feature being the chief difference from the Australians. In culture the Tasmanians were probably on approximately the same level as the more primitive tribes of Australian aborigines. The tale of the extermination of the Tasmanians, who never numbered more, perhaps, than five or six thousand, is one of the blackest pages in the history of European colonization. The European settlement began in 1804, and by 1824, when the first census was taken, there were only 340 natives alive. These had dwindled down to four by 1865. The 'last Tasmanian,' a woman named Tinganina, is said to have died in 1876.

HISTORY. In 1642 the Dutch navigator Abel Janszoon Tasman (q.v.) discovered the island now known by his name, supposing it to be the mainland of the southern continent, and called it Van Diemen's Land, in honor of his friend and patron, Anthony Van Diemen, Governor of the Dutch East Indies. It was visited by Captain Cook in 1777. The next recorded exploration is that of George Bass, a young English surgeon, who explored the strait which bears his name in 1798, and thus discovered that Tasmania was not a peninsula, but an island. Later in the year he returned and surveyed the entire coast. No colonizing was attempted until 1803. In that year Captain Collins brought out 400 convicts from England, and in 1804 laid out Hobart Town—so called in honor of Lord Hobart, Secretary of State for the Colonies—the present capital of Tasmania. In the same year a settlement was founded in the northern part of the island by colonists from Sydney. In 1806 this colony was transferred to Launceston. From these two centres the colonization of the island proceeded steadily. Till 1823 the island was under the authority of the New South Wales Government. In that year it received a separate Lieutenant-Governor and in 1825 a separate Governor. The opposition to convict labor, always deep-seated, notwithstanding the scarcity of laborers, led, in 1835, to the first petition to the Home Government for its abolition. This, however, did not take place until 1853. In that year, too, the colony received its present name of Tasmania. In 1854 a constitution providing for responsible government by a colonial parliament was framed by the Legislative Council of the colony, in accordance with the terms of the Australian Government Act of 1850, and this bill received the royal assent in 1855. On January 1, 1901, Tasmania became a member of the Commonwealth of Australia.

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TASMANIAN WOLF, Tiger-Wolf, Zebra-Wolf, or Thylacine. A wolf-like, carnivorous and savage marsupial of Australia. See Dasyure; Colored Plate of Marsupials; Plate of Phalangers.

TAS'MAN SEA. That portion of the South Pacific Ocean which is included between Australia and Tasmania on the west and New Zealand on the east (Map: Australasia, J 6). It is more than 15,000 feet deep, and contains but few islands.

TASSEART, tȧ'särt, Antoine (1729-88). A Flemish sculptor, born and trained in Antwerp. After working in London and Paris, he was called to Berlin in 1774 by Frederick the Great, who made him Court sculptor and rector of the Academy. He was especially esteemed by Prince Henry, the King's brother, for whose palace the fashioned many statues and groups. His other principal works include the busts of the Great Elector, of Frederick II., and of Moses Mendelssohn, and of later date the statues of generals Seydlitz and Keith, now in the Cadet School at Gross-Lichterfelde.

TASSAERT, Nicolas François Octave (1800-74). A French historical and genre painter. He was born in Paris, and studied at the Ecole des Beaux-Arts and in the ateliers of Girard and Guillon Lethière. In modeling his art upon Chardin and Greuze, he portrayed, with powerful realism and able technique, the sufferings of the poor and the unfortunate. His exaggerated pathos does not appeal to present taste, but he was highly regarded by Delacroix, Rousseau, and other Barbizon masters. After a large historical picture, the "Funeral of Dagobert" (Versailles), came such subjects as the "Death of Héloise," the "Slave Merchant," "Two Mothers," the "Unhappy Family" (Luxembourg), and the "Old Musician." He asphyxiated himself with the fumes of charcoal.

TAS'SIE, James (1735-99). An English modeler. He was born at Pollokshaws, near Glasgow, and became a stonemason. While working at his trade he studied modeling in Glasgow, and in 1763 went to Dublin, where he entered the laboratory of Henry Quin, a physician who spent his leisure in making imitation gems. Together they invented a kind of vitreous paste, in which they cast wax models of gems and medallions. In 1766 Tassie settled in London, where he continued his work with gems, and also made many casts. The former became very popular, being made with great skill, color, and transparency, and approaching the originals in beauty. His personal collection became famous. At the command of Empress Catharine of Russia he furnished her copies of all his pastes and employed Rudolph Raspe, the creator of Baron Munchausen, to catalogue them. He was associated with Wedgwood in some of his work. He has also considerable claim to remembrance as an original artist, as he made from life many portrait medallions of eminent contemporaries. These works, cast in white enamel, have both charm and verisimilitude. A collection of them is in the Scottish National Portrait Gallery.

TASSO, täs'sō, Bernardo (1493-1569). An Italian poet, born in Venice and educated at Padua. The most part of his life was spent in the service of various ducal and princely rulers, from 1563 in that of Guglielmo Gonzaga, Duke of Mantua, who made him Governor of Ostiglia in 1567. His reputation as a poet rests on the romantic epos *L'Amadigi di Gaula* (1560), based on the Spanish prose version of *Amadis of Gaul.* An episode of it he treated afterwards separately in *Il floridante*, completed by his son Torquato in 1587. His lyrics *Amori* (1555) and *Rime, odi e salmi* (1560) are now forgotten, but his voluminous correspondence, *Lettere* (Padua, 1733-51), is a valuable contribution to the political and literary history of his time.

TASSO, Torquato (1544-95). A famous Italian poet, son of the preceding, born at Sorrento, March 11, 1544. Accompanying his father on his various military and diplomatic missions, he received his early training in Naples, Rome, Urbino, and Venice. Fired by the reports of the inroads made by the Turks in Hungary and by the accounts of their piratical landings on the coast of Italy, the Christian population began to think of a new crusade against the Moslems, and the young Tasso now conceived the idea of writing a poem on the Crusades. He actually did compose on the subject some verses which he revised and incorporated in the first cantos of his *Gerusalemme liberata.* In 1560 he was sent to the University of Padua to study law, but he soon gave up law for philosophy and letters. He was in the meantime at work upon a poem of chivalrous import, the *Rinaldo* (published at Venice in 1562). From Bologna, where he had been engaged in study for two years, Torquato had to flee in 1564 in order to escape a prosecution for certain satires that he had aimed at professors and fellow students. Induced by the willingness of Cardinal Luigi d'Este to take him into his service, he went to

Ferrara in 1565, and there devoting some attention to his *Gerusalemme*, already begun, he also played a distinguished part at the Court of the Duke, Alfonso II.

Tasso was regularly attached to the suite of Alfonso II. in 1572, and left with full leisure for his literary pursuits, so that in 1573 he was able to compose in a short time his excellent pastoral drama, the *Aminta*, and to continue work upon the *Gerusalemme*, which was finished by 1575. In this same year he was given the sinecure post of historiographer of the Court of Este. Troubles of various kinds now began to affect his mind, and his mental ailment, made worse by a blow on the head received during a quarrel, developed into a mania, which consisted in a belief on his part that he was inclining to heretical principles and was therefore watched and persecuted. In June, 1577, he drew a knife upon a servant who seemed to be watching him as he was conversing with the Princess Lucrezia d'Este, and by order of the Duke he was confined in a room of the palace that he might there receive treatment. Having been later transferred to the Franciscan monastery in Ferrara, he escaped thence one night in July, 1579, and wandered for a while begging his way about Italy, and fleeing in turn from the various asylums offered him. During the lucid intervals of this period he composed several of his best dialogues.

In 1579 he returned to Ferrara, at a time when the attention of the Court was wrapt in the nuptials of the Duke and Margherita Gonzaga. Having failed on this account to obtain the audience that he sought, he became frantic and, bursting into the Court one day, he behaved so violently that it was found necessary to imprison him in the insane asylum of Sant' Anna. He was treated kindly and was allowed to receive the visits of princes, persons of the Court and other friends. At one moment a furious maniac, at the next he was in perfect possession of his faculties and could write his philosophical *Dialoghi*.

As soon as his confinement in Sant' Anna became known, pirated editions of his works began to appear. In 1580 a certain Malaspina published in Venice a garbled edition of fourteen cantos of the *Gerusalemme* under the title *Goffredo*, and this induced a friend of Tasso, Angelo Ingegneri, to publish a more correct edition at Parma and Casalmaggiore (1581). Still better editions are the two that appeared at Ferrara, also in 1581, prepared by still another friend of the poet, Bonnà, who had access to Tasso's own manuscript. But the *Gerusalemme liberata*, thus given to the public in its proper form, no longer pleased its author, who set to work to correct and remodel it, eventually producing the luckless *Gerusalemme conquistata*, a work decidedly inferior to the earlier and inspired epic.

Vincenzo Gonzaga, Prince of Mantua, obtained of the Duke of Ferrara, in 1586, permission to maintain the poet in his own household, and took him away with him. While living with this patron, Tasso completed his tragedy, *Il re Torrismondo* (published at Bergamo, 1587), but his malady regained control of him and, fleeing again, he resumed his wandering life. Having visited Bologna, Naples, Rome, and Florence, he returned to the Court of Mantua in 1591; but toward the end of the year he went again to Rome in company with the Duke, and during the little while he was yet to live he spent his time between Rome and Naples. In 1593 the *Gerusalemme conquistata* was published, and in 1594 Pope Clement VIII. summoned Tasso to the Capitol to be crowned as poet laureate. This ceremony was prevented, however, by the increasing illness of Tasso, who died April 25, 1595. Legendary accounts of the adventures of the unfortunate poet have played a considerable part in the literature of both Italy and other foreign lands, and have afforded themes for the imagination of Goethe, Byron, Lamartine, Espronceda, Leopardi, Prati, and Carducci; but sober historical investigation has made clear that the poet was insane and that Alfonso d'Este was his friend and patron rather than his tyrannical master.

Tasso's prose works embrace his correspondence (*Epistolario*), *Dialoghi* (dialogues on philosophical, moral, literary, and æsthetical subjects), *Orazioni*, *Trattati*, *Discorsi* (these last deal with the nature of heroic poetry, the polemic stirred up by his *Gerusalemme*, etc.). The poetical works include his *Rime* (sonnets, octaves, *canzoni*, etc., some of them love lyrics in the Petrarchian manner, others religious and political in tone); the *Rinaldo* (his early chivalrous poem of twelve cantos in octaves, narrating the adventures of the French hero, Renaut de Montauban, and thus dealing with the Old French legendary matter about Charlemagne and his peers, which had been introduced into Northern Italy at a very early date—to this matter the poet has added a good deal of his own invention); the *Aminta*, the best Italian pastoral drama; the tragedy *Torrismondo* (notable as being one of the first literary attempts in Italy to deal with the Northern Germanic matter that has since been so important in the romantic movement); *Il Monte Oliveto* (a fragment in octaves, celebrating the origin of the congregation of the monks of Mount Olivet); *Le sette giornate del mondo creato* (a philosophical and imaginative account of the creation written in blank verse); *La Gerusalemme liberata* (his masterpiece and one of the greatest glories of Italian literature, singing in twenty cantos of octaves the crusade of Godfrey of Bouillon and developing in connection with it many beautiful love episodes).

Bibliography. Solerti's ed. of the *Opere minori in versi* (vols. i. and ii., *Poemi minori*, Bologna, 1891; vol. iii., *Teatro*, ib., 1895; vols. iv.-vii., *Rime*) and the eds. of the *Gerusalemme liberata* by S. Ferrari (Florence, 1890) and Solerti (Florence, 1895). Consult: Solerti, *Vita di Torquato Tasso* (Turin, 1895); Ferrazzi, *Torquato Tasso, studi biografici-critici-bibliografici* (Bassano, 1880); Cherbuliez, *Le prince Vital, essai et récit à propos de la folie du Tasse* (Paris, 1864); D'Ovidio, "Il carattere, gli amori e le sventure di Torquato Tasso," in the *Studj critici* (Naples, 1879); Proto, *Sul Rinaldo di Torquato Tasso* (Naples, 1895); Vivaldi, *Sulle fonti della Gerusalemme liberata* (Catanzaro, 1893); Multineddu, *Le fonti della Gerusalemme liberata* (Sassari, 1895); De Grisy, *De T. Tassi Poemate quod Inscribitur Gerusalemme conquistata* (Paris, 1867); Mazzoni, "Della Gerusalemme conquistata," in *In Biblioteca* (Bologna, 1886); Guidi, *Annali delle edizioni e delle ver-*

sioni della Gerusalemme liberata (Bologna, 1868); Solerti, "Bibliografia delle publicazioni tassiane in occasione del terzo centenario," in the *Rivista delle biblioteche e archivi* (1895). Of the English translations of the *Gerusalemme liberata* the most noted is that by Fairfax (London, 1600).

TASSONI, tȧ-sō′nê, Alessandro (1565-1635). An Italian diplomat, critic, and poet. He was born in Modena of an old patrician family. About 1595 he published at Rome a dialogue in defense of Alessandro Magno and Obizzo d'Este, an effort which was dedicated to Cardinal Alessandro d'Este, and which attracted such favorable notice from that prelate that young Tassoni was taken into the service of Cardinal Ascanio Colonna (1597). His *Considerazioni sopra le rime del Petrarca* (1609) became the occasion of bitter controversy. In 1613 Tassoni entered the service of Duke Charles Emmanuel of Savoy. But his *Filippiche contra gli Spagnuoli* (1615; reprinted 1855) incurred the displeasure of Cardinal Prince Filiberto of Savoy, and Tassoni withdrew into private life (1622). Afterwards he became secretary to Cardinal Ludovisi, and then councilor and chamberlain at the Court of Duke Francis I. of Modena (1632). The work by which the poet achieved his greatest fame was *La secchia rapita* ("The Stolen Bucket," written 1614; printed in Paris 1622; edited by Carducci 1861, etc.). This is a mock heroic poem in twelve cantos, founded upon an actual incident of the Modenese wars. Precursor of Boileau's *Lutrin* (1673) and Pope's *Rape of the Lock* (1712), it is perhaps the first example of modern humor. Not its entertaining mixture of wit and seriousness alone, but the Tuscan purity of its language and the perfection of its versified form, have made it an Italian classic. A selection of Tassoni's letters was published by Gamba (Venice, 1827), and Casini edited his *Rime* (Bologna, 1880). Consult: D'Ancona and Bacci, *Manuale della letteratura italiana* (Florence, 1893); Muratori, *Vita di Alessandro Tassoni* (Modenese edition of the *Secchia*, 1744); and Bacci, *Le considerazioni sul Petrarca di Alessandro Tassoni* (Florence, 1887).

TASTE (OF. *taster*, Fr. *tâter*, to taste, from Lat. _*taxitare_, frequentative of *taxare*, to touch, intensive of *tangere*, to touch; connected with Goth. *tēkan*, Icel. *taka*, AS. *tacan*, Eng. *take*). The tongue is supplied with nerve endings which not only (like those of the skin) mediate sensations of pressure, temperature, and pain, but also furnish sensations of taste. The nerve endings concerned in gustatory sensation are the taste bulbs or beakers, many of which are clustered together in the sides of each circumvallate and fungiform papilla (the filiform papillæ are insensitive to taste). Taste sensations enter consciousness highly fused with pressure, temperature, and notably with smell sensations; e.g. the flavor of wine is largely smell. Hence it is not strange that the number of elementary taste qualities has but recently been determined. Linnæus gave a list of 20 qualities; another early writer 10; modern methods have lowered the number to 4: sweet, bitter, sour, and salt, to which Wundt adds, doubtfully, alkaline and metallic. See Tongue and accompanying illustrations.

If the tongue be experimentally explored by stimulating individual papillæ with four solutions (usually sugar, quinine, tartaric acid, and salt), it will be discovered that most papillæ are selective; e.g. one may react only to sweet, another only to salt and sour, a third to sweet, salt, and sour, etc. That such differences should appear is but natural, for each papilla is, in reality, a cluster of taste cells. Now it is possible so to treat a papilla which has yielded more than one taste as to destroy temporarily its reaction to one of these tastes without destroying its sensitivity to the others; thus a 20 per cent. solution of cocaine hydrochlorate will eliminate bitter alone. From these facts, it is warrantable to assume that the doctrine of specific sense energies applies to the tongue. The recent work of Kiesow and Nadoleczny (stimulating the chorda tympani at a point near the internal ear) seems to establish the possibility of inducing specific taste sensations by inadequate electrical stimulation; pressure yields more doubtful results.

Kiesow has shown that the tongue is not equally sensitive over all its surface; the tip is best for sweet, the base for bitter (pressure here seems at times to arouse bitter), the sides for sour. Sensitivity to salt is about equal over all the surface. Recent experimentation has established beyond much doubt the existence of *taste contrasts*, both simultaneous and successive. The contrasting pairs are sweet-salt, sweet-sour, salt-sour: bitter does not contrast with any taste. The stimulation of the tongue by one member of these pairs increases its sensitivity to the other member, or causes distilled water to give the contrasting taste. As in the cases of vision and smell (qq.v.), taste contrasts imply *taste compensations*. A mixture of sugar and salt in proper proportions is insipid. From these facts, Kiesow has constructed a two-dimensional taste continuum—a square whose opposite corners are sweet and salt, bitter and sour. Mixtures of adjacent terms will, then, give an intermediate, mixtures of opposite terms, an insipid taste.

Bibliography. Kuelpe, *Outlines of Psychology* (London, 1895); Hofman and Bunzel, *Pflüger's Archiv*, lxvi. (1897); Kiesow and Nadoleczny, *Zeitschrift für Psychologie und Physiologie*, xxiii. (1900); Kiesow, *Philosophische Studien*, x. (1894), xii. (1896); Titchener, *Experimental Psychology* (New York, 1901); Vintschgau, in *Hermann's Handbuch der Physiologie*, iii. (1880); Zeyneck, *Centralblatt für Physiologie*, xii. (1898).

TATAR BAZARJIK, tȧ-tär′ bä'zär-jēk′, or Pazarjik. A district town in Eastern Rumelia, Bulgaria, situated on the Maritza, 74 miles southeast of Sofia (Map: Balkan Peninsula, E 3). It lies in a low region and suffers from inundations. Population, in 1892, 16,343, mainly Bulgarians. The place was founded by Tatars in the fifteenth century.

TATARS (less correctly *Tartars*, Fr. *Tartare*, from ML. *Tartarus*, from Pers. *Tātar*, Chin. *Tah-tar*, *Tah-dzŭ*, Tatar, possibly from a Tungusic or Manchu word meaning archer, nomad; probably confused by popular etymology with Lat. *Tartarus*, hell, on account of their atrocities). A term loosely applied to certain Tungusic tribes originally inhabiting Manchuria and Mongolia, and now represented by the Fishshin Tatars of Northern Manchuria, the Solons and Daurians of Northeastern Mongolia, and the Manchus of China. In the course of the westward movement of the Mongols the term Tartar obtained vogue among the civilized peoples of Western Asia and Eastern Europe, and came to be applied with little discrimination to the hordes of Mongols who descended from time to time upon the frontiers of Occidental civilization and to the kindred peoples subdued by them. Ultimately it came to be used almost, if not quite, as a synonym for Turkish (Tûrki), in which sense it is still employed by some modern ethnologists.

The 'Tatars of Siberia' (Baraba, Irtish, Tobol, etc.) are probably of very mixed origin. In Western Siberia some fragments of the Ostiaks, etc., have been styled Tatars, probably from their adoption of Tatar customs, etc. The Tatars of European Russia are of diverse origins. The so-called Kazan and Astrakhan Tatars are fragments of the Golden Horde. The Tatars of the Crimea are probably composed of the Nogai-Tatars of the steppes and the Tatars of the mountains and coast regions. There are besides the Tatars of the Caucasus. It will easily be seen that most of these peoples styled Tatars are, linguistically at least, of Turkic stock, but very mixed physically. Consult: Wolff, *Geschichte der Mongolen oder Tartaren* (Breslau, 1872); Howorth, *History of the Mongols* (London, 1876-80); Vámbéry, *Etymologisches Wörterbuch der turko-tatarischen Sprachen* (Leipzig, 1878); id., *Die primitive Cultur des turko-tatarischen Volkes* (ib., 1879); De Harlez, *La religion nationale des Tartares orientaux* (Brussels, 1887); Chantre, *Recherches anthropologiques dans le Caucase* (Paris, 1885-87).

TATE, Sir HENRY (1819-99). An English philanthropist and art patron. He was born at Chorley, Lancashire; entered early on a commercial career in Liverpool, and in 1874 went to London, where he acquired a large fortune in sugar-refining. His chief claim to distinction is as founder of the National Gallery of British Art, popularly known as the Tate Gallery, on the Thames Embankment, near Vauxhall Bridge. This originated in his private collection of modern British pictures. His desire to have this collection preserved prompted his offer of $240,000 for a building purely devoted to British art, if the Government would provide the site. The building was completed and opened in 1897.

TATE, NAHUM (1652-1715). An English poetaster, born in Dublin. He graduated at Trinity College, Dublin, in 1672, and five years later he was settled in London. In 1692 he succeeded Shadwell as poet laureate. With the exception of Pye (q.v.), he is the tamest of the laureates. He passed his last days in the Mint in Southwark, then a privileged sanctuary for debtors. Tate composed several plays and much poor verse, including elegies and birthday odes. His best poem, composed independently, is *Panacea, or a Poem on Tea* (1700). With some success he wrote a second part to Dryden's *Absalom and Achitophel* (1682). The best passages, however, were by Dryden. In literary history Tate has gained unenvied fame as an adapter of several plays by Shakespeare and other Elizabethans. Among them are *Richard II.* (1681), *King Lear* (1681), and *Coriolanus* (1682). His version of *Lear*, in which Cordelia survives and marries Edgar, held the stage till 1840. Tate is also known as the joint author, with Nicholas Brady, of the *New Version of the Psalms* (1696; supplement 1698). To Tate is ascribed the beautiful Christmas hymn "While Shepherds Watched."

TATE, RALPH (1840-92). An English geologist and paleontologist, born at Tenwick. He was educated at the Cheltenham Training College and Royal School of Mines. In 1861 he entered the Philosophical Institution of Belfast as a teacher of natural sciences, and during the following years devoted himself to the study and description of the Liassic fossils of Ireland. In 1867 he joined an expedition for the exploration of Nicaragua and Venezuela, and upon his return to England published a series of papers on the geology and paleontology of those countries. He received an appointment as professor of natural sciences at Adelaide, South Australia, in 1875, where he passed the remainder of his life. He established the Royal Society of South Australia, and was otherwise active in the formation of geological science. The list of his publications includes several hundred papers and monographs.

TATIAN, tā'shan. A Christian apologist of the second century. He was a native of Assyria, received a Greek education, and came to Rome in the time of Justin Martyr, with whom he was intimately associated, probably about the year 152. Under the instruction of this first Christian philosopher, Tatian early became a Christian, and wrote thereupon his first important work, *The Address to the Greeks*. After Justin's death he turned toward views which caused him to be identified with the Gnostics, although comparison of the different accounts leads to the suspicion that party spirit may have exaggerated his departure from the commonly received Christian doctrines and practices. Tatian returned to Mesopotamia, where he was welcomed heartily and performed valuable services for the Church. He prepared here a harmony of the Gospels in Syriac, under the name of *Diatessaron*, or *The Fourfold Gospel*, which early attained a wide circulation among the Syriac-speaking churches, and was made the subject of a commentary by Ephrem Syrus. The Syriac original cannot have been prepared long after Justin's death (about 166), and therefore gives important testimony to the general acceptance of the Fourth Gospel at that time, and hence to its considerably earlier origin. The *Diatessaron* has accordingly been an object of great interest, but the text has been until recently regarded as hopelessly lost. In 1883 a description of an Arabic translation of the *Diatessaron* existing in the Vatican Library, previously but imperfectly described by others, was put forth by Ciasca, a 'scriptor' in that library, and in 1888 he published an edition of the text with a Latin translation. A second manuscript of the same translation had meantime been presented to the library (1886). This Latin version has been translated into English by Hill (Edinburgh, 1894), and an English translation from the Arabic has been made by Hogg (ib., 1897). Consult: Zahn, *Forschungen zur Geschichte des neutestamentliche Kanons*, vol. iv. (Erlangen, 1891); Harris, *The Diatessaron of Tatian* (London, 1890); id., *Fragments of the Commentary of Ephrem Syrus on the Diatessaron* (ib., 1895).

Both the extant works of Tatian may be found in translation in the *Ante-Nicene Fathers*, vols. ii. and iv. (New York, 1885 et seq.).

TATISHTCHEFF, tȧ-tĭsh′chef, Vassili Nikititch (1686-1750). A Russian historian, born in the Government of Pskov. He was educated in the Moscow School of Artillery and Engineering and in Germany. For many years he was superintendent of the mines of the Ural region, and Governor of Astrakhan. He wrote a valuable *History of Russia*. His *Testament* (1775) is a didactic work addressed to his son.

TATIUS, tā′shĭ-ŭs, Achilles. A Greek writer. See Achilles Tatius.

TATLER, The. A penny paper published at London by Sir Richard Steele, issued three times a week and running through 271 numbers, between April 12, 1709, and January 2, 1711. Its original purpose was merely to describe events of the day; but with the contributions of Addison, which began in number 18, it gradually assumed a more didactic tone and eventually became a set of essays on various social and quasi-political topics. Its sudden withdrawal was probably occasioned by the exception taken by Steele's superiors in Government offices to certain statements printed in it and the editor's consequent dismissal from the gazetteership. His pseudonym of Bickerstaffe had also by this time been penetrated. Steele wrote 188 of the papers and Addison 41. The remainder were mostly written by both in collaboration. The successor of the *Tatler* was the *Spectator* (q.v.).

TAT′NALL, Josiah (1795-1871). An American naval officer, born at Bonaventure, near Savannah, Ga. He was educated in England, and entered the United States Navy in 1812. He served with Decatur in the Algerine War, became a lieutenant in 1818, had charge in 1829 of the surveys of the Tortugas reefs, received command of the mosquito division in the Mexican War, participated in the capture of Vera Cruz, and led the attack upon the forts at Tuxpan, where he was wounded. In 1850 he was promoted to a captaincy, and in 1857 became flag-officer on the Asiatic station. In June, 1859, he actively aided the British gunboats accompanying the British envoy sent to Peking to exchange ratifications of the treaty made in the preceding year, and helped to tow the British marines to a point whence they attempted to storm the Taku forts. During a visit made by Tatnall to the British flagship for the purpose of offering the services of American surgeons, some of the men who had accompanied him served, without his knowledge at the time, one of the forward guns of the British flagship. In extenuation of this technical violation of international law he declared that "Blood is thicker than water;" and his action was sustained both by public opinion and the Government. On the outbreak of the Civil War in 1861, he resigned and became a captain in the Confederate Navy, charged with the defense of Georgia and South Carolina. In March, 1862, he was given command of the *Merrimac* (*Virginia*), and the defenses of Virginia; destroyed this vessel in order to escape capture; was later court-martialed for this, but was acquitted; was unsuccessful in his defense of Savannah, and was in January, 1865, obliged to destroy his fleet. He was included in Johnston's surrender to Sherman, was paroled, and in 1866 removed with his family to Halifax, but returned in 1870 and was inspector of the port of Savannah until his death. Consult the *Life of Commodore Tatnall*, by C. C. Jones and Tatnall's son, J. R. F. Tatnall (Savannah, 1878).

TÁTRAFÜRED, tä′trȧ-fṳ′rĕd (Ger. *Schmeks*). A noted Hungarian watering-place and health resort in the county of Zips, situated in the midst of pine forests on the southern slope of the Hobe Tátra, at the foot of the Schlagendorf peak at an elevation of 3340 feet above the sea. It has mineral springs, pine-cone baths, and a cold-water cure. Near by are the health resorts of Uj Tátrafüred (Neuschmeks) and Alsó Tátrafüred (Lower Schmeks).

TÁTRA (tä′trŏ) **MOUNTAINS.** See Carpathian Mountains.

TATS, täts. An agricultural people of extreme Western Persia and the Caspian region of the Caucasus. Although they may possess some Mongolian blood, they are not Tatars either somatically or linguistically. Some authorities class them with the Persian Tajiks (q.v.). They are closely related to the Gurans. The Caspian Tats number between 30,000 and 40,000. Their language is a dialect of Persian.

TA TS'ING, tä′tsĭng′ (or Ch'ing). The dynasty on the throne of China at the opening of the twentieth century. It is of Manchu origin and begins with the year 1644. The name—*Ts'ing*—means 'pure' or 'purity,' and is said to be synonymous with the word *Manchu*. *Ta* means 'great' and is prefixed to almost all dynastic names. It is to be remembered that the personal name of a Chinese Emperor is never used during his lifetime. When he comes to the throne a name for the period of years during which he reigns is chosen; but it is convenient at times to transfer this name to the man himself; hence we sometimes speak of the Emperor K'ang-hi, or the Emperor K'ien-lung, though strictly speaking these names denote only certain periods of years. After death a 'temple-name' is chosen for each, and this is the name by which he is spoken of in history.

The Reign-Periods of the Ta Ts'ing Ch'ao or 'Great Pure' Dynasty of China

NAME OF REIGN	Began	Ended
1. Shun-chih	1644	1661
2. K'ang-hi or K'ang-hsi	1662	1722
3. Yung-ching, or Yuug-chêng	1723	1735
4. K'ien-lung or Ch'ien-lung	1736	1795
5. K'ia-K'ing or Chia-ch'ing	1796	1820
6. Tao-Kwang	1821	1850
7. Hien-fung or Hsien-fêng	1851	1861
8. T'ung-chih	1862	1874
9. Kwang-sü or Kwang-hsü	1875	......

TAT′TAM, Henry (1788-1868). A distinguished Coptic scholar. He was born in Ireland and was educated at Trinity College, Dublin, and at Göttingen and Leyden; he was ordained in the Church of England; and was rector of Saint Cuthbert's, Bedford, 1818-45; archdeacon of Bedford, 1844; and rector of Stamford Rivers, Essex, 1849. He traveled in the East and became distinguished as an Orientalist, in which department he published various works. Among the ancient Syriac manuscripts which he found at a convent in Egypt were the *Ecclesiastical History* of John, Bishop of Ephesus, and the

Epistles of Ignatius. He published a Coptic grammar (1830, 2d ed. 1863), and a dictionary (1835), besides versions of the prophets (1836-52) and of the *Apostolical Constitutions* (1849) in that language.

TAT′TERSALL'S. A famous English market for riding and carriage horses, situated in Grosvenor Place, London. It was established about 1780 by Richard Tattersall, a groom to the Duke of Kingston. It consists of a large and handsome building in the centre of which is a large court under a glass roof. It is the centre of all business relating to horse-racing and betting throughout the country.

TATTLE. A vicious and hypocritical fop in Congreve's *Love for Love*, who boasts that he never "kisses and tells;" but he is not above a free discussion of his love affairs. He is smitten with the charms of Angelica, but is gulled into marriage with an aged coquette, Mrs. Frail. The character may have been an elaboration of Malagene in Otway's *Friendship in Fashion.*

TATTOOING (from *tattoo*, from Tahitian *tatu*, tattooing, tattooed). The practice of decorating the surface of the body by introducing pigments under the skin. The process consists in pricking the skin with a sharp instrument and inserting the pigments, usually powdered charcoal, in the punctures. The design appears in a deep blue color and is indelible. In the modern development of the custom other pigments have come into use.

As a primitive mode of ornamentation, tattooing is very widespread, its distribution as compared with the related custom of scarification being determined by the color of the skin. In general, light-skinned races tattoo, while dark-skinned peoples practice scarring.

The original significance of tattooing is disputed. It has been held by some authorities that it had a religious or social meaning, but the best evidence goes to show that it was at first purely ornamental in character. It must indeed be admitted that in many instances the tattooed designs have a tribal or clan or even a religious meaning, but this usage is probably a derivative of the decorative.

The patterns range from simple lines and dots to complex designs. Probably the highest development of the custom among primitive peoples is in New Zealand, though it is also much practiced in various parts of the East Indian archipelago and in Polynesia. The tattooing of the natives in North and South America and in parts of the world other than those mentioned above is, as a rule, of simple character. In modern times and among higher races the Japanese have brought the art to its highest state of perfection. The prevalence of the practice among sailors of all nationalities is well known, but in both these cases the patterns in use have entirely lost their primitive characteristics and are of civilized origin. Consult Lacassagne, *Les tatouages* (Paris, 1881); Joest, *Tätowieren, Narbenzeichnen und Körperbemalen* (Berlin, 1887).

TAUBERT, tou′bĕrt, WILHELM (1811-91). A German pianist and composer, born in Berlin. He studied philosophy at the university there, at the same time studying composition under Berger and Klein, and afterwards taught music until 1831, when he became conductor of the Court concerts. In 1841 he was appointed conductor of the royal opera. He was a member of the Academy of Arts from 1839 and president of the musical section of the same from 1882. His works include the operas: *Die Kirmes* (1832), *Macbeth* (1857), *Cesario* (1874), music for the *Medea* of Euripides, and Shakespeare's *Tempest.* His songs were popularized by Jenny Lind and other noted singers.

TAUCHNITZ, touk′nĭts, CHRISTIAN BERNHARD, Baron (1816-95). A German publisher, born near Naumburg, a nephew of the following. His firm, founded in Leipzig (1837), was noted for its accurate classical and biblical texts, its dictionaries, and other works of reference. In 1841 Tauchnitz began a *Collection of British Authors*, now extending to some 3500 volumes and widely read on the Continent. English authors were paid a royalty by Tauchnitz, who thus helped to establish the present international copyright law. A similar collection of translated *German Authors* was begun in 1866 and *Students' Tauchnitz Editions* of English and American works began to appear in 1886 with German notes and introductions. Tauchnitz was made Baron in 1860, British Consul General for Saxony in 1872, and member of the Saxon House of Peers in 1877.

TAUCHNITZ, KARL CHRISTOPH TRAUGOTT (1761-1834). A German publisher, born in Grosspardau. He began to print books in 1797 at Leipzig. He was the first to use stereotype plates (1816) in Germany. His stereotyped editions of the classics were once widely famed alike for their cheapness, their convenience, and their accuracy. He thus printed a Bible in Hebrew and the Koran in Arabic. By his will Leipzig received 4,500,000 marks for charitable ends. The business was continued by his son Karl Christian (1798-1884).

TAUERN, tou′ērn. A division of the Eastern Alps, including the principal section of what was known to the ancients as the Noric Alps (Map: Austria, D 3). It lies between the rivers Drave and Mur on the south and the Enns on the north, and extends from the eastern part of Tyrol through the Austrian crownlands of Salzburg and Carinthia into the northern part of Styria. The system consists of two main divisions, the Hohe (high) Tauern in the west, and the Niedere (low) Tauern in the east. The whole system has a length of about 150 miles and a width of 28 miles. It is wholly of Archæan formation, consisting chiefly of gneiss in the west and mica-slate in the east, with some granite. The western or Hohe Tauern, as their name implies, are considerably higher and more rugged than the eastern. Their main range forms a sharp ridge with steep sides rising above the snow line and carrying over 250 glaciers, from which numerous mountain torrents fall in cataracts down the steep valleys. The highest peak in the system is the Grossglockner, with an altitude of 12,461 feet.

TAULER, tou′lĕr, JOHANN (1300-61). A German mystic. He was born at Strassburg and when fifteen years old entered the Order of the Dominicans. When the 'black death' visited Strassburg in 1346, he stuck to his post and comforted the people. Excepting preaching tours into the Rhineland, he remained in Strassburg until his death. Tauler was an emotional yet practical mystic and left a large number of sermons full of evangelistic life. He preached in German and wrote *The Book of Spiritual Poverty*, which, as well as many of his sermons, was translated by Susanna Winkworth, but not literally. Of the various editions of Tauler's works, the Frankfort edition of 1826 is the most complete. Consult: Schmidt, *Johannes Tauler* (Hamburg, 1841); id., *Nicolas von Basel, Bericht von der Bekehrung Taulers* (Strassburg, 1875); Preger, *Geschichte der deutschen Mystik*, vol. iii. (Leipzig, 1893); Susanna Winkworth, *Tauler's Life and Times* (London, 1857).

TAUNTON, tän′ton. The capital of Somersetshire, England, in the valley of the Tone, 38 miles southwest of Bristol (Map: England, C 5). The streets are wide and are well paved. The Church of Saint Mary is of Perpendicular architecture, and is famous for its ornamented tower; that of Saint James was the conventual church of Taunton priory. Taunton is the headquarters of the Somerset Archæological and Natural History Society and has an extensive museum in the remains of the Norman castle. It owns the water and electric lighting plants, and sewage works, and maintains parks, pleasure and recreation grounds. It has manufactures of silk and hosiery. Ina, King of the West Saxons, built a castle in Taunton about A.D. 700. This was soon after destroyed, but another fortress was built on the site soon after the Conquest, at which period the town had a mint. Population, in 1891, 18,961; in 1901, 21,078. Consult Toulmin, *History of Taunton* (Taunton, 1822).

TAUNTON. One of the county-seats of Bristol County, Mass., 36 miles south of Boston; on Taunton River, and on the New York, New Haven and Hartford Railroad (Map: Massachusetts, E 4). It is regularly laid out with finely shaded streets, and has many handsome residences. Among its institutions are the State Insane Asylum, Morton Hospital, the Old Ladies' Home, and Bristol Academy. The Public Library contains 47,000 volumes. Other important collections are the Bristol County Law Library and that of the Old Colony Historical Society. The city hall, county court house, the post-office, and the jail are buildings of merit. There are several pleasure grounds, of which Taunton Green and Woodward Springs Park are the more noteworthy. The Bristol County Agricultural Society has extensive grounds and buildings here.

Taunton carries on a large trade, being the business centre of a number of towns in the vicinity. It has also important industrial interests, the various establishments in the census year 1900 having $11,737,399 capital, and an output valued at $12,594,814. The principal manufactures are cotton goods and silverware. There are stove foundries, locomotive works, wood-working establishments, and manufactories of copper ware, tacks, wire nails, stove lining, carriages, buttons, boxes, oilcloth, brick, etc. Herring fishing is another industry of considerable importance.

The government, under the charter of 1882, is vested in a mayor, chosen annually, and a bicameral council, and in subordinate officials, the majority of whom are elected by the council. The school committee, however, is chosen by popular vote. For maintenance and operation, the city spends annually about $462,000, the principal items being: schools, $116,000; interest on debt, $81,000; streets, $41,000; police department, $40,000; charities, $33,000; and fire department, $27,000. The water-works, which represent an expenditure of $1,288,129, and the electric light plant, are owned by the municipality. Population, in 1890, 25,448; in 1900, 31,036.

Settled in 1638 as Cohannat, Taunton was incorporated under its present name in 1639. It was made a shire town in 1746 and was chartered as a city in 1865. The first permanent settlement in Vermont was made by a company from Taunton in 1736. Consult: *Quarter-Millennial Celebration of the City of Taunton* (Taunton, 1889); Emery, *History of Taunton* (Syracuse, 1893).

TAUNUS, tou′nụs. A mountain range of Western Germany, in the Prussian Province of Hesse-Nassau, extending about 55 miles in a northeast direction from the right bank of the Rhine near its confluence with the Main. It consists mainly of schists and quartzites, and reaches its highest elevation, 2713 feet, in the northeast. It is steepest, however, in the southwest, where it falls into the Rhine in precipitous crags crowned with ruined castles. The higher portions of the range are forest-clad, and the lower slopes are covered with vineyards yielding some of the best of Rhenish wines. The range is also famous for its numerous mineral springs, including those of Wiesbaden.

TAURIDA, tou′rĭ-då. A government of European Russia, consisting of the peninsula of the Crimea (q.v.) and a portion on the mainland connected with the peninsula by the Isthmus of Perekop (Map: Russia, D 5). Area, about 24,550 square miles. The region north of the isthmus is mostly flat and its climate is considerably colder than that of the peninsula. The principal river of the mainland portion is the Dnieper, which forms its northwest boundary. This part of the government is well adapted by its steppe-like surface for stock-raising. Large numbers of merino sheep are reared. Wheat, rye, barley, and oats are produced extensively. The cultivation of industrial plants and fruits is confined principally to the peninsula. The chief manufactures are flour, tobacco, and some iron products. Population, in 1897, 1,443,566, of whom the Russians constituted about 71 per cent. and the Tatars over 12 per cent. The capital is Simferopol. See CRIMEA.

TAURIN (from Lat. *taurus*, bull, so called because first discovered in the bile of the ox), or AMIDO-ETHYL-SULPHONIC ACID, $C_2H_4(NH_2)SO_3H$. A remarkable substance occurring, as a constituent of tauro-cholic acid, in the bile and in other animal products and tissues. In a state of purity it forms six-sided glistening prisms, which are perfectly transparent, neutral, devoid of odor, readily soluble in water, but insoluble in alcohol and ether.

TAU′RUS. A mountain range in the southern part of Asia Minor forming the southern boundary of the Anatolian Plateau, which covers the central part of the peninsula (Map: Asia, C 5). It follows the Mediterranean coast from the Euphrates in the east toward the Ægean Sea. On the north it slopes gradually toward the plateau, but on the south it falls in steep terraces toward the sea. The Taurus rises to a height of 7000 to 10,000 feet, being highest near the eastern end. It is broken by a number of river valleys, the principal being that of the Sihun, which separates from the main range a northeastern extension known as the Anti-Taurus.

TAUSIG, tou'sĭk, KARL (1841-71). A German pianoforte virtuoso, born in Warsaw. He became famous for technique and interpretative ability, and won a world-wide reputation by the concert tours that occupied his short life. He was connected with the musical life of Dresden (1859-60), Vienna (1862), and Berlin (1865), in which latter city he founded a 'Schule des höheren Clavierspiels,' which he gave up in 1870. Of his composition and arrangements the great proportion are classical pianoforte works which he edited. He also prepared and edited a new edition of Clementi's *Gradus ad Parnassum*, and arranged the piano score of Wagner's *Meistersinger*. He composed and published two *Etudes de concert* (F♯ and A♭), also *Ungarische Zigeunerweisen*, *Nouvelles soirées de Vienne*, and *Valses-Caprices* on themes from Strauss.

TAUS'SIG, FRANK WILLIAM (1859—). An American political economist, born in Saint Louis, Mo. He graduated at Harvard in 1879, and became full professor of economics there in 1892. His publications include: *The Tariff History of the United States* (1888; 4th ed. 1898), a standard work on the subject; a *History of the Present Tariff, 1860-83* (1885), and *Protection to Young Industries as Applied to the United States* (1883), in the "Questions of the Day Series;" *The Silver Situation in the United States* (1892); and *Wages and Capital* (1896). He also edited *State Papers and Speeches on the Tariff* (1892); and for some years was editor-in-chief of the *Quarterly Journal of Economics*.

TAUTENHAYN, tou'ten-hīn, JOSEPH (1837-—). An Austrian medalist and sculptor, born in Vienna, where he studied at the academy (1854-60) under Radnitzky (1818-1901) and sculpture under Franz Bauer (1798-1872), then in the engravers' academy of the Imperial mint. After his return from a study trip through Italy, France, and England, undertaken in 1869-72, he was appointed Imperial engraver of coins and medals, and in 1881 professor at the academy. Among a large number of choice medals those commemorating the Coronation of Francis Joseph as King of Hungary (1867), the Imperial Silver Wedding (1879), and the Bicentennial of the Relief of Vienna from the Turks (1883), are the most noteworthy. His plastic work on a large scale includes a group of the "Birth of Athens," and statues for the university, also statues for the Art-Historical Museum and the Houses of Parliament.

TAUTOG (Massachusetts Indian *tautauog*, pl. of *taut*, sheep's head, the Indian name of the fish). An American food-fish (*Tautoga onitis*) of the family (Labridæ) to which the wrasses of Europe belong. It is found from Maine to South Carolina, especially along the coast of Southern New England, on rocky and weedy bottoms, where it lives on mollusks, crustaceans, worms, sand-dollars, etc. It is abundant, is of considerable importance as a food-fish, and is locally known as 'blackfish' and 'oyster-fish.' It may attain an extreme weight of 22 pounds, with a length of three feet, but the average weight is about three pounds. The annual catch is about 1,500,000 pounds, valued at $60,000. The tautogs spawn in May and June, and are very prolific, a large fish yielding over a million eggs, which are small and buoyant, and hatch in four or five days. Consult Goode, *Fishery Industries*, sec. i. (Washington, 1884). See Colored Plate of FOOD-FISHES.

TAV'ERNER, RICHARD (c.1505-75). An English religious writer. He was born at Brisley, Norfolk; graduated at Oxford in 1529; was clerk of the signet under Thomas Cromwell, and managed to retain Court favor after Cromwell's fall (1540). In 1545 he was returned to Parliament, and by the King's gift came into possession of much property. Under Edward VI. he maintained his position. Early won for the Reformation and the author of a translation of the Augsburg Confession (1536) and other original and translated works in the interest of Protestantism, and a licensed lay preacher under Edward VI., he still was unmolested by Mary, although he lost his office. Under Elizabeth he came again into royal favor and was high sheriff of Oxford (1569). Taverner's principal literary work was a revision of Thomas Matthew's Bible of 1537, upon the suggestion of Thomas Cromwell. Some of the happiest renderings, as 'parable' for 'similitude,' 'the love of many shall wax cold,' 'the Israel of God,' in the current version are due to Taverner. It was the first complete Bible ever printed in England (London, 1539).

TAVERNIER, tȧ'vâr'nyȧ', JEAN BAPTISTE, Baron d'Aubonne (1605-c.89). A French traveler, born in Paris. He became a dealer in precious stones, and between 1638 and 1663 made a number of journeys to Persia, China, India, and the East Indies. His *Voyages en Turquie, en Perse, et aux Indes*, edited by Chappuzeau and La Chapelle, went through several editions, of which the best is that of 1679.

TAVIRA, tȧ-vē'rȧ. A seaport town of the Province of Algarve, Portugal, 136 miles southeast of Lisbon, on both sides of the river Gilão, at its mouth (Map: Portugal, B 4). The harbor is navigable for small vessels and affords an important commerce in mineral waters and white wines. The town is of much less importance than during the Middle Ages. Population, in 1900, 12,178.

TAV'ISTOCK. A market-town in Devonshire, England, picturesquely situated on the western border of Dartmoor, about 35 miles southwest of Exeter, and 12 miles north of Plymouth, in the fertile valley of the Tavy, which is crossed by two bridges within the town. There are iron foundries and mining works, copper, lead, tin, and iron being found in considerable quantity in the neighborhood. The parish church, dating from 1318, is a handsome edifice. Tavistock was formerly of great importance, owing to its abbey, the largest and most magnificent in Devonshire, which was founded in the year 961, for the Benedictine Order. The refectory and abbey gateway still exist. Population, in 1901, 5043.

TAVOY, tȧ-voi'. The capital of a district of the same name in Tenasserim, Lower Burma, 160 miles west by north of Bangkok, on the Tavoy River, 30 miles from its mouth (Map: Burma, C 4). It is the shipping point for the rice and fruit of the surrounding region, and manufactures earthenware and salt. Tavoy has been a British possession since 1824. Population, in 1901, 22,371.

TAVRIS, tȧ-vrēs′. A town of Persia. See Tabriz.

TAWING, See Leather.

TAWNY, or **TENNE.** The term for orange color in heraldry (q.v.).

TAX (OF., Fr. *taxe,* from ML. *taxa, tasca,* taxation, tax, from Lat. *taxare,* to touch, rate, appraise, estimate), and Taxation. A tax is a compulsory contribution from private income or wealth to meet the general expenses of government. The purpose of taxation is primarily the securing of revenue, although it may incidentally subserve political, social, or moral ends. The common element in all forms of taxation is the destination of the revenue derived from them—to cover general expenses of government. This characteristic serves to distinguish from taxes such compulsory payments as fees and special assessments (q.v.), which are primarily payments to meet costs incurred in affording special public services to the individuals who pay them.

Taxation, while it is to-day by far the most important source of public revenue, is of comparatively recent origin. The mediæval State depended for its revenues largely upon the product of the public domain. (See Finance.) It was in the cities that taxation first developed. Payment of taxes was generally regarded as prerequisite to citizenship. With the increase in public needs which accompanied the development of the national State, various forms of indirect taxes—tolls, impost duties—were levied; and with the extension of citizenship characteristic of the modern State, the duty of paying taxes has become practically universal. The broadening of the functions of the State, noted under Finance, has had the effect of making taxation an increasingly important element in economic life. In general, the higher the social and economic development of a nation, the heavier is the burden of taxation upon its citizens.

Principles of Taxation. Writers on finance are accustomed to lay down certain general principles of justice and of administration to which practical systems should conform. Taxes should be capable of yielding a large revenue; they should be economical, i.e. the cost of collection should not materially increase the burden imposed upon the taxpayer; they should be elastic, capable of responding to a sudden demand for revenue; they should not impair their source through discouraging industry. So far as possible, they should be collected in such a way as to cause the taxpayer the least inconvenience; they should be certain, so that each man might know what he might be expected to pay and make provision accordingly. Most important of all, they should be equitably distributed.

On what principle the distribution of taxes should be made is a question on which financial theorists are far from an agreement. In the first half of the nineteenth century most writers regarded a tax as a payment to the State for protection, or for the privilege of securing an income under the laws of the State. It followed from this view that taxes should be distributed according to the benefit received, or according to the cost incurred by the State in affording the benefit. Such a principle proved unsatisfactory, since both benefit and cost are indeterminable. In recent years the doctrine which has the widest following teaches that since civilized existence is conditioned by the State, each individual is born with the duty of contributing to the needs of the State in proportion to his ability or faculty. This theory more nearly than any other corresponds with public sentiment and with the actual practice of taxation.

Proportional, Progressive, and Degressive Taxation. A system of proportional taxation is one in which the contribution from income or wealth remains a constant percentage, whatever the size of the latter may be. It is defended on the ground that it approximates the ideal of taxation according to ability. Progressive taxation, in which the contribution increases relatively to income or wealth, may be defended on the same ground, since one who possesses a large income is obviously more able to surrender a certain percentage of it than one who has a small income is to surrender an equal percentage. More often it is advocated as a measure of social equalization. Degressive taxation, in which the contribution diminishes relatively to income or wealth, has no valid defense; it exists only because of the imperfection of the taxing machinery, which finds less difficulty in levying upon small aggregates of wealth than upon large.

An ideal system of taxation would be a single tax on incomes. Such a tax would have to take account of the necessary expenditures of individuals, since these affect faculty; it would also take account of the character of income, whether funded or unfunded, since the former, being more certain, places its recipient in a better economic position than the latter. Income taxes, however, have proved practicable to only a limited extent. (See below.)

A tax on all property would approximate the same end, since the value of property is closely dependent upon the income it yields. This tax was practicable enough when almost all property was tangible and incapable of concealment. It is the most unsatisfactory of systems when, as at present, a vast amount of property consists in intangible personality. For these reasons, a multiple system of taxation, direct and indirect, is necessary to provide satisfactory revenues and to approximate fairness in distribution.

Shifting and Incidence of Taxation. The problems of taxation are immensely complicated by the fact that a tax may not rest upon the persons who pay it in the first instance, but may be shifted in whole or in part through price changes. A tax upon the output of a factory would naturally result in an equal rise in price. The manufacturer might pay the tax, but its ultimate incidence is upon the consumer. A tax on houses might temporarily be borne by the owner, but in the nature of the case it would ultimately result in higher rents, since it would put a check upon building. A tax on land value, on the other hand, could not be shifted, since it would not affect the amount of land available for use, and hence could not raise rents.

Direct and Indirect Taxes. A classification of taxes of much practical importance is that which distinguishes between direct and indirect. The distinction cannot be sharply drawn; but it may in general be said that direct taxes are those which are levied upon the persons or property of those upon whom they are expected to rest, while indirect taxes are levied upon commodities or industrial processes with the expectation of their further diffusion. Examples of the former kind are the poll tax, the general property tax, and the income tax. Examples of indirect taxes are customs duties and excise taxes. The practical advantage of indirect taxation lies in its ease of collection, and in the fact that it creates a minimum of opposition on the part of the taxpayer, who does not recognize that he is paying a tax through the enhancement of price of articles which he may purchase or not as he chooses. This very fact gives rise to one of the chief disadvantages of such taxation: namely, that it encourages wasteful administration, since the financier is not held to such strict account for funds raised in this way. A further objection to indirect taxation is that it weighs most heavily upon the poor, since it is only commodities in general use which can yield a considerable revenue through indirect taxation.

Forms of Taxation. The simplest form of taxation is the poll tax, a head tax levied equally upon all citizens or inhabitants. This tax was not uncommon in England toward the close of the Middle Ages; it was an important form of taxation in the New England colonies. Where it still exists it is of minor importance. A tax on general property was developed in the northern colonies of America. Taxes on houses are discussed under the title House Tax (q.v.). Land is in some countries, as in the United States, taxed at the same rate as other forms of property; in other countries a special land tax is levied. A tax on land if permanent has the peculiarity of diminishing the value of the land by the capitalized value of the tax; it may therefore be said to be borne wholly by the one who owns the land at the time when the tax is first imposed. In New Zealand the tax on land is graduated with the size of the holding. The aim of this system is to prevent the accumulation of holdings in a few hands.

For inheritance tax, see that title.

The chief forms of indirect taxes are customs duties (see Tariff) and excise taxes, or taxes upon the production or sale of commodities. The latter are common wherever business is highly developed. They are employed in England to offset duties on imports, which would otherwise serve to protect the native producer.

Taxation in the United States. There are no constitutional restrictions upon the power of the Federal Government over taxation save that "no capitation or other direct tax shall be laid unless in proportion to the census or enumeration," "no tax or duty shall be laid on articles exported from any State," "no preference shall be given . . . to the ports of one State over those of another," and "that all duties, imposts, and excises shall be uniform throughout the United States." The power of the States to tax is also practically unlimited, except that they may not tax interstate commerce, or levy import or export duties, or exercise the right of taxation in a manner to impair the obligation of a contract or to confiscate property without due process of law. The State Constitutions in many cases place further limitations upon the power of taxation exercised by the State Governments. The two fields of National and State taxation have been on the whole well defined and separate since the adoption of the Federal Constitution. While there is no legal objection to the right of the State to levy excise taxation, the prohibition of taxation of like commodities entering the State by interstate commerce renders this right nugatory; the States are therefore practically confined to direct taxation, and the Federal Government has refrained from entering this field of taxation except in periods of great national emergency.

State Taxation. In the majority of American States the basis of the fiscal system is found in the general property tax, levied both for State and local purposes, upon the realty and personalty of the inhabitants of the State. This tax, although general, is now being abandoned or at least limited in application, this being true of Vermont, Connecticut, Delaware, Pennsylvania, and Wisconsin. The tax has been frequently condemned on account of its inadequacy as a test of 'faculty' or ability to pay taxes and because of its failure to reach personal property. According to a report of a special committee of the California Senate on taxation and revenue (January, 1901) there is but one opinion throughout the whole country of the practical working of the tax, and this is "that it is inequitable, unfair, and positively unjust." The tax leads to understatement, to widespread perjury, and to numerous forms of evasion and dodging. Through the inefficiency and occasional dishonesty of assessors, and through their frequent dependence upon popular favor, property of all sorts, and more especially personal property, escapes its just burdens, while in many cases the system of basing the taxation of the State upon the local assessment leads to a competition among the various districts of the State to keep their local assessment unreasonably low and thus evade, as far as possible, the burden of the State general property tax. The resulting inequalities are only partially remedied by the various State Boards of Equalization which now exist in about one-half of the States and which exercise the right to raise or lower the assessment of counties and in cases even to alter the assessment of individuals. It has, moreover, been found impracticable to secure good results by imposing severe penalties for evasion or by paying portions of the tax to persons discovering such evasions. Remedial legislation has been proposed in several States, but the Industrial Commission in its final report went beyond such palliative measures and recommended "that the States abandon the general property tax"—but "that local revenues be raised by taxes on real estate and personalty under the general property tax system, as at present."

Mortgages are taxed in most States together with the other forms of personalty, and as no deduction is usually made in the assessment of mortgaged property, the imposition of the tax on mortgages usually amounts to double taxation. Attempts have been made in Massachusetts, California, Oregon, and elsewhere to prevent this double taxation of mortgaged property as well as in some cases to shift the burden of the tax from the borrower to the lender. The tax in its present form is also criticised on the ground of its frequent evasion.

The general property tax, while practicable for a new, homogeneous, agricultural country, becomes objectionable in a more highly developed community owing to the escape of personalty, which has grown more rapidly in value than real property. The legal exemption of intangible personal property has been advocated (notably by the Massachusetts Tax Commission of 1897) because of its practical escape under present conditions and because it is claimed to be usually nothing but an evidence of ownership or of an interest in tangible property already taxed. The proposal to exempt intangible personal property has never met with the approval of the farmers or owners of rural property, unless it is accompanied by some means of reaching the property or income of which the intangible personal property is the title or evidence of ownership. There are also advocates of the exemption of taxes on improvements on land as well as adherents of a single tax on land values that will absorb the whole value of the land. See SINGLE TAX.

In connection with the general property tax, many of the Southern States also depend upon a number of license or privilege taxes upon various forms of business, exhibitions, etc., and in 1901 a special committee of the Senate of California advocated like taxes for that State. In the South the tax is not graduated, but is usually a fixed charge, and according to Seligman (*Essays in Taxation*) is the natural result of the economic constitution of the South in the past. The aristocratic landed interest did not desire to tax themselves by a land or poll (slave) tax, but attempted to shift the burden in colonial days by taxing imports and exports, and, after the adoption of the Constitution of the United States, by levying business taxes or licenses.

A few States levy an income tax, in some cases instead of the general property tax, in others in connection with it. The income tax law of Massachusetts has survived from colonial days. It exempts incomes under $2000, taxing only the excess, and exempts also the income from property already taxed. It is laxly administered. There are also incomes taxes, or, as they are sometimes known, occupation taxes, in Louisiana, Pennsylvania, Virginia, North Carolina, and South Carolina.

The assessment of the property of corporations by local bodies under the general property tax has everywhere been found to be inadequate, and the expedient has commonly been resorted to of assessing the property of such corporations by a State board instead of by local assessors. Corporations are taxed, however, on another basis than that of the value of their property. According to Professor Seligman, the basis of taxing corporations in the United States has been: (1) the value of the property; (2) the cost of the property; (3) the capital stock at par value; (4) the capital stock at market value; (5) the capital stock plus the bonded debt at market value; (6) the capital stock plus total debt, both funded and floating; (7) the business transacted; (8) gross earnings; (9) dividends; (10) capital stock according to dividends; (11) net earnings; (12) value of franchise. Several States have accepted gross revenue or net earnings as a basis for taxation, and in several States, Wisconsin, Michigan, etc., this tax is progressive. A feature of recent taxation is the so-called special franchise tax. A tax of this sort, which falls upon "franchises for the use of streets granted by municipalities to public-service corporations" was passed by the New York Legislature in 1899, and a somewhat similar tax was levied in New Jersey in 1900. One of the most serious drawbacks to the just and equitable taxation of corporations lies in the interstate location of their property and the interstate character of their business and the consequent frequent conflicts of jurisdiction. To prevent this Prof. Henry C. Adams advocates the Federal taxation of interstate commerce, while another authority on finance (Professor Seligman) urges uniformity of State action or, in default thereof, taxation by the Federal Government and subsequent redistribution of such revenue among the States.

FEDERAL TAXATION. The revenue of the Federal Government has been obtained principally from customs and internal revenue duties. From 1875 to 1898, inclusive, the receipts from internal revenue fluctuated between $111,000,000 and $171,000,000, then during and after the Spanish War they rapidly rose to $307,000,000. Of this amount $254,000,000, or over four-fifths, were obtained from spirits, fermented liquors, and tobacco in the order named, $39,000,000, or 13 per cent., from the stamp taxes, and the remainder from legacies and distributive shares of personal property, oleomargarine, playing cards, special taxes not otherwise enumerated, penalties, etc.

The following table shows the receipts of the Federal Government from taxation for the ten years 1892-1901:

	Customs revenue	Internal revenue
1892	$177,452,964	$153,971,073
1893	203,355.017	161,027,624
1894	131,818,530	147,111,233
1895	152,158,617	143,421,672
1896	160,021,752	146,762,865
1897	176,554,127	146,688,574
1898	149,575,062	170,900,641
1899	206,128,482	273,437,162
1900	233,164,871	295,327,927
1901	238,585,456	307,180,664

In 1894 and from 1898 on, the internal revenue has been more productive than the customs revenue, this having been also true during the fiscal years from 1864 to 1868, inclusive. The cost of collecting the customs revenue in 1901 was 3.23 per cent. and that of collecting the internal revenue was 1.43 per cent., or $1 of cost for $70 collected.

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TAXATION OF COSTS. The official review and confirmation of the amount of costs due a successful litigant. In England the court determines the way in which the costs shall be taxed, and this is done before a taxing master, or registrar. The official performing similar duties in Scotland is known as the auditor.

In the United States the clerk of each court usually taxes the costs of successful parties. His rulings may be reviewed by the court upon motion. See COSTS.

TAX DEED. A properly authenticated instrument by which a public officer transfers land sold for taxes. As it does not represent the free act of the owner of the land, its validity depends upon the constitutionality and regularity of the tax sale, the proceedings in which it usually recites. The deed may run in the name of the State, or in the name of the officer executing it in his official capacity. Delivery of the deed may be compelled by mandamus. See TAX SALE.

TAXIDERMY (from Gk. τάξις, *taxis*, arrangement + δέρμα, *derma*, skin). The art of skinning, preserving, and stuffing the skins of animals, and of mounting them for exhibition. Before skinning all animals should be carefully measured. When possible make the measurements prescribed by taxidermists. Also make drawings and if possible casts of those parts whose form and expression are characteristic and can adequately be expressed in no other way. These precautions have reference to the mounting of the animals in a truly life-like attitude and form. The mounting of animals requires experience and, for the greatest success, an artist's eye for form and a sculptor's skill in modeling. The skin should be carefully removed from the body to the tips of the toes and to the bill in the case of the bird. Directions as to where and how far to cut the skins of the various sorts of animals may be found in taxidermists' guides. Do not cut the skin at the claws and beak, and in the case of birds, leave the skull within the skin. Clean the leg and skull bones of all flesh, clear out the brain, and preserve the skin and all it contains by anointing it thoroughly on the inside with arsenical soap. Many taxidermists prefer to have the entire pelvic and pectoral girdles preserved at least.

The subsequent treatment of the skin depends somewhat on whether the specimen is to be mounted, and upon the facilities at hand and the ease and cost of transportation. Except in the case of young, and of certain species, the skins of mammals, whether preserved in the field or in the laboratory, should if possible be preserved *wet*—in a salt and alum bath. The proportions recommended by Hornaday are: to one gallon of water add three-fourths of a pound alum (one pint) and 1¾ pounds salt (1 quart); heat to near the boiling point until the crystals are all dissolved. When possible test with a salometer, where liquid should stand at 15°. Do not allow the liquid to remain in a zinc or galvanized vessel. Immerse the skins in the cooled solution. For the first two or three days do not allow the skins to crumple or fold, and to facilitate the penetration of the fluid to all parts of the skins stir them about in the fluid. Keep greasy skins by themselves and replace a dirty and bloody preservative by a clean one.

Skins for mounting should be preserved *dry* only when the lack of facilities and the cost of transportation render the wet method prohibitive. By the dry method the skins may be preserved with arsenical soap. When the soap is all absorbed the skins should be dusted with finely powdered salt and alum in equal proportions. Very good skins may be prepared with salt alone in an emergency; but such skins should be guarded against the attacks of insects, rats, mice, cats, dogs, etc.

Bird skins may be preserved either with powdered arsenic and alum or with arsenical soap. Before removing the skin of a bird plug the vent and nostrils with cotton. Dirt and blood-spots should then be washed out with water and the feathers dried with generous and repeated sprinkling of meal, plaster of Paris, or sawdust. The skin having been removed and anointed with the preservative, replace the skull (using great care here as elsewhere not to stretch or tear the delicate skin); gently fill the eye-sockets and throat with cotton to their natural fullness; wind the wing-bones and legs with cotton to an amount equal to the muscles removed, and gently draw them down into the skin of the arms and legs, which should be placed in a natural position. Then make as close an imitation of the body as possible (of cotton for little birds and of tow for large ones), insert it into the skin, packing it in just sufficiently to fill out all the natural roundness and no more, and draw the skin over it. Next smooth all the feathers carefully, lay the wings naturally beside the body, and tie them there by many windings of thread round and round the whole length of the body. This done lay the bird on its back on a board, stretch out the beak and tail, and fasten them in position if necessary and leave the specimen in an airy place until thoroughly dried. A light label should be attached to the leg. Skins so preserved are better for study purposes than when mounted, as they are easily handled, take less room in a cabinet, and are more easily cared for. When properly preserved they may be prepared for mounting at any time by softening, by means of wrapping in damp cloths for several hours or days.

The mounting of skins is a very elaborate process, and good results depend not only upon acquired skill, but upon a knowledge of anatomy, bionomics, and good artistic taste. In the case of the smaller birds and animals it consists of arranging wires lengthwise of the body and the limbs, so connected as to support the body in a life-like attitude; but large animals must have the substance of the body replaced by some firm material, such as clay or some plastic composition, which must be modeled with great intelligence if the figure, after the skin has been drawn over it and fastened, is to be satisfactory.

Consult: Hornaday, *Taxidermy and Zoölogical Collecting* (New York, 1892); Rowley, *The Art of Taxidermy* (New York, 1898).

TAXILA, tăk′sē-lȧ (Lat., from Gk. Τάξιλα, Chin. *Chu-sha-shi-lo*, from Skt. *Takṣakaśila*, rock of Takshaka, a Naga king, or, less probably, *Takṣaśila*, carved rock, or from Pali *Takkasila*, rock of the Takkas, a tribe living between the Indus and the Chenab). A famous city of ancient

India. It was situated near the modern village of Dheri Shahan, on the little stream Tabranala, in the District of Rawalpindi, in the Punjab. It was one of the most populous and wealthy of all the cities of India. It was the residence of Aśoka (q.v.) while he was Viceroy of the Punjab. During the early part of the second century B.C. Taxila probably formed part of the dominions of the Græco-Bactrian King Eucratides. The Sus or Abars became its masters B.C. 126, only to lose it at the beginning of the next century to Kanishka, King of the Kushans. Consult: McCrindle, *Invasion of India by Alexander the Great* (Westminster, 1896); id., *Ancient India as Described in Classical Literature* (ib., 1901).

TAXONOMY (from Gk. τάξις, *taxis*, arrangement + νόμος, *nomos*, law, from νέμειν, *nemein*, to distribute) IN PLANTS. The classification of plants. Probably the first scientific study of plants was the attempt at classification. Artificial classifications, beginning with the most ancient one into herbs, shrubs, and trees, and culminating in the Linnæan system (see BOTANY) in the middle of the eighteenth century, were at first necessary on account of lack of knowledge of the structure of plants. Such classifications simply catalogued and pigeonholed the rapidly accumulating material, in preparation for a classification based upon natural relationships. Natural systems have been evolving since the eighteenth century; being modified by every advance in morphological knowledge, none are abreast of current opinion, and no final classification seems to be in sight. Each newly proposed system, however, approaches to it. The present system is a composite one, not being referable to any single systematist, but having had a somewhat natural and very slow development. In its larger outlines it is presented below. All of the groups mentioned are described under their several titles.

At present four primary divisions of the plant kingdom are recognized, as follows:

IV. Spermatophytes or Seed-plants.
III. Pteridophytes or Fern-plants.
II. Bryophytes or Moss-plants.
I. Thallophytes or Thallus-plants.

These categories are distinct enough, and there is no difficulty in assigning all plants to them, but the question arises, Are they equivalent groups? Some think there should be more primary groups, and others fewer. Beginning with the lowest great division, there is an increasing complexity. An easy differential way of separating the groups is as follows: *Thallophytes* have thallus-bodies but no archegonia (q.v.); *bryophytes* have archegonia but no fibro-vascular bundles; *pteridophytes* have fibro-vascular bundles but no seeds; *spermatophytes* have seeds.

I. THALLOPHYTES, the least natural group of the four, comprise what seems to be a heterogeneous mass of forms. They are divided into two great parallel series, algæ and fungi, the former containing chlorophyll (green pigment) and being independent plants, the latter containing no chlorophyll and being parasites or saprophytes. The algæ are usually subdivided as follows:

- Algæ
  - Rhodophyceæ or red algæ.
  - Phæophyceæ or brown algæ.
  - Chlorophyceæ or green algæ.
  - Cyanophyceæ or blue-green algæ.

It is a serious question whether the Cyanophyceæ should be included in this way with the other algæ, for they appear to be far more nearly related to the bacteria, a group of fungi. The classification of the fungi is in a very unsatisfactory state, but the plants are for the most part being treated under the following heads:

- Fungi
  - Basidiomycetes or basidium fungi (toadstools and their allies, including rusts and smuts).
  - Ascomycetes or sac-fungi (mildews, lichen-fungi, etc.).
  - Phycomycetes or alga-like fungi (molds, downy mildews, etc.).
  - Schizomycetes or fission-fungi (bacteria).
  - Myxomycetes or slime molds.

The first three groups are regarded as true fungi; the last three are problematical as to their relationships, the last two especially often being regarded as distinct from the fungi.

II. BRYOPHYTES form a very natural group, the two great series being liverworts (Hepaticæ) and mosses (Musci). Their principal subdivisions are as follows:

- Bryophyta
  - Musci
    - Bryales.
    - Sphagnales.
  - Hepaticæ
    - Anthocerotales.
    - Jungermanniales.
    - Marchantiales.

III. PTERIDOPHYTES also form a natural group, though the main divisions are very dissimilar in appearance. They are as follows:

- Pteridophyta
  - Lycopodiales or club-mosses.
  - Equisetales or horsetails.
  - Filicales or ferns.

IV. SPERMATOPHYTES should probably be divided into two primary groups, although at present they are treated as one. The two great divisions, gymnosperms and angiosperms, differ more in essential features from one another than does the former group from pteridophytes, but they are held together at present by the common character of seed production. The existing gymnosperms are grouped as follows:

- Gymnospermæ
  - Gnetales.
  - Coniferales (pines and their allies).
  - Ginkgoales (maiden-hair tree).
  - Cycadales (cycads).

The angiosperms comprise a vast assemblage of forms that are easily separated into two great series, monocotyledons and dicotyledons, but whose further division is at present in a somewhat chaotic state. Most of the subdivisions heretofore suggested are confessedly artificial, and probably as far as one may go safely with natural groups is as follows:

- Angiospermæ
  - Dicotyledones
    - Sympetalæ.
    - Archichlamydeæ.
  - Monocotyledones

The unit of classification used by taxonomists is the *species*, a group very difficult to define, but understood in a general way. The species always bears two names, as Quercus alba, the systematist's name for white oak, 'alba' indicating the species, and 'Quercus' the genus to which the species belongs. In some cases forms of a species may be distinct enough to be characterized, and are called varieties, being designated by adding a third name to the species binomial. The next higher taxonomic group is the *genus*, which comprises one or more species. For example, 'Quercus' is the oak genus, containing one or many species. The next higher taxonomic category is the *family*, which comprises one or more genera, and is indicated except in a few exceptional cases by the common termination 'aceæ,' as 'Rosaceæ,' the rose family. The next higher category is the *order*, the form of whose designation is not so fixed as that of the family, but which is increasingly indicated by the termination 'ales,' as 'Coniferales.' Still higher categories are often employed, but the usage is so variable that nothing definite can be stated in reference to them. All of these categories have their intermediate subdivisions, which general usage has in the main established. For example, a genus may have its species grouped into *subgenera;* a family may be broken up into *tribes*, each containing its own genera; and an order often has its *suborders*.

The literature of taxonomic botany is vast in extent, and a complete list of even the most important works cannot be cited. No work as yet contains a systematic presentation of all the known species of plants. The most extensive current works are as follows: Engler and Prantl, *Die natürlichen Pflanzenfamilien* (Leipzig), completed in four sections, each containing numerous parts, and including all known genera; Bentham and Hooker, *Genera Plantarum* (London, 1863-83), including all known genera of flowering plants; Engler, *Das Pflanzenriech* (Leipzig), a few parts of which have appeared, and which is planned to be completed in twenty years, including descriptions of all known species of plants.

Each country has its own manuals containing descriptions of its flora. The current manuals dealing with the flowering plants and in some cases the fern plants of the United States are as follows: Gray, *Manual of Botany* (6th edition, revised by Watson and Coulter, New York, 1890), including Northeastern United States; Britton and Brown, *Illustrated Flora of the Northern United States and Canada* (ib., 1896-98); Britton, *Manual* (ib., 1901), including the same range; Chapman, *Flora of the Southern United States* (3d edition, Cambridge, Mass., 1897); Small, *Flora of the Southeastern States* (New York, 1903); Coulter, *Manual of Rocky Mountain Botany* (New York, 1885); id., *Botany of Western Texas* (Washington, 1891-94); Brewer, Watson, and Gray, *Botany of California* (Cambridge, Mass., 1876 and 1880); Greene, *Manual of the Bay-Region Botany* (San Francisco, 1894), including region south of Maryland and Kentucky west to 100th meridian; Howell, *A Flora of Northwest America*, not yet complete (Portland, Oregon, 1897—); Rydberg, *Flora of Montana* (New York, 1900). The only attempt to include in a single work the whole flora of North America is Gray's *Synoptical Flora of North America*, incomplete (1878-95). For pteridophytes (fern-plants) of the United States, consult: Underwood, *Our Native Ferns and Their Allies* (New York, 1888); Clute, *Our Ferns in Their Haunts* (New York, 1901). For mosses of the United States, see Lesquereux and James, *Mosses of North America* (1884; out of print); Barnes, *Keys to North American Mosses* (Madison, Wis., 1896); Grout, *Mosses with a Hand Lens* (Brooklyn, 1900; revised and enlarged, 1903). For the important taxomonic literature of algæ and fungi, see articles on the principal groups.

TAX SALE. A public sale of land by proper officials acting under authority of law, to collect the amount due for unpaid taxes. The requisites and details to be followed vary widely in the different States, but certain general principles are common. The taxes must be constitutional and be legally assessed; they must be due and unpaid; a proper return of the fact of the delinquency must have been made; the land must be advertised for sale at a definite time and place, and must be sold at public auction to the highest bidder. In some States, if it is practicable to sell a portion of the land for enough to satisfy the unpaid taxes, it is mandatory on the tax collectors to advertise and sell it in that way. However, it is usual to sell tracts of land as they are assessed. Most States allow the owner to redeem the land within a specified period, usually upon payment of the amount paid by the purchaser and a fixed rate of interest. Accordingly, immediately after the sale it is customary to give the purchaser merely a certificate which will entitle him to demand a tax deed upon the expiration of the time for redemption. See TAXATION; TAX DEED; TITLE.

TAX TITLE. The interest or title acquired by a purchaser of land at a tax sale. If the sale be valid, the validity of the title depends upon the failure of the owner to redeem within the proper time. Until the expiration of the time allowed for redemption, the purchaser has practically only a right in the nature of a lien on the property. See TAX SALE.

In most States the deed is *prima facie* evidence of title in the purchaser. In many States, after the expiration of the time for redemption, a tax title is made superior to all other claims. In a few States, however, the purchaser gets only the right of the delinquent taxpayer and, therefore, the title may be very precarious. When the tax title of a purchaser in good faith proves to be invalid for any reason, he is generally allowed to recover back the purchase price, and may recover from the owner the actual value of any reasonable improvements he may have made. See TAXATION; TAX SALE; TITLE.

TAY, tā. A river of Scotland draining the greater part of Perthshire (Map: Scotland, E 3). It rises as the Dochart on the border of Argyllshire, and flows first eastward, traversing the beautiful Loch Tay, then southeast, and finally northeast as the Firth of Tay, a broad tidal estuary through which it enters the North Sea, 10 miles below Dundee. It is 118 miles long and navigable for small vessels to Perth, though the mouth of the estuary is obstructed by sand banks. The estuary is spanned by an iron railroad bridge over 3000 yards long.

TAY, LOCH. A lake in West Perthshire, Scotland, situated in a mountain basin, 355 feet above the sea-level. It is about 15 miles long, with an average breadth of one mile, and varies from 100 to 600 feet in depth (Map: Scotland, D 3). Its picturesque features and salmon fishing make it a favorite tourist and angling resort. Ben Lawers, on its western side, rises 2945 feet.

TAYABAS, tȧ-yä'bȧs. A province of Luzon, Philippine Islands, occupying the isthmian portion between the central and southern part of the island, and the region along the east coast of Central Luzon, formerly included under the districts of Infanta and Príncipe (Map: Luzon, H 10). These two districts and the large island of Polillo (q.v.) lying to the east of them were annexed to the province in 1902. Total area, 4429 square miles, of which the dependent islands take up 491, and of these the island of Polillo 294 square miles. The entire mainland portion is occupied by a high coast range covered with forests and generally inaccessible and unexplored except in the isthmian region, where alone there are means of communication. The northern districts are undeveloped, but in Tayabas proper there are some agriculture and cattle-raising, and considerable mechanical industries, including weaving, the manufacture of hats, cigar-boxes, and cocoanut oil, and boat-building. Population estimated in 1901 at 131,045, consisting of Tagálogs in the south and Ilongotes and Negritos in the north. Capital, Lucena.

TAYABAS. A town of Tayabas Province, Luzon, Philippines, situated on the east bank of the river of the same name, sixty-five miles southeast of Manila (Map: Luzon, H 11). It is the centre of a large inland and coast trade, and has a dockyard for native vessels. Population, about 15,000.

TAYGETUS, tȧ-ĭj′ė-tŭs (Lat., from Gk. Ταὔγετος), now called Pentedaktylon. The principal mountain range of the Peloponnesus, Greece (Map: Greece, D 5). It extends southward through the middle of the peninsula and forms the central one of the three promontories in which Southern Greece terminates. It is an almost unbroken ridge, and reaches in Mount Hagios Elias an altitude of 7903 feet. It formed the ancient boundary between Laconia and Messenia.

TAY′LER, John James (1797-1869). An English Unitarian. He was born at Church Row, Newington Butts, Surrey; graduated B.A. at the University of Glasgow, 1818; and was minister of a Unitarian congregation at Manchester, 1820-53. In 1840 he became professor of ecclesiastical history in Manchester New College, and in 1852 also professor of theology. When the college was removed to London (1853), he became principal. He was co-pastor with Rev. James Martineau of the Unitarian congregation in Little Portland Street (1850-60). He published *Retrospect of the Religious Life of England* (1845; 3d ed. 1876); *Christian Aspects of Faith and Duty* (2 series, 1851-1877); *Attempt to Ascertain the Character of the Fourth Gospel* (1867; 2d ed. 1870). Consult his *Life and Letters* by J. H. Thom (London, 1872).

TAY′LOR. A city in Williamson County, Tex., 35 miles northeast of Austin; on the Missouri, Kansas and Texas and the International and Great Northern railroads (Map: Texas, F 4). The buildings and grounds of the Fair Association and artesian wells are noteworthy features of the city. Taylor is the centre of extensive cotton interests, and also has considerable trade in farm produce, live stock, wool, etc., and manufactures of flour and cottonseed oil. The International and Great Northern Railroad maintains repair shops here. Population, in 1890, 2584; in 1900, 4211.

TAYLOR, Alfred Swaine (1806-80). A celebrated English medical jurist, born at Kent. He studied in the united hospitals of Guy and Saint Thomas in 1823, and upon their separation attached himself to Guy's, where he studied under Sir Astley Cooper and Joseph H. Green. In 1831 he began to deliver at Guy's Hospital the first English course of lectures on medical jurisprudence. In 1832 he became joint lecturer with Aikin on chemistry at Guy's, and he held this chair alone from 1850 to 1870. His great work, *Elements of Medical Jurisprudence* (1836), had passed through twelve editions by 1891, and during this period was the standard work on the subject. This work won for him in 1859 the Swiney prize. He first drew attention to the great incentive for secret murder offered by life insurance, and to the possibility of arsenical poisoning from wall papers and other fabrics. His *Handbook on Poisons* (1848) is his other notable work.

TAYLOR, [James] Bayard (1825-78). An American poet, man of letters, journalist, and traveler, born at Kennett Square, Chester Co., Pa. His education was obtained in the common schools of the neighborhood. He became, in 1842, the apprentice of a printer, and here he published his first volume, *Ximena; or the Battle of the Sierra Morena, and Other Poems* (1844). In 1844-45 he made a pedestrian tour through Europe, describing his experiences in *Views Afoot; or Europe Seen with Knapsack and Staff* (1846). The following year, 1847, he joined the New York *Tribune*, and remained on the staff of that paper as long as he lived, publishing in its pages the sketches of many of his subsequent books. As its special correspondent, he visited California in 1849, where he spent five months among the gold-diggers; two years later he was in Egypt, Asia Minor, and Syria; in 1852-53 in India, crossing from Bombay to Calcutta, and then going to China to join the expedition of Commodore Perry to Japan. From 1862 to 1863 he was secretary of the United States legation at Saint Petersburg, and later *chargé d'affaires* there, and was influential in securing for the Northern States the sympathy of Russia. In 1874 he was again in Egypt, and the same year at the Millennial Celebration in Iceland. For several years previously he had lived in Germany, and there in 1870-71 he brought out the work for which he is best known, his excellent translation of Goethe's *Faust*. In 1876 he wrote the *Ode* in honor of the opening of the Centennial Exhibition in Philadelphia. In February, 1878, he was appointed Minister to Germany, and returned again to that country, but died there toward the end of the same year, leaving unfinished biographies of Goethe and Schiller. He was married in 1850 to Miss May Agnew, and in 1857, to Miss Marie Hansen of Gotha, Germany, who survived him, reëdited his works, and, with H. E. Scudder, wrote his *Life and Letters* (1884).

Taylor's work is very voluminous, and varied both in kind and in quality. He wrote books of travel, of which the chief are: *El Dorado; or Adventures in the Path of Empire* (1850); *A Journey to Central Africa* (1854); *A Visit to India, China, and Japan* (1855); *The Lands of the Saracen* (1855); *Northern Travel* (1858); *Travels in Greece and Russia* (1859); *At Home and Abroad* (1859 and 1862); *Colorado, a Summer Idyl* (1867); *By-Ways of Europe* (1869); *Egypt and Iceland in the Year 1874* (1874); and others. His novels include: *Hannah Thurston* (1863); *John Godfrey's Fortunes* (1864); *The Story of Kennett* (1866); *Joseph and His Friend* (1870). His poems were also very numerous;

besides *Ximena*, the chief volumes are: *Rhymes of Travel, Ballads, and Other Poems* (1849); *The American Legend* (1850), delivered before the Phi Beta Kappa Society of Harvard; *A Book of Romances, Lyrics, and Songs* (1852); *Poems and Ballads* (1854); *Poems of the Orient* (1855); *Poems of Home and Travel* (1855); *The Poet's Journal* (1863); *The Picture of Saint John* (1866); *The Ballad of Abraham Lincoln* (1870); *The Masque of the Gods* (1872); *Lars, A Pastoral of Norway* (1873); *The Prophet, A Tragedy* (1874); *Home Pastorals, Ballads, and Lyrics* (1875); and *The National Ode* (1876), all showing variety in subject and manner. He had a distinct lyrical faculty, as his beautiful "Bedouin's Song" proves, but he never seemed able to bring his varied powers under full artistic control. The public persisted in regarding him as a traveler and journalist rather than as a poet, and, despite the remonstrances of some friendly critics, it is probable that the public was right. At most he is a minor poet, a good translator, and a versatile writer of prose. Besides the biography by his wife, there is a *Life* by Albert H. Smythe, in the "American Men of Letters" series (1896), and a sketch of his personality is to be found in W. D. Howells's *Literary Friends and Acquaintance* (1900).

TAYLOR, Benjamin Franklin (1819-87). An American author and journalist, born in Lowville, N. Y. During the Civil War he was with the Western armies as correspondent of the Chicago *Evening Journal*, and his letters attracted so much attention that many of them were translated and published in European papers. After the war he traveled and lectured for several years. He wrote many books, including several volumes of verse and a novel, *Theophilus Trent* (1887). He is probably best known by his poem "The Isle of Long Ago."

TAYLOR, Brook (1685-1731). An English mathematician, born at Edmonton, Middlesex. He was educated at Cambridge. In 1712 he was made a fellow of the Royal Society, and two years later became its secretary. Taylor is chiefly known for a theorem which bears his name, and which appeared in his *Methodus Incrementorum Directa et Inversa* (1715), the first important treatise to deal with the calculus of finite differences. Taylor also contributed in a valuable way to the problem of the centre of oscillation (*Philosophical Transactions*, xxviii.), to the theory of vibrations of a string, and other questions of mathematical physics. His *Linear Perspective* (1715) and *New Principles of Linear Perspective* (1719) were a notable advance in the theory. They also contained an enunciation of the principle of vanishing points, the first in English and the most complete to that time. For biography consult the preface to his posthumous work, *Contemplatio Philosophica* (1793).

TAYLOR, Charles Fayette (1827-99). A celebrated American orthopædic surgeon, born in Williston, Vt., and educated at the University of Vermont. The year 1857 he spent in London, studying the Swedish movement cure under Roth. Subsequently he settled in New York City, and was one of the first to introduce the movement cure (q.v.) into this country. Dr. Taylor early became a specialist in orthopædic surgery, in which he was very successful. He was especially skillful in devising original appliances to meet deformities. Among his inventions are the Taylor splint for treatment of curvature of the spine and the long extension hip splint. He was the founder of the New York Orthopædic Dispensary and Hospital, of which he was the executive surgeon for many years. Taylor established in New York City an institute for the treatment of deformities, which was successfully operated for many years, previously to the organization of the hospital. His publications include: *Principles and Practice of Hygeio-Medical Science*, with George H. Taylor (1857); *The Movement Cure* (1858); *The Theory and Practice of the Movement Cure, or the Treatment of Lateral Curvature of the Spine*, etc. (1861); *The Mechanical Treatment of Angular Curvature, or Potts' Disease of the Spine* (1865); *"Spinal Irritation" or the Causes of Backache Among American Women* (1864); *Infantile Paralysis and Its attendant Deformities* (1867); and *On the Mechanical Treatment of Disease of the Hip-Joint* (1873).—Dr. Henry Ling Taylor, son of C. F. Taylor, is an orthopædic surgeon of note, and professor of orthopædic surgery in the New York Post-graduate Medical School and Hospital.

TAYLOR, Sir Charles Purcell (1863—). An English marine engineer. He was largely self-educated, but gradually became distinguished as a consulting engineer, especially in connection with marine practice. During the Civil War in Chile in 1891, he served successfully as an intermediary between the United States and Chile in the *Baltimore* affair. His principal publications, which have appeared as reports, include the following: *The Docks and Harbors of the World; Coal Mines and Iron Works of the World; Briquettes and Smokeless Fuel; The First Transatlantic Steamer; The Steering of Ships; Smokeless Powder;* and *The Choice and Use of Motor Cars.*

TAYLOR, Dan (1738-1816). Founder of the New Connection of General Baptists. He worked in the mines of Yorkshire till 1762. After having been for a year one of Wesley's preachers he seceded, but continued preaching. In 1763 he united with the General Baptists and rose to prominence as a preacher among them. In 1769 he headed a secession from that body. (See Baptists.) His better known works embrace: *A Compendious View of Christian Baptism* (1772); *Fundamentals of Religion* (1775); and *The Eternity of Future Punishment* (1789, written against the Universalist Elhanan Winchester). Consult his biography by Adam Taylor (London, 1820), and by W. Underwood (ib., 1870).

TAYLOR, Edward Thompson (1793-1871). An American preacher, widely known as 'Father Taylor.' He was born in Richmond, Va.; was taken in charge by a lady near that city; ran away to sea at the age of seven, and for ten years was a sailor. In the War of 1812 he served on a privateer, the *Black Hawk*, was captured, and was confined first at Melville Island and then in Dartmoor Prison, where he became the chaplain to his fellow prisoners, having joined the Methodist Episcopal Church in 1811. After his release from prison he was successively a peddler of tin and ironware and a buyer of rags, and a farmer; was regularly licensed to preach in 1814; and in 1819 became an itinerant Methodist minister. In 1829 he was chosen minister of the newly established Seamen's Bethel in Boston, which position he held until 1868, when he resigned. He visited Europe in 1832 and Palestine in 1842, and was chaplain to the United States frigate sent with relief to Ireland during the famine of 1846. By his warmth of heart, his native wit, and his natural eloquence he gained a remarkable influence over his sailor auditors, and throughout the United States he was regarded as in some respects the most eloquent preacher of his day. Numerous anecdotes have been told to illustrate his wit and his power as a public speaker, and accounts of his eloquence may be found in Miss Martineau's *Retrospect of Western Travel*, in Buckingham's *America, Historical, Statistic and Descriptive*, in Dickens's *American Notes*, in Miss Bremer's *The Homes of the New World*, and in Mrs. Jameson's *Commonplace Book of Thoughts, Memories, and Fancies.* Walt Whitman spoke of him as an "essentially perfect orator." Consult Haven and Russell, *Father Taylor, the Sailor Preacher* (Boston, 1872).

TAYLOR, George (1716-81). A signer of the Declaration of Independence, from Pennsylvania. He was born in Ireland, emigrated to America as a redemptioner in 1736, and, after serving a wealthy manufacturer as a clerk, married his employer's widow. He became very wealthy, was a member of the Provincial Assembly from 1764 to 1770, and on July 20, 1776, was chosen a member of the Continental Congress. He served only a short time, retiring in March, 1777. Consult: Sanderson, *Signers of the Declaration of Independence* (Philadelphia, 1825-27).

TAYLOR, Hannis (1851—). An American lawyer and diplomat, born at New Berne, N. C. He was educated at the University of North Carolina. From 1893 to 1897 he was United States Minister to Spain. In 1899 he published the first volume, followed in 1898 by the second volume of *The Origin and Growth of the English Constitution*, a work in which he attempted not only to trace the history of the English system of government, but also the growth therefrom "of the Federal Republic of the United States."

TAYLOR, Sir Henry (1800-86). An English poet, born at Bishop-Middleham in Durham. He began writing verses in the Byronic manner and was soon contributing clever articles to the *Quarterly Review.* Encouraged by Southey, whom he visited at the Lakes, he settled in London as a man of letters (1823). In 1824 he was given a clerkship in the Colonial Office, a post which he filled with great ability till his resignation in 1872. He made warm friendships with Mill, Lockhart, Rogers, Carlyle, Spedding, Aubrey de Vere, and many other literary men. In recognition of his services to the Government and to literature, he was made K.C.M.G. (1869). His last years were passed at Bournemouth. Taylor's literary fame rests secure on *Philip Van Artevelde* (1834; performed by Macready, 1847), one of the most poetic tragedies since the Elizabethan age. Other tragedies in the same style but of less merit are *Isaac Comnenus* (1827), *Edwin the Fair* (1842), and *Saint Clement's Eve* (1862). *The Virgin Widow,* a dramatic poem (1850), is an experiment in romantic comedy. In 1847 Taylor published *The Eve of Conquest and Other Poems.* His strongest prose is represented by *The Statesman* (1836), a collection of ironical discourses on success, which were taken seriously; and by a charming *Autobiography* (1885; but privately printed, 1877), containing carefully drawn portraits of his early contemporaries. Consult his *Works* (Author's edition, 5 vols., London, 1878); selection from poems in Miles's *Poets and Poetry of the Century* (ib., 1891); and *Correspondence,* ed. by Dowden (ib., 1888).

TAYLOR, Henry Clay (1845—). An American naval officer, born in Washington, D. C. He graduated at the Naval Academy in 1863, was assigned to the West Gulf Blockading Squadron, and took part in the battle of Mobile Bay (August 5, 1864). After the Civil War he spent two years in the South Pacific Station, and on his return home was detailed for duty at the Naval Academy. In 1868 he was promoted to the rank of lieutenant-commander, and after taking part in a surveying expedition (1870-71), he again spent two years at the Naval Academy. In 1879 he was advanced to the rank of commander, and from 1881 to 1884 he commanded the *Swatara* on the Asiatic station. Two years after his return he was appointed commandant of the Norfolk Navy Yard, a post which he held two years. From 1893 to 1896 he was president of the Naval War College at Newport, R. I., and he was also for several years superintendent of the Naval Academy at Annapolis. In 1897 he was again ordered to sea service, and was appointed commander of the battleship *Indiana.* In the spring of 1898 he joined Admiral Sampson's fleet at Key West, and in May he took part in the bombardment of San Juan. The next month, with the *Indiana* and other war vessels, he conveyed General Shafter's army from Tampa to Santiago, and on July 3d, when Cervera came out of the harbor, his vessel took an important part in the destruction of the Spanish fleet. After the war he was placed in command of the receiving ship *Vermont*, and in 1902 he was appointed chief of the Bureau of Navigation.

TAYLOR, Isaac (1787-1865). An English miscellaneous writer, inventor, and artist, born at Lavenham, in Suffolk. He studied engraving under the direction of his father, with whom he executed the plates for Boydell's *Illustrations of Holy Writ* (1820), commended for their originality by Rossetti. Turning to literature, he joined the staff of the *Eclectic Review* (1818), for which he continued to write for many years. Some time before this he had begun the study of patristic literature and of Lord Bacon. He was known as the great lay preacher of his time. Of his publications we may mention: *The Elements of Thought* (1823; 11th ed. 1867), which grew out of his early studies of Bacon and the Church Fathers; a translation of the *Characters of Theophrastus* (1824) with etchings by himself; *The Natural History of Enthusiasm* (1829; 10th ed. 1845); *Saturday Evening* (1832), a devotional volume which had an immense sale in England and the United States; *Home Education* 1838; 7th ed. 1867); a translation of the *Jewish Wars* of Josephus (1847 and 1851); *Ancient Christianity and the Doctrines of the Oxford Tracts* (8 parts, 1839-40; 4th ed. 1844); and *The Spirit of Hebrew Poetry* (1861). His sisters Jane (1783-1824) and Ann (1782-1866), afterwards Mrs. Gilbert of Nottingham, became well known for their children's verses. Their *Original*

Poems for Infant Minds (1804-05), which ran through more than fifty editions in England and America, were also translated into German, Dutch, and Russian. Equally popular was *Rhymes for the Nursery* (1806), containing from Jane the familiar "Twinkle, twinkle, little star." The sisters also produced *Hymns for Infant Minds* (1810), which has passed through about one hundred editions. Ann wrote the hymn beginning "I thank the Goodness and the Grace." Consult: the *Taylors of Ongar*, by Isaac Taylor (London, 1867); the *Autobiography of Mrs. Gilbert*, ed. by Josiah Gilbert (ib., 1874); and the *Poetical Works of Ann and Jane Taylor* (ib., 1877).

TAYLOR, Isaac (1829-1901). An English ecclesiastic, born at Stanford Rivers. In 1885 he became canon of York Minster. He was the author of *The Liturgy and the Dissenters* (1860), and one or two other theological pamphlets; but was best known by his works on philology. His *Words and Places, or Etymological Illustrations of History, Ethnology, and Geography* (1864; 2d ed. 1865) was a work of great research as well as erudition. In *Etruscan Researches* (1874) Taylor tried, but unsuccessfully, to prove that the Etrurians were allied to the Mongolian races. In 1876 Taylor published *The Etruscan Language;* in 1883 his best known work, *The Alphabet* (2d ed. 1899); and later *The Origin of the Aryans* (1890) and *Names and Their Histories* (1896). He died at Settrington.

TAYLOR, Isaac Ebenezer (1812-89). An American gynæcologist. Educated at Rutgers College and at the medical department of the University of Pennsylvania, Dr. Taylor received his degree from the latter institution in 1834. He was professor of obstetrics and of the diseases of women and children in Bellevue Hospital Medical College, 1861-67; president of the same, 1861-89; professor emeritus, 1867-89. He is credited with the introduction, in connection with Dr. I. A. Washington, of the hypodermic use of medicines.

TAYLOR, Jeremy (1613-67). An English prelate and author. He was born at Cambridge, the son of a barber, and educated at Caius College. He was ordained before he had reached his twenty-first year, and attracted the attention of Laud, who procured him a fellowship at All Souls', Oxford. About the same time he was made chaplain to the King, and in 1638 rector of Uppingham. His first notable publication was *Episcopacy Asserted* (1642). His stand on the Church-and-King side cost him his living. For a while he accompanied the royal army, and then retired into Wales, where he opened a school at Newton in Carmarthenshire. During the thirteen years of his enforced seclusion, he produced his most memorable works—the *Liberty of Prophesying*, on behalf of the expelled Anglican clergy, in 1647; the *Life of Christ* and the *Holy Living* in 1649; the *Holy Dying* in 1652; and a number of other devotional and controversial books. In 1660, with a dedication to Charles II., appeared his *Ductor Dubitantium, or the Rule of Conscience in All Her General Measures*, the most learned, subtle, and curious of all his works. Promotion was a matter of course to one who was at once a stanch royalist, a profound theologian. and a consummate writer; and before the year was out he was made Bishop of Down and Connor. He was not happy in his Irish see, from which he prayed to be delivered as from 'a place of torment.' The Scotch Presbyterian ministers who had occupied the livings under the Commonwealth disputed his belief in the invalidity of their ordination, and were only ejected with difficulty. He remained at his post, however, until his death. Taylor, sometimes styled the English Chrysostom on account of his golden eloquence, has few equals for richness of fancy. His inexhaustible imagery, full of tender beauty, touched with the characteristic melancholy of the age, reminds us of Shakespeare and Spenser and Fletcher rather than of a sober theologian. With Sir Thomas Browne, he is the best representative of the ornate and florid prose of the seventeenth century. His style is perhaps seen at its best in his sermons, though his *Holy Living* and *Holy Dying*, for their deep and practical piety, have been popular devotional manuals for each generation since his time. The best complete edition of his works is that by Eden in ten vols. (London, 1847-52), with a memoir by Bishop Heber, revised by the editor. Consult also the essay by Dowden, in *Puritan and Anglican* (London, 1900).

TAYLOR, John (1580-1653). An English writer, styled by himself the 'King's water poet.' He was born at Gloucester. After studying there at the grammar-school, he was apprenticed to a London waterman. Pressed into the navy, he served under Essex at Cadiz (1596), and, according to his own statements, he made many voyages in the Queen's ships. Retiring from the navy with a lame leg, he became a famous waterman on the Thames. He frequently superintended the river pageants. As trade waned, owing largely to the fashion for coaches, he began writing doggerel, which attracted great attention and secured him the patronage of men of letters. He also made many tours, which furnished him with material for amusing sketches. On the outbreak of the Civil War (1642) he went to Oxford, where he opened a public house. Returning to London (1645), he took the Crown Tavern in Long Acre. There he died. Though Taylor cannot be taken seriously as a poet, his work is interesting as a picture of contemporary manners. Of his separate publications, numbering about 150, may be mentioned the *Penniless Pilgrimage* (1618), an account of a trip to Scotland; *Laugh and Be Fat* (1613), a burlesque of Thomas Coryate's *Odcombian Banquet; Praise of Hempseed* (1620), an account of a voyage from London to Queensborough, in Kent, in a brown-paper boat; and *Travels in Germanie* (1617). In 1630 Taylor brought out an edition of his writings under the title, *All the Works of John Taylor, the Water Poet, being 63 in number.* This folio was reprinted by the Spenser Society (three parts, London, 1868-69). Other pamphlets not contained in the edition of 1630 were also reprinted by the same society (five parts, 1870-78). For a selection consult his *Early Prose and Poetical Works* (London, 1888).

TAYLOR, John (1750-1824). An American legislator and writer, born in Orange County, Va. He graduated at William and Mary College in 1770, and was a member of the United States Senate from 1792 until 1794, for two months in 1803, and from 1822 until his death. In 1798 he moved in the House of Delegates the famous

"Virginia Resolutions." (See VIRGINIA AND KENTUCKY RESOLUTIONS.) He published: *An Inquiry into the Principles and Policy of the Government of the United States* (1814); *Aratos; being a Series of Agricultural Essays, Practical and Political* (6th ed. 1818); *Construction Construed and the Constitution Vindicated* (1820); *Tyranny Unmasked* (1822); and *New Views of the Constitution of the United States* (1822). In his political works he was an ardent advocate of strict construction of the Constitution.

TAYLOR, JOHN (1808-87). The successor of Brigham Young (q.v.) as President of the Church of Jesus Christ of Latter-Day Saints. (See MORMONS.) He was born in England, became a Methodist local preacher, and emigrated to Canada in 1829. In 1836, under the ministration of Parley P. Pratt, he joined the Mormon Church and was elected one of the Twelve Apostles. At the assassination of the Prophet Joseph Smith, Jr. (q.v.), he was himself wounded, but was one of those who counseled the Mormons to keep the peace. Opposing the claims of Sidney Rigdon (q.v.) to the headship of the Church, he started with the first emigrants for the Salt Lake Valley. Appointed in 1849 to the European mission, he published a Mormon monthly in Paris and translated the *Book of Mormon* into French and German. Returning to America in 1854, he was stationed in New York as superintendent over the Eastern churches and there published the *Mormon*. Having served as associate justice of the inchoate State of Deseret, as a probate judge of Utah County, and a member of the Utah Legislature, in 1858 he was indicted for treason against the United States Government. On October 6, 1880, he was elected President of the Church.

TAYLOR, JOHN LOUIS (1769-1829). An American jurist, born in London, England. He removed to Fayetteville, N. C., and was admitted to the bar. From 1792 to 1794 he was a member of the State Legislature, in 1798 was elected a judge of the Superior Court, and was Chief Justice of the Supreme Court from 1810 until his death. In 1817 he was appointed a commissioner for the revision of State statutes, the work being published in 1821. His publications include: *The North Carolina Law Repository* (1814-16); *Term Reports* (1818); and *On the Duties of Executors and Administrators* (1825).

TAYLOR, JOSEPH (1586?-1653?). An English actor, mentioned in the Shakespeare folio of 1623 as one of those who appeared in Shakespeare's plays. His Hamlet, which he acted after Burbage, is interesting on account of the tradition that Shakespeare himself trained him in the part. At different times he was a member of the company at the Globe Theatre and elsewhere, and later in life he was appointed to the Government office of Yeoman of the Revels. Consult Collier, *Memoirs of the Principal Actors in the Plays of Shakespeare* (London, 1846).

TAYLOR, NATHANIEL WILLIAM (1786-1858). An American Congregational theologian. He was born at New Milford, Conn.; graduated at Yale College in 1807. He studied theology five years with Dr. Dwight and was ordained pastor of the First Church (Congregational), New Haven, in 1812, as successor of Moses Stuart. In 1822 he was elected Dwight professor of didactic theology in Yale College, and held the position till his death. In 1828 he preached in New Haven the *concio ad clerum*, presenting views on native depravity which were denounced as heretical, and led to a protracted discussion between him and Dr. Tyler. The controversy attracted much attention in New England and elsewhere. After Dr. Taylor's death, four volumes of his works were edited by President Noah Porter: *Practical Sermons* (1858); *Lectures on the Moral Government of God* (1858); *Essays, Lectures, etc., upon Select Topics in Revealed Theology* (1859). His *Life* was published at New Haven in 1858.

TAYLOR, PHILIP MEADOWS (1808-76). An Anglo-Indian officer and novelist. He was born in Liverpool, England, and when fifteen years old went to India to enter a commercial firm in Bombay, but instead received a commission in the Nizam of Hyderabad's army. In 1841 he was commissioned to pacify the State of Shorapore and was appointed administrator during the minority of the ruler, a task that he accomplished with satisfaction both to the natives and to the British Government. After the Raja's accession he was appointed administrator of the ceded districts in the Western Deccan, his rule during the perilous time of the Mutiny being eminently successful. He returned to England in 1860 and in 1869 was made a companion of the Star of India. Besides his brilliant administrative services Taylor was widely known by his popular novels illustrative of stirring periods in the history of India; the chief of them are: *The Confessions of a Thug* (1839); *Tippoo Suttaun, a Tale of the Mysore War* (1840); *Tara, a Mahratta Tale* (1863); *Seeta* (1872); and *A Noble Queen* (1878), the last two descriptive of the Indian Mutiny. Consult his autobiographical *Story of My Life* (London, 1877).

TAYLOR, RICHARD (1826-79). A Confederate soldier, familiarly known as 'Dick' Taylor. He was the son of President Zachary Taylor, and was born at New Orleans. He graduated at Yale in 1845, and was for a time with his father in the Mexican War. He was a member of the Louisiana seceding convention, and later became colonel of the Ninth Louisiana regiment. He was soon promoted to the rank of brigadier-general; fought under Stonewall Jackson in the Shenandoah Valley campaign, and then in the Seven Days' Battle before Richmond; was promoted to the rank of major-general, and was put in command of Louisiana, the western part of which he recovered for the Confederacy. On April 8, 1864, he defeated General Banks at Sabine Cross Roads, and captured 22 guns and about 2500 prisoners, thereby making it necessary for the Federal general to give up the Red River Expedition and to retreat. On the following day, however, Taylor himself sustained a severe repulse at Pleasant Hill. On May 4, 1865, he surrendered to General Canby. He published *Destruction and Reconstruction* (1879).

TAYLOR, ROWLAND (?-1555). An English martyr. He was born at Rothbury, Northumberland, and was educated at Cambridge, where he became principal of Borden Hastel about 1531. He was associated with Cranmer as domestic chaplain, and received in succession numerous ecclesiastical appointments. At Cambridge he had become acquainted with the Protestant manual *Unio Dissidentium* and was a firm believer in, and adherent to, its doctrines. As rector of the living of Hadleigh, Suffolk, to which he had been presented by Cranmer in 1544, he opposed the performance of mass by a priest in 1554, was imprisoned by order of Queen Mary, condemned to death, and on February 9, 1555, was burnt on Aldham Common, near Hadleigh.

TAYLOR, SAMUEL COLERIDGE. See COLERIDGE-TAYLOR, SAMUEL.

TAYLOR, THOMAS (1758-1835). An English classic scholar known as 'the Platonist.' He was born of humble parents in London. He studied at Saint Paul's School, taught school, and at length obtained a clerkship in a London bank. His spare time he gave to study of chemistry, mathematics, and especially Greek philosophy; and soon after 1780 he began his lectures on Plato, Plotinus, and the Neo-Platonists. Twelve of them were delivered at the house of Flaxman, the sculptor. On receiving an annuity of £100 from a friend, he resigned his place in the bank and began translating and expounding the ancient classical authors, a work for which he was ill equipped. Among his translations are: *Plato* (1804); *Aristotle* (1806-12); the *Orphic Hymns* (1787); *Apuleius; Celsus; Iamblicus; Julian; Maximus Tyrius; Pausanias; Plotinus; Porphyry;* and *Proclus*. Among his miscellanies are: *Vindication of the Rights of Brutes* (1792); *The Eleusinian and Bacchic Mysteries* (1790); and *Theoretic Arithmetic* (1816). Taylor enjoyed the friendship of Peacock, Romney, and Langton. He died at Walworth, London. He figures as a character in Isaac D'Israeli's novel *Vaurien*. Consult W. E. A. Axon, *Thomas Taylor, the Platonist* (London, 1890).

TAYLOR, THOMAS GLANVILLE (1804-48). An English astronomer, born at Ashburton, Devonshire. In 1830 he became director of the East India Company's observatory at Madras, where he collected valuable meteorological and magnetic data, and determined the longitude of Madras. His observations are the first satisfactorily accurate ones made within the tropics. He published the valuable *Madras General Catalogue* (1844), containing the places of 11,015 stars.

TAYLOR, Sir THOMAS WARDLAW (1833—). A Canadian lawyer and judge, born in Auchtermuchty, Scotland. He studied at Edinburgh University, and was admitted to the Upper Canadian bar in 1858. From 1872 to 1883 he was Master of Chancery, and from 1883 to 1887 puisne judge of the Manitoba Court of Queen's Bench. In 1887-99 he was Chief Justice of Manitoba, and in 1890 and 1893 was administrator of the provincial government. He made extensive study of equity jurisprudence, on which subject he published a volume of *Commentaries* (1875). His further works include *Chancery Statutes and Orders* and *The Public Statutes Relating to the Presbyterian Church.*

TAYLOR, TOM (1817-80). An English playwright and journalist, and editor of *Punch*, born at Bishop-Wearmouth, near Sunderland. After attending the University of Glasgow he entered Trinity College, Cambridge, where he was elected fellow of his college (1842). He tutored at Cambridge for two years and was then appointed professor of English literature in London University. He also studied law at the Inner Temple, where he was called to the bar in 1846. On the creation of the Board of Health in 1850, he became its assistant secretary and afterwards its secretary. He began early to write for various London periodicals, but chiefly for *Punch*, of which he became editor in 1874. Much interested in art, he wrote biographies of Benjamin Robert Haydon (1853), and of Sir Joshua Reynolds (1865), and edited *Charles Robert Leslie's Autobiographical Recollections* (1860) and *Pen Sketches by a Vanished Hand* (1879), a collection of essays by Mortimer Collins. He also wrote or adapted more than a hundred dramatic pieces. In them he showed himself a great master of stage craft. Among the most popular were: *Still Waters Run Deep* (1855); *The Overland Route* (1860); *'Twixt Axe and Crown* (1870); *The Ticket-of-Leave Man* (1870); and *Lady Clancarty* (1874). In *Masks and Faces* (performed in 1852) he collaborated with Charles Reade.

TAYLOR, WILLIAM (1765-1836). An English philologian, known sometimes as William Taylor of Norwich. He was born in Norwich, England. He became an enthusiast for the literature of Germany, and devoted most of his life to making it known to his countrymen. His finest production was a translation of Bürger's *Lenora* in ballad metre (completed 1870; published 1796), which led to Scott's version. He also translated Lessing's *Nathan the Wise* (1791), Goethe's *Iphigenia* (1793), and some of Wieland's *Dialogues of the Gods* (1795). By this time he was writing on German literature extensively for the reviews. These articles were collected under the title *Historic Survey of German Poetry* (1828-30). Though interesting for his many eccentricities, Taylor has a place in literary history as the first interpreter of German literature for England. He died at Norwich. Consult: the *Memoir* by Robberds (London, 1843); and Herzfeld's valuable monograph, *William Taylor von Norwich* (Halle, 1897).

TAYLOR, WILLIAM (1821-1902). A missionary bishop of the Methodist Episcopal Church. He was born in Rockbridge, Va., and entered the Baltimore Conference in 1843. He was missionary to California (1849), and organized the first Methodist church in San Francisco. He was an evangelist 1856-61, and left America, visiting England, Ireland, and Palestine in 1862. He was evangelist in Australia (1863-66); South Africa (1866); West Indies (1867); Australia (1869-70); Ceylon (1870-76), establishing the South India Conference on a self-supporting basis; and South America (1877-83), with brief intervals in the United States. He was elected Missionary Bishop of Africa in 1884, and retired in 1896. He wrote the following works: *Seven Years' Street Preaching in San Francisco* (1857); *The Model Preacher* (1859); *Christian Adventures in South Africa* (1867); *Reconciliation, or How to Be Saved* (1867); *Election of Grace* (1875); *Infancy and Manhood of Christian Life* (1875); *Four Years' Campaign in India* (1875); *Our South American Cousins* (1878); *Self-Supporting Missions in India* (1882); *The Story of My Life* (1895); *Flaming Torch in Darkest Africa* (1898).

TAYLOR, WILLIAM MACKERGO (1829-95). A Congregational minister. He was born at Kilmarnock, Ayreshire; graduated at the University of Glasgow (1849); and at the divinity hall of the United Presbyterian Church, Edinburgh (1852). He was ordained pastor of the United Presbyterian Church at Kilmaurs (1853); pastor of the United Presbyterian Church at Derby Road, Liverpool (1855); pastor of the Broadway Tabernacle (Congregational), New York (1872), and so continued till 1893, when he retired in consequence of a paralytic stroke. Besides biographies of Rev. Matthew Dickie (1872) and of John Knox (1885), he published numerous volumes of sermons and discourses, of which those of a biographical character on Joseph, Moses, David, Elijah, Daniel, Paul, were very popular. He delivered the Lyman Beecher lectures at Yale in 1876, *The Ministry of the Word;* the L. P. Stone lectures at Princeton, *The Gospel Miracles in Their Relation to Christ and Christianity* (1880); also published *The Scottish Pulpit from the Reformation to the Present Day* (1887). A brief memoir appeared in New York in 1895.

TAYLOR, ZACHARY (1784-1850). The twelfth President of the United States. He was born in Orange County, Va., on November 24, 1784, and was the son of Col. Richard Taylor, an officer of the Revolutionary War and one of the first settlers of Louisville, Ky., whither Zachary was taken in early childhood, and where he lived until his twenty-fourth year, working on a plantation and receiving only an elementary education. His elder brother, who had received a lieutenancy in the army, died in 1808, when Taylor was appointed to the vacant commission. In 1810 he was promoted to a captaincy; and in 1812, with 50 men, two-thirds of whom were ill of fever, he defended Fort Harrison, on the Wabash, against a large force of Indians led by Tecumseh. Promoted to the rank of major for his gallantry, he was employed during the war in fighting the Indian allies of Great Britain. In 1822 he built Fort Jesup; in 1832 he served as colonel in the Black Hawk War; and in 1836 was ordered to Florida, where he gained an important victory over the Seminole Indians at Okeechobee, for which he was appointed brigadier-general, and was made commander of the United States forces in Florida. In 1840, having been appointed to the command of the Southwestern Department, he purchased a plantation near Baton Rouge, La. On February 28, 1845, Congress passed the resolution for the annexation of Texas, formerly a province of Mexico, and for some time an independent republic. Texas claimed the Rio Grande for her southwestern boundary; Mexico insisted that there could be no claim beyond the Nueces, and prepared to defend the disputed territory, even if she could not reconquer the whole of Texas. General Taylor was ordered to Corpus Christi. This point he occupied in November with a small force which was increased by reenforcements to 4000 men. On March 28, 1846, he had moved to the Rio Grande, across the disputed territory, and had begun to build Fort Brown, opposite and commanding the Mexican port of Matamoros. General Ampudia, the Mexican commander, on April 12th, demanded that he should retire beyond the Nueces, pending negotiations; and on the refusal of General Taylor, his successor, General Arista, crossed the Rio Grande with a force of 6000 men and 10 pieces of artillery. On May 8th he was defeated at Palo Alto by General Taylor, with a force of 2300; and on the next day was driven from a new position at Resaca de la Palma across the Rio Grande. War was declared first by the President, and later by Congress, to exist by the act of Mexico; and 50,000 volunteers were called for. Taylor was made major-general, was reenforced, and ordered to invade Mexico. On September 9th, with 6600 men, he attacked Monterey, which was defended by about 10,000 regular troops. After ten days' siege and three days' hard fighting, it capitulated. General Scott, having been ordered to advance on the City of Mexico by Vera Cruz, withdrew a portion of the troops of General Taylor, leaving him only 5000 volunteers and 500 regulars, chiefly flying artillery, to meet an army of 21,000, commanded by Santa Anna. He took a strong position at Buena Vista, fought a desperate battle, on February 22 and 23, 1847, and won a decisive victory. (See MEXICAN WAR.) This victory, against enormous odds, created the utmost enthusiasm. General Taylor, popularly called 'Old Rough and Ready,' was nominated by the Whigs in 1848 for President of the United States, and was elected, receiving 163 electoral votes, while General Cass, the Democratic candidate, received 127 electoral votes, and Martin Van Buren, the Free Soil candidate, received none. Entering upon the Presidency in 1849, he found a Democratic plurality in Congress, with a small but vigorous Free-Soil Party holding the balance of power, while the most exciting questions connected with the extension of slavery, as the admission of California, the settlement of the boundaries of Texas, the organization of the other newly acquired Mexican territories, etc., were agitating the country, and threatening a disruption. On July 4, 1850, sixteen months after his inauguration, he was attacked with bilious colic, and died on the 9th. Consult Howard, *General Taylor* (New York, 1892), in the "Great Commanders Series." See UNITED STATES.

TAY'LORVILLE. The county-seat of Christian County, Ill., 26 miles southeast of Springfield; on the Wabash and the Baltimore and Ohio Southwestern railroads (Map: Illinois, C 4). It has a public library (Carnegie), and a fine court-house. Taylorville is surrounded by a productive section engaged in farming, stock-raising, and horse-breeding. There are also coal mines in operation near the city. Paper, chemicals, brick, tile, wagons, bags, and agricultural implements constitute the principal manufactures. The government is vested in a mayor, chosen biennially, and a unicameral council. The water-works are owned and operated by the municipality. Taylorville was settled about 1839, and was incorporated in 1882. Population, in 1890, 2829; in 1900, 4248.

TAYRA, or **TAIRA** (South American name). A plantigrade, weasel-like carnivore of Central and South America (*Galictis barbara*), closely allied to the grisons (q.v.). It is about three feet long, nearly half of this belonging to the bushy tail; dark brown above, yellowish below; preys upon small animals, and often gathers into small bands which hunt in company, usually in the early morning.

TAY'TAY. A pueblo and the chief town of the Province of Paragua, Palawan Island, in the Philippines; situated in the southwestern angle of the bay of the same name in the northeastern part of the island, in latitude 10° 50′ N., longitude 119° 30′ E. The bay of Taytay is about 11 miles long and 6 miles wide, and affords good shelter in the southwest monsoon. There is a fort with walls 30 feet high and accommodations for 700 men. In the neighborhood of the town are large tracts of cultivated ground. A bridle path connects Taytay with the harbor of Malampaya, 4 miles away, on the western coast of the island. Population, about 1750.

TAYUG, tȧ-yo͞og′. A town of Luzon, Philippines, in the eastern part of the Province of Pangasinán, situated 28 miles east of Lingayén (Map: Luzon, E 2). Population, in 1887, 9954; now 19,600.

TAZE′WELL, Littleton Waller (1774-1860). An American political leader, born at Williamsburg, Va. He graduated at William and Mary College in 1792; was admitted to the bar in 1796; was a member of Congress in 1801-03; and then devoted himself to the practice of law. From 1824 until 1833 he was a member of the United States Senate. As a member of the Committee on Foreign Relations he wrote the famous report on the Panama mission. He opposed most of the acts of Adams and of Jackson; was an enemy to the policy of protection; denounced nullification, but was not in sympathy with Jackson's method of suppressing it; and attacked the Administration for removing the deposits from the United States Bank. In 1834 he was elected Governor of Virginia, and after serving his term withdrew from public life. His principal published work is *Review of the Negotiations Between the United States and Great Britain Respecting the Commerce of the Two Countries* (1829).

TCHAD. A lake of Central Africa. See Chad.

TCHAIKOVSKI, chī-kôf′skĭ. See Tschaikowsky.

TCHEKHOFF, chĕk′ôf, Anton Pavlovitch (1860—). A Russian novelist, born of former serfs at Taganrog (Southern Russia). In 1884 he received the degree of M.D. at Moscow, but never practiced medicine, as his literary career (begun in 1879 in humorous periodicals) held out promise of great success. His collected *Humorous Stories* and *In Twilight* (1887) and *Morose Folks* (1890) attracted general attention, and from that time his reputation increased rapidly, until at present he occupies with Gorki the front rank of the younger Russian writers. The latest edition of his works appeared in eleven volumes (Saint Petersburg, 1900). The *Memoirs of a Stranger, Fires, Ward No. 6, A Tedious Story,* and *Steppe* are the best of his longer works. The general tenor of all his works, bristling with sallies of humor, stinging wit, and often verging on caricature or the farcical, is pessimistic anger. But in all his writings the native humor is so pronounced that they are read by all classes with the greatest avidity.

TCHELYABINSK, chĕl-yȧ-bĭnsk′. An important district town in the Government of Orenburg, Eastern Russia, 363 miles northeast of Orenburg (Map: Russia, K 3). As the western terminus of the Trans-Siberian Railway the town has considerable commercial importance. Population, in 1897, 19,891.

TCHELYUSKIN, chĕl-yo͞os′kĭn, Cape. See Severo Cape.

TCHER′EMIS′SES. A Finnish tribe of Eastern Russia, living in the region on the left bank of the middle Volga—Vyatka, Kazan, and the adjoining governments. They number about 250,000. Their average height is 1.61 meters, the cephalic index 79. In general, they have red hair and a full beard of the same color; their eyes are sunken and of blue, greenish, or chestnut shade; the complexion is fair and freckled, the cheek bones prominent, the face and lips thin, the chin round, and the nose straight. Some authorities believe that they received through the Bulgarians the Tatar influences displayed in their social life, their houses, costumes, social organization, and religious ideas. They believe in evil and good gods, the former called 'Yo' and the latter 'Yurnon Bairan,' and there is evidence that they believe in life after death and in spirits. While the corn blossoms they will not work, and at the end of the period they sacrifice cows, sheep, and fowls in a curious ceremony in which they put the head, heart, and liver of the sacrifice in a bowl and offer it up with prayer before the fire. For three days they eat and pray, and at the end of the ceremony throw whatever is not consumed into the fire, which is kept continually burning. They have also many magical rites to ward off the evil influences of the spirits of the wood, river, and snow and to keep the ghosts of the dead in their graves. Consult Smirinov, *Mordves et Tcheremisses* (Paris, 1895).

TCHERKASSY, chĕr-käs′sē. A district town in the Government of Kiev, South Russia, situated on the Dnieper, about 200 miles southeast of Kiev (Map: Russia, D 5). It trades in grain, tobacco, and sugar. Population, in 1897, 29,619.

TCHERNAYA, chĕr-nä′yȧ. A small river in the Crimea, Government of Taurida, Southern Russia, flowing into the Black Sea near Sebastopol. On August 16, 1855, the Russians, numbering 74,000 men, who were besieged in Sebastopol, advanced against the Allies, numbering 39,630, and on the banks of the Tchernaya were repulsed with heavy loss.

TCHERNAYEFF, chĕr-nä′yĕf, Mikhail Grigorievitch (1828-98). A Russian general. He fought in the Crimean War and in the Caucasus and went to Turkestan in 1864 as major-general and captured Tashkend. He left the army in 1867, commenced the practice of law at Moscow, and became an ardent advocate of Panslavism (q.v.). In 1876 he was given the command of the Servian army on the Morava and was defeated by the Turks at Alexinatz, October 29th. In 1879 he tried to organize a revolution in Bulgaria and was sent as prisoner to Adrianople and thence brought to Russia. From 1882 to 1884 he was Governor-General of the military department of Tashkend in Turkestan.

TCHERNIGOV, chĕr-nē′gêf. A government in the southwestern part of Russia. Area, 20,233 square miles (Map: Russia, D 4). The surface is level, and in the north marshy. It is watered by the Dnieper and the Desna. The chief occupation is agriculture and the principal products are rye, buckwheat, potatoes, wheat, and tobacco. Stock-raising is also important. There is an abundance of porcelain clay, which is used extensively for the production of porcelain ware; wooden ware is also largely manufactured. There are a number of sugar refineries and distilleries.

Population, in 1897, 2,322,007, consisting largely of Little Russians. Capital, Tchernigov (q.v.).

TCHERNIGOV. The capital of the Government of Tchernigov, Russia, situated on the Desna, 476 miles southwest of Moscow (Map: Russia, D 4). It has two cathedrals dating from the eleventh and the twelfth centuries and remains of an old castle. Population, in 1897, 25,580. Tchernigov rose to political and commercial importance as early as the eleventh century.

TCHERNYSHEFF, chĕr′nĭ-shĕf′, Alexander Ivanovitch, Prince (1786-1857). A Russian general. He served against the French at Austerlitz and Friedland, and on the side of Napoleon at Aspern and Wagram. He bore an important part in the campaigns of 1813-14; was made a count in 1825 and Minister of War in 1828. Nicholas I. created him a prince in 1841.

TCHERNYSHEVSKI, chĕr′nĭ-shĕf′skē, Nikolai Gavrilovitch (1828-89). A Russian publicist and author, born at Saratov. He went in 1846 to the Saint Petersburg University, and soon after devoted himself to literary work. In 1862 he was put into prison for his radical views, and there he wrote in 1863 his novel *What's to Be Done?* which became the political gospel of the Nihilists. He was in exile in Siberia until 1883 when he was allowed to settle at Astrakhan, and at his native town in 1889, a few months prior to his death. Tchernyshevski's historical mission lies in shaping the liberal thought of Russia. His works, which include a translation of Mill's *Political Economy,* were published in Switzerland in 1868-70, in 4 volumes. Consult Plekhanoff, *Tchernyshevski* (Stuttgart, 1894).

TCHETCH′EN, or **CHECHEN.** One of the eastern groups of the peoples of the Caucasus, dwelling between the Kabards and Lesghians and numbering about 225,000 (cephalic index, Eastern Tchechen, 84.5). Tchetchen is the name given them by the Russians; the Georgians call them Kisti, but their native appellation is Nakhtche, or 'people.' They are one of the most primitive peoples of the Caucasus and in their mountain fastnesses even now resist Russian conquest. Their religion seems to be Islamism imposed upon an earlier crude form of Christianity with a heathen background. By language they rank as an independent stock.

TCHIGORIN, chĭg′ō-rĭn, Michael (1850—). A Russian chess master, born in Saint Petersburg. He was engaged for a time in the Russian civil service, but early became interested in chess, and at the Berlin tournament of 1881 increased his local fame as an expert by following Blackburn and Zukertort in the list of victors. He was defeated by Steinitz at Havana in 1889, although two years afterwards he won two cable matches. In 1892 he made an unsuccessful attempt to win the world's championship. At the Moscow tournament of 1899 he won first prize, divided the first honors in 1900 at the National Russian Tournament, and was third in the International Masters' Tournament held at Monte Carlo in 1901.

TCHIKHATCHEFF, chē′kȧ-chĕf′, Peter Alexandrovitch (1808-90). A Russian geologist and traveler. In 1842, with Elie de Beaumont, Heppert, and Verneuil, he investigated the Altai Mountains, the result being *Voyage scientifique dans l'Altaï oriental et les parties adjointes de la frontière de Chine* (1845). An attaché in the Russian Embassy at Constantinople (1845-47), he mastered Turkish, and during 1847-63 traversed Asia Minor, making large geological, paleontological, archæological, zoölogical, and botanical collections. He embodied the results of his studies in *Asie Mineure* (1853-69). Among his other works are *Etudes de géographie et d'histoire naturelle* (1890).

TCHISTOPOL, chēs-tō′pôl. A district town in the Government of Kazan, Russia, situated on the Kama, 90 miles southeast of Kazan (Map: Russia, H 3). It has flour mills, distilleries, and cotton mills. Population, in 1897, 20,161.

TCHITA, chē′tȧ. The capital of the Territory of Transbaikalia and an important centre of Eastern Siberia, on the Tchita River and the Trans-Siberian Railway, 532 miles by rail east of Irkutsk (Map: Asia, L 3). Population, in 1897, 11,480, largely Buriats.

TCHITCHAGOFF, chē-chä′gôf, Pavel Vassilievitch (1765-1849). A Russian admiral. He served under his father, Vasili Yakovlevitch (1726-1809), a Russian admiral, and completed his studies in England (1792-93). As head of the Navy under Alexander I. he greatly promoted the efficiency of the service. In 1812 he received an important military command, but failing to prevent Napoleon's recrossing the Berezina he fell into disgrace and left Russia. His *Memoirs* (1886-88) are valuable.

TCHORLU, chôr′lo͞o. A town of the Vilayet of Rodosto, in European Turkey, on the Tchorlu River, a tributary of the Ergene, 20 miles northeast of Rodosto (Map: Balkan Peninsula, F 4). There are Christian churches and mosques. Wine and fruit are produced; native carpets and woolen cloth are manufactured. Population, about 11,500.

TCHUKTCHI, cho͞ok′chē, or **CHUKCHI** (from *cháwtcy,* rich in reindeer). A people living in the extreme northeast of Asia, numbering some 15,000. The 'reindeer Tchuktchi' dwell in the interior about the Kolyma River; the 'sea (or fishing) Tchuktchi,' who form the great majority, inhabit the coast of the Arctic from Bear Island to East Cape, while on the Pacific side they have mingled with the Eskimo. They are tall, well built, rather light-skinned, decidedly brachycephalic in part (there seem to be two physical varieties among them), and differ somewhat in form and features from the typical Mongolians, with whom they are allied by speech. Besides an interesting Shamanism, the Tchuktchi have a wealth of folk-lore and mythology not without traces of Eskimo influence. Among them, as among several other savage tribes, the old men commit suicide with great ceremony.

TCHUST, cho͞ost. A town in the Territory of Ferghana, Russian Turkestan, 110 miles northeast of Khokand (Map: Persia, M 1). The natives manufacture knives and saddles. Population, in 1897, 13,686.

TCHUVASHES, cho͞o-văsh′ĕz. A people of Eastern Russia, probably of Finnic origin, and now with a strong Tatar admixture. Their seat is near the Volga and they number somewhat over 500,000. Their language, which is distinct, is assigned to the Ural-Altaic stock. They are industrious and orderly, their chief occupations being agriculture and cattle-breeding. The Tchuvashes are nominally Christians, but more primitive Shamanistic beliefs and practices are still prevalent among them. Consult Schott, *De Lingua Tschuwaschorum* (Berlin, 1841).

TEA (from Fuhkien Chin. *te*, Chin. *ts'a*, *ch'a*, tea), *Camellia Thea*, or *Thea Sinensis*. A shrub, the dried leaves of which are one of the most important articles of commerce, and yield one of the most esteemed and extensively used of all non-alcoholic beverages. The tea shrub, which is a native of subtropical Asia, but is grown in tropical climates also, is 20 to 30 feet high, but under cultivation only three to six feet high, with numerous branches and lanceolate leaves, two to six inches long. The flowers are axillary, rather large, white, and fragrant. Numerous varieties have been produced in China, where tea is grown chiefly on the southern slopes of hills in the regions between latitudes 24° to 35° N., and longitudes 115° to 122° E. A new plantation is made by sowing two or three seeds at proper distances. The first crop is obtained in the third year, when the shrub is still small. When about seven years old, it yields only a scanty crop of hard leaves, and is cut down, to induce new shoots to sprout from the root. This is frequently repeated till the plant dies at about thirty years of age.

TEA (*Thea Sinensis*).

History and Commerce. Tea appears to have been used for ages in China, where it is believed by the natives to be indigenous. At the end of the sixteenth century it is mentioned by Maffei, a Portuguese writer, in his *Historiæ Indicæ*, as a product both of China and Japan. On June 27, 1615, a Mr. Wickham wrote the first English record of it. His letter is among the documents of the East India Company. From this time it became gradually known to the wealthy citizens of London, who received presents of small quantities from China via India, or by small, exorbitantly dear lots in the markets—sometimes as much as £10 a pound. In 1657 a rather large consignment was received by Thomas Garraway, a London merchant, who established a house for selling the prepared beverage.

The tea-farms of China are usually small, and require careful cultivation and much attention; for the plant will thrive only in well-manured or very rich soil. Although an evergreen, the leaves are useful only at certain seasons. Some of the new leaves, which appear in April, are made into young hyson of such fine quality that it has rarely been used for distant export because it is said to lose flavor by the sea-voyage. Much is, however, sent overland to Russia, where it commands an exorbitant price. The ordinary picking begins in May; and later in the season, a third picking of an inferior, more bitter woody grade is obtained and sold mainly to poor people. The odor and flavor of dried tea are developed by the oxidation which the leaves undergo in the process of drying. Moreover, different qualities and colors are prepared from the same leaves, which may also be roasted and scorched to produce the different varieties distinguished by odor and taste. For *green teas* the leaves are roasted in pans for about five minutes almost immediately after they are gathered. After being rolled with the hands upon a table they are returned to the pans, and kept in motion by the hands for about an hour. They are then dull green, but become brighter afterwards. For *black teas*, they are spread and tossed in the air till they become flaccid; they are then roasted for a few minutes, rolled, exposed to the air for a few hours while soft and moist, and lastly dried slowly over charcoal fires, till they become almost black. Hence their dark color and distinguishing flavor seem due to the long exposure to the atmosphere in the process of drying, and the oxidation of certain inherent ferments acting rapidly upon the juices of the leaf, and especially upon the astringent principle during this exposure. For the purpose of giving special odors to different varieties of tea, numerous odoriferous plants are employed in differents parts of China, the blossoms of the sweet-scented olive (*Osmanthus fragrans*) being frequently used. In China spurious teas have been prepared and exported under the name of 'lie teas,' but they have not been popular. The Chinese color ('face') the export green teas with Prussian blue, turmeric, etc., to please the eye. Facing is not regarded as adulteration, which is unlawful in the United States.

In 1836, after some difficulty in obtaining plants, the culture of tea was attempted on a large scale in India. Plantations had been formed at an earlier period in Assam and had made great progress. In Ceylon the culture of tea has extended. Large quantities are also produced in Java, the industry being carried on by wealthy companies. The growth of this plant has been attempted in South Carolina, with considerable success, and experiments are being made in several other Southern States.

Among the numerous varieties of tea used in the United States are the following: Green. *Chinese.*—(1) Gunpowder sorts—Shanghai, Pingsuey Moyune, Imperial Moyune, and Canton; (2) Hyson sorts—Shanghai, Shanghai young, Moyune, Moyune young, Canton young, and Twankay or Imperial Hyson. *Japanese*—Gunpowder and young Hyson. *Java*—Gunpowder. Black. *Chinese.*—(1) Conjou sorts—Canton Foo-chow-foo, Hung-muey, Oopack Kaison, and Oonam; (2) Pekoe sorts—plain orange Foo-chow, scented orange, Canton scented orange and flowery Pekoe, Oolong, and Souchong. *Assam*—Conjou orange Pekoe, and Souchong. *Java*—Conjou and, rarely, Imperial.

The use of teas as a beverage is general in

Southeastern Asia, and has become prevalent among the British, the Russians, and the Dutch. Among other European peoples its use is much less general, and is chiefly confined to maritime districts, towns, and the wealthy.

Where tea is difficult to obtain substitutes of two sorts are used: those, such as Maté, guarana (qq.v.), coffee leaves and kolanut, which contain theine or caffein (q.v.), and which consequently have the stimulating effect; and those, such as Siberian tea (*Saxifraga crassifolia*), Appalachian tea (*Viburnum cassinoides*), Labrador tea (*Leiophyllum buxifolium*), Chilean tea (*Myrtus Ugni*), Trinidad pimento tea (*Pimenta officinalis*), which resemble the true tea in flavor or smell, or which possess some other stimulating principle. See Plate of Beverage Plants.

TEACH, or **THATCH,** Edward (?-1718). An Anglo-American pirate, popularly known as Blackbeard. Probably he was born at Bristol, England, and in his youth went to the West Indies. He became widely known and feared for his robberies and atrocities, throughout the West Indies and along the coast of Carolina and Virginia. For winter quarters he built himself a house which is still standing, on the upper bank of the Pasquotank, N. C., accessible only from the Sound. There on November 22, 1718, he was attacked by two small sloops under the command of Lieutenant Maynard of the British Navy, and by a successful ruse led to board the vessels, when he with several of his men was killed, and of the 15 prisoners taken, 13 were subsequently hanged. His *Life* is included in Charles Johnson's *Lives of the Pyrates* (1724), and he appears in Howard Pyle's *Jack Ballister's Fortunes* (1894).

TEACHERS COLLEGE. An institution in New York City for the training of teachers and school administrators, founded in 1888, and made a part of the educational system of Columbia University (q.v.) in 1898, taking academic rank with the schools of law, medicine, and applied science. The college is represented in the Columbia University Council by its dean and an elected representative of the faculty, but maintains its separate corporate organization, with a board of trustees who assume the entire financial responsibility for its maintenance. The departments of instruction are history and philosophy of education, educational administration, educational psychology, elementary and secondary education, English, French, and German, Greek and Latin, history, biology, geography, physics and chemistry, mathematics, kindergarten, fine arts, domestic art, domestic science, manual training, music and voice training, and physical education. No department undertakes work for which adequate provision is made in other faculties of the university. The college maintains two schools of observation and practice: the Horace Mann School, with kindergarten, elementary and high school departments, and the Speyer School, consisting of a kindergarten, an elementary school, and special classes in sewing, cooking, and manual training. The large demand for university extension work in 1902-03, when 45 courses were given, led to the establishment of an extension department, beginning in September, 1903. The buildings, five in number, were valued in 1903 at $2,000,000, when the endowment was $190,000, and the gross income $230,000. The total registration was 3018, including 729 collegiate students, 1093 in the Teachers College schools, and 1196 extension students. The Bryson Library contains 22,000 volumes.

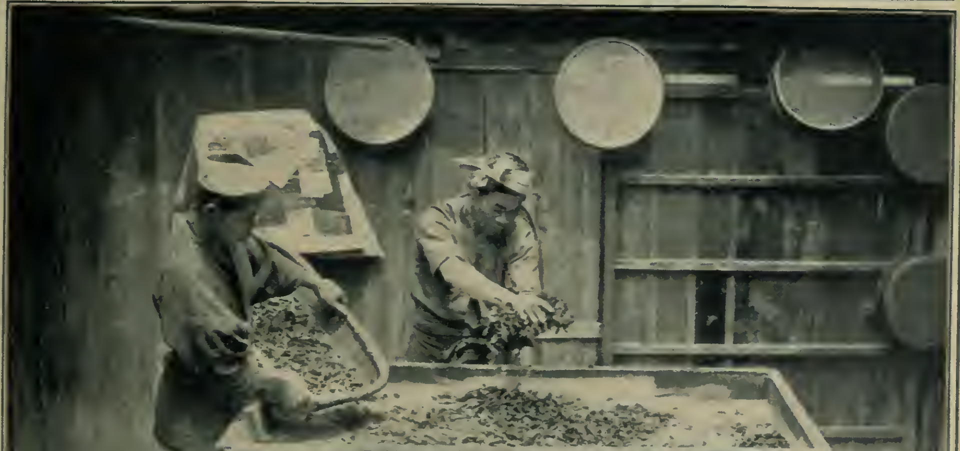
TEACHING OF THE TWELVE APOSTLES (Gk. *διδαχὴ τῶν δώδεκα ἀποστόλων*, *didachē tōn dōdeka apostolōn*), also called the Didache. An ancient Christian document, written in Greek, probably before 150, of great value for the study of organization, belief, and worship in the early Church. It was found in 1873 by Bryennios (q.v.), Metropolitan of Nicomedia, in an eleventh-century manuscript in the Monastery of the Holy Sepulchre in Constantinople, and was published by him ten years later. Modern editors include it, by general consent, among the Apostolic Fathers (q.v.). The *Teaching* was apparently compiled from earlier material, for use as a church manual. It contains a description of the Two Ways, one of life, the other of death, in the form of rules for Christian conduct, somewhat akin to the Decalogue, but longer. Whether or not this part of the *Teaching* was originally separate from the rest, it is evident that it was used in catechetical instruction, to prepare converts for baptism. The second portion of the *Teaching* sets forth the proper observance of the rites of baptism and the Lord's Supper, with directions for their administration, and prayers and forms for use in the same. It further defines the office and duties of the Christian leaders, especially apostles, prophets, teachers, bishops, and deacons. Ceremonial and organization are alike extremely simple. The whole concludes with a paragraph announcing the speedy second coming of Christ and the final judgment.

The *Teaching* was held in high honor in the early Church, falling short, however, of canonicity. It forms the basis of the seventh book of the *Apostolic Constitutions* (q.v.), and bears some literary relationship to the *Shepherd* of Hermes and perhaps to the *Apology* of Aristides. Most critics are inclined to attribute it to Syria or Egypt, but no decisive argument exists for either. By the fourth century the *Teaching* had taken its place definitely among the 'ecclesiastical' as distinguished from the 'canonical' books, and it was thenceforward employed only for edification, not for authoritative teaching in the Church. Consult: Schaff, *The Teaching of the Twelve Apostles* (3d ed., New York, 1889); Harris, *The Teaching of the Apostles* (Baltimore, 1887; contains facsimiles of the manuscript); Cruttwell, *Literary History of Early Christianity* (London, 1893; contains an English translation); Krüger, *History of Early Christian Literature* (New York, 1897). The text will be found critically edited, in Funk, *Patres Apostolici* (2d ed., Tübingen, 1901).

TEAGUE. A faithful and humorous footman in Howard's *Committee*, who gave his name for some time afterwards to many Irishmen in the literature of the later Stuarts. The part, said to have been drawn from a servant of the author's, was most successfully created by the actor Lacy.

TEA INSECTS. The tea plant is attacked by several injurious insects, as the faggot-worm (*Eumeta Carmerii*), one of the bagworms, whose larva carries a case made up of fragments of twigs and feeds upon leaves of the plant. The tea borer (*Zeuzera coffeæ*) is the larva of a

TEA



1. THE LAST PICKING.

2. DRYING THE LEAVES IN A TEA-HEATER.

cossid moth; it bores into the stems of both coffee and tea plants. Three species of bark-lice (*Aspidiotus theæ*, *flavescens*, and *transparens*) also occur commonly upon tea, and the first named is one of the most serious enemies of the growing plant, very noticeable at the time of pruning. Three mites feed upon the leaves, one of them a 'red spider' (*Tetranychus bimaculatus*), another the five-legged tea-mite (*Typhlodromus carinatus*), closely related to the rust-mite of the orange. It feeds upon the lower leaves. The yellow tea-mite (*Acarus translucens*) feeds upon the buds and produces the condition called 'sulky.' Consult Watt, *The Pests and Blights of the Tea Plant* (Calcutta, 1898).

STICK-COVERED COCOON OF A FAGGOT-WORM.

TEAK (Malayan *tekka*, Tamil *tekku*, teak-tree). Two kinds of timber, valuable for shipbuilding and other purposes. Indian teak (*Tectona grandis*) belongs to the natural order Verbenaceæ; African teak or African oak (*Oldfieldia Africana*), to the Euphorbiaceæ. The former is found in the mountainous parts of Malabar and other parts of Southeastern Asia. The teak forests of India are mostly under governmental control and yield a considerable revenue. The usual practice is to girdle the trees and allow them to stand for two years to season thoroughly before felling. Teak has been introduced in some parts of India in which it is not indigenous. It is a beautiful tree which rises above all the other trees of the East Indian forests, sometimes attaining a height of 200 feet. Silk and cotton stuffs are dyed purple by the leaves. The timber, which will sink in water unless dry, is one of the most valuable produced in the East; it resembles coarse mahogany, is easily worked, strong, durable, and not liable to the attacks of insects. It is largely used for furniture, some of which is handsomely carved, and for shipbuilding, for which purpose it is exported. The teak generally grows rather in clumps in forests than in forests of itself. African teak is adapted to the same uses as the Indian teak, through it is not quite as durable.

TEAL (connected with Dutch *teling*, teal, brood, *telen*, to breed, and perhaps with AS. *tilian*, Eng. *till*, OHG. *zil*, Ger. *Ziel*, object). One of a group of small beautiful fresh-water ducks, mostly in the genera Nettion and Querquedula. They are migratory, going to the tropics for the winter, and when in the United States are shy and silent, feeding chiefly at night on water-plants, seeds, worms, and insects. They make their nests usually at some distance from water and lay greenish, or in some species cream-colored eggs. Species of these two genera are known in all parts of the world. The commonest North American species is the green-winged teal (*Nettion Carolinense*). This fine bird is nearly the same as the 'common' teal (*Nettion crecca*) of the northern parts of the Old World. About a dozen other species are met with in Asia, Africa, and South America, all favorites among gunners and epicures. The blue-winged teal (*Querquedula discors*), represented in Europe by the garganey (q.v.), is very abundant in many parts of North America. It is rather larger than the common teal. The head and neck are blackish with a large white crescent in front of the eye. The wing-coverts are sky-blue and the under parts are purplish gray with black spots. The cinnamon teal (*Querquedula cyanoptera*) is also blue-winged, but the general color is rich purplish chestnut and there is no white on the head. This is a South American duck, which is also common west of the Rocky Mountains as far north as Oregon. Two other species belong to South America. Consult authorities and Plate under DUCK.

TEANO, tȧ-ā'nō. A city in the Province of Caserta, Italy, 42 miles north-northwest of Naples, at the foot of the extinct volcano Rocca Monfina. It was one the leading cities of Campania. The present town is interesting for its old ruins, among them a castle. Population (commune), in 1901, 13,326.

TEARSHEET, DOLL. A vicious and vigorous female character in the second part of Shakespeare's *Henry IV*.

TEARS OF THE MUSES. A poem by Edmund Spenser, published in 1591, by Ponsonby. It is a discussion of the mediocrity of the literature of the day, and is put into the mouths of the various muses, who thus deplore the decay of their power. Its source is a Latin poem by Harvey (1588). In the *Midsummer Night's Dream*, V. i., Shakespeare describes the work as 'a piece sharp and satirical.'

TEASEL (AS. *tæsel*, *tæsl*, OHG. *zeisala*, teasel, from AS. *tæsan*, Bavarian Ger. *zaisen*, to tease wool), *Dipsacus*. A genus of plants of the natural order Dipsacaceæ. The only valuable species is the fuller's or clothier's teasel (*Dipsacus fullonum*), a native of Southern Europe, naturalized in the United States. It is a biennial, several feet high, with sessile serrated leaves, prickly stems and leaves; and with cylindrical heads of pale or white flowers, between

TEASEL (*Dipsacus sylvestris*).

which are oblong, hook-pointed, acuminated, rigid bracts. The plant is cultivated for the heads, which are cut off when in flower, and are used for raising the nap of cloth, a purpose for which no mechanical contrivance has been found to equal them. The split heads are fixed on the circumference of a cylinder, which is made to revolve against the surface of the cloth. The wild teasel (*Dipsacus sylvestris*), from which fuller's teasel is supposed to have originated, has straight instead of hooked prickles on the heads. It is a common and troublesome weed in some parts of the United States.

TEA TREE. See Cajeput.

TEA-WATER PUMP. A spring famous in New York during the eighteenth and part of the nineteenth century. It was situated north of the present City Hall Park, on Chatham Street, and was for a long time the chief source of supply for drinking purposes, owing to the purity of its water.

TEAZLE, tē′z'l, Lady. A sprightly country-bred girl who is married to an elderly and exacting but kind-hearted old gentleman, in Sheridan's *School for Scandal.* She falls in with a set of society gossips and her head is turned by the keenness of their acid speech. She is courted by the hypocritical friend of her husband, Joseph Surface. The rôle was created by Mrs. Abingdon.

TEAZLE, Sir Peter. The husband of Lady Teazle (q.v.). The rôle was created by Mr. King.

TECHE, tĕsh. A bayou in Louisiana (Map: Louisiana, D 3). It leaves the Red River near Alexandria and flows southeast in a course of 175 miles, during which it sends off numerous branches to the Atchafalaya Bayou, and finally empties into that bayou below Grand Lake, sending also several widely separated arms directly to the Gulf of Mexico. It is interesting as having been anciently a main outlet of the Red River, and is lined with high and extensive alluvial banks which form excellent agricultural lands safe from inundations. The bayou is navigable for steamers to Saint Martinsville, about 90 miles.

TECHNICAL EDUCATION (from *technic,* from Gk. *τεχνικός, technikos,* relating to art or handicraft, from *τέχνη, technē,* art, handicraft, from *τίκτειν, tiktein,* to bring forth, produce). The term technical education, strictly speaking, embraces all instruction that has for its object the direct preparation for a career or vocation. In common use, the designation is applied to such instruction as bears directly upon the industrial arts. The field of such education ranges from instruction in the arts and sciences that underlie industrial practice in its broadest and most complex relations to the simple training in manipulation needed for the prosecution of some productive trade. This wide province naturally calls for numerous and widely divergent types of schools.

Technical schools may conveniently be divided into three classes: (1) Institutions of a collegiate or university grade to which the titles engineering schools, institutes of technology, polytechnic institutes, and schools of applied science are variously given, and which are devoted to instruction in advanced mathematics and science, and the theory and practice of industrial operations. (2) Schools in which the purpose is to prepare for practical work in some particular field of industry and which afford instruction in those branches of science and art that underlie its special problems. This class is represented by schools of weaving, dyeing, building, and machine construction and draughting. The term 'technical school' has been used in a specialized sense in this article to denote institutions of this character. In this class may be grouped schools of industrial art in which the study of design is supplemented by training in manipulation. Evening continuation schools which afford instruction in science, art, and technical methods may also be considered in this group. (3) Trade schools which supply a training in the practice of some productive trade. The function of the first type of school is to educate its students for managers and superintendents of industrial establishments, consulting and designing engineers and architects, etc.—in other words, to supply leaders and organizers for the industrial world; that of the second, to provide foremen, designers, and experts in special lines of industrial practice; and that of the third, to train craftsmen for practical work at a trade.

Engineering Schools; Schools of Applied Science; Institutes of Technology. The earliest establishment of this type of school occurred in France and Germany. In France, the Ecole des Ponts et Chausées, originally started in 1747 as a drawing school, was organized in 1760 for the training of engineers for the Government service. In 1794 the celebrated Ecole Polytechnique was founded, primarily to fit men for the engineer and artillery corps of the French Army. Not only has this school done much to set the standard of scientific training for the State service, but from the fact that many of its graduates have engaged in private work, it has exerted a strong influence upon general industrial practice. Other special engineering schools have been established at different times by the French Government, and in 1829 the Ecole Centrale des Arts et Métiers was founded as a private institution. The standards of this school have always been of the highest character. In Germany the first institution that approached a modern engineering school was the School of Mines founded at Freiberg in 1824, in order to develop engineers for working the mines in the neighborhood. Later in the century came the great development of pure science in the German universities, and following this came an era of equal activity in the field of applied science, which quickly resulted in the widespread establishment of polytechnics or *Technische Hochschulen.* Rivalry between the various States played a part in the spread of these schools, each striving to outdo the others in magnificence of buildings and completeness of equipment. These institutions, which often had their beginnings in secondary technical or trade schools, have now become foundations coordinate with the universities, requiring equal academic preparation for admission, and representing specialized courses in engineering, architecture, industrial chemistry, and agriculture. Schools of this kind are uniformly supported by the governments of the various States, and present a very highly developed organization. The splendid Technische Hochschule at Charlottenburg, and similar institutions at Munich, Dresden, Darmstadt, and Hanover, are foremost examples of this class. Engineering schools of a high grade are maintained also by the governments of Austria, Italy, Switzerland, Sweden, and Russia. Great Britain awakened more slowly to the need of technical education than other European countries. In 1881 a Royal Commission on Technical Instruction was appointed to investigate the entire subject. Among other results of this awakening was the foundation of the City and Guilds of London Institute, formed by a union of many of the wealthy corporations of the old London guilds. The scope of the Institute activities includes the support and management of three institutions in the city of London, and the direction of a system of examinations dealing with the work of technical classes throughout England and Wales, and represents a system that touches all the important phases of technical instruction with the single exception of the trade school. The most important of the three schools established in London, the Central Institution of the City and Guilds of London Institute, is a well-organized school of technology. The Institute gave £100,000 for buildings and equipment, and annually contributes £10,000 to its support. Courses are provided for training engineers, architects, industrial chemists, and technical teachers. Other schools of an advanced character and several university departments of applied science have come to the front in Great Britain, prominent among which are Owens College (q.v.), Manchester; Mason College, Birmingham; Yorkshire College, Leeds; and Bradford Technical College.

In the United States the development of the school of technology has been exceedingly rapid, and has resulted in a type of institution that in some respects is the superior of anything to be found abroad. The Rensselaer Polytechnic Institute (q.v.), founded in 1824 by Stephen Van Rensselaer as a school of theoretical and applied science, was the first establishment in this field. The work of this school has been almost exclusively devoted to the training of civil engineers. In response to the growing demand for scientific instruction, the Sheffield Scientific School (1847) at Yale and the Lawrence Scientific School (1848) at Harvard were founded. Most of the technical schools, however, date from the later years of the Civil War. In 1861, through the efforts of Prof. William B. Rogers, the charter of the Massachusetts Institute of Technology (q.v.) was granted, and in 1865 the first classes were organized. The Worcester Polytechnic Institute (q.v.) was opened to students in 1867. This was the first school of technology in the United States to provide systematic instruction in workshop practice as an element of the course in mechanical engineering. In 1864 the first courses in the School of Mines, Columbia University, were organized, and from this have developed the several schools of applied science of that institution. In 1871 the Stevens Institute of Technology (q.v.) at Hoboken was opened. The beginnings of the Sibley College of Mechanical Engineering and the Mechanic Arts were made at Cornell University in 1872, and other courses in applied science were soon established there. In the next twenty years a large number of schools of the first rank were founded either as separate institutions or as departments of universities. Notable among those of the first kind are Purdue University (q.v.), Lafayette, Ind.; Rose Polytechnic (q.v.), Terre Haute, Ind.; the Michigan School of Mines, Houghton, Mich.; the Case School of Applied Science (q.v.), Cleveland, Ohio; and the Armour Institute of Technology (q.v.), at Chicago, Ill. Prominent among the second group are the engineering departments of Lehigh University, the Ohio State University, Washington University (Saint Louis), and the universities of Michigan, Wisconsin, Minnesota, Pennsylvania, and California.

The history of these schools has been marked by the development of a number of very significant features of instruction. To begin with, emphasis has from the first been placed upon the laboratory method of instruction, as opposed to sole reliance upon text books. Following the organization of instruction in pure science came that in applied science. Another feature that has characterized the instruction in many of these institutions is the degree of specialization in the instructing staff made possible by the large numbers of students. The courses of study of American schools of technology almost universally extend through four years.

TECHNICAL AND APPLIED ART SCHOOLS; CONTINUATION SCHOOLS. All the types of this group of institutions have reached a high point of organization on the Continent of Europe. Technical schools, in which to practical training in the methods of a special craft is added instruction in the scientific principles upon which they are based, appear in greatest numbers in Austria, Germany, and France. Some have been established by guilds or masters' societies, some by a union of manufacturers of a town or city wishing to improve the efficiency of their establishments, and others by action of the local authorities or by the Government. A steady tendency toward Government control and support is apparent in all the Continental countries. Prominent among schools of this type are the special schools for weaving and dyeing, of which frequent examples are found in various parts of Germany. The most famous institution of the kind is located at Krefeld, in Prussia. In this model institution very thorough study is made of the chemistry and technology of dyeing, and of the mechanism and pattern designing involved in weaving. The Advanced School of Weaving at Lyons, France, the School of Silk Weaving near Zurich, Switzerland, the School of Weaving and Dyeing at Yorkshire College, Leeds, and the textile departments of the Manchester Technical School and of the Bradford Technical College, are other examples of this type of school. In the United States similar schools are the textile and dyeing schools of the School of Industrial Art of the Pennsylvania Museum, at Philadelphia, and the textile schools at Lowell and New Bedford, Mass.

Another type of technical school found in Germany and Austria is the *Baugewerkschule* or building trades school. These schools are generally open during the winter months alone. Only students are admitted who have had practical experience in some branch of the trade, and the courses deal with the principles and practice of building construction, the nature of materials, mechanical and freehand drawing, modeling, science, mathematics, and bookkeeping. The courses generally run through four terms and are strictly professional in character. Many of the *Fachschulen* of Austria, although aiming at trade instruction, might well be classed as technical schools on account of the character and extent of the technical instruction that is offered in addition to the practical work. Another form of technical school is represented by a class of institutions of the secondary grade, which aim to prepare rather for entrance into industrial work than for direct mastery of any one special branch. In these schools the courses commonly include instruction in the elements of a general education, as well as the study of applied science and practical training in a number of representative industrial processes. The *Industrieschulen* and *Gewerbeschulen* of Germany and Austria are examples of this type. Courses in these schools are generally from three to five years in length, and embrace, besides practical industrial work, instruction in mechanical and freehand drawing, geography, business forms, mathematics, bookkeeping, science, and technology. Schools of this kind are found at Chemnitz, Cologne, Komotau, Munich, and Nuremberg. In Austria the School of the Technological Industrial Museum, at Vienna, is the foremost example, and serves as a model for all other schools of this class throughout the Empire.

France has a very important and highly organized system of State schools for the training of foremen and superintendents in mechanical industries at Chalons, Aix, Angers, and Lille. The courses are three years in length. The instruction, both practical and theoretical, given in these schools, has been of so thorough a character that the result in large part has been to train managers and mechanical engineers rather than foremen. Other technical schools of an advanced character in France are the Industrial Institute of the North of France, at Lille, and the Institution Livet, at Nantes, which is a private foundation. A school of a special type exists at Lyons, the Ecole Martinière. Distinct courses are provided for boys and girls. In the former the sciences and arts are studied in their relation to commerce and industry. The object is not to prepare for any special trade, but to develop general capacity for an industrial or commercial career. The course, which lasts for three years, is very similar to those of the American manual training schools. The courses for girls aim to furnish a trade training in commercial accounting, embroidery, industrial drawing, and women's tailoring, together with a general education. The Finsbury Technical College, in London, is the most important institution of this class in England. Several well-equipped schools of this general type exist in other parts of England, among which are the Manchester Technical School, the Birmingham Technical School, and the Sheffield Technical School. In the United States the manual training high schools (see MANUAL TRAINING) approach quite close to this last category of schools, but devote a larger proportion of time to general branches.

Schools of industrial or applied art have also reached their highest point of development on the Continent of Europe. In Austria and Germany the *Kunstgewerbeschule*, often connected with an extensive and admirably filled museum, is found in all the large cities. Courses in drawing, painting, modeling, and design are provided, leading to some special branch of applied art. In some schools, notably those at Munich and Vienna, the handicraft side is prominent and much attention is given to practical work at carving, metal-chasing, stained glass, leather-embossing, fresco painting, embroidery, porcelain-painting, lithography, smithing, and other lines. In France are to be found not only the first schools of painting, sculpture, and architecture in the world, but also the most thoroughly organized provision for instruction in decorative and industrial art. The Government lends liberal support to the art schools, and assists in establishing new ones when the need of such is manifest. Some are supported entirely by the State, and others are assisted through grants. All are under the direction of the Minister of Public Instruction and Fine Art. Excellent schools of applied art are to be found in all parts of France, often with a distinct trend of instruction toward the industries prominent in the locality, as in the case of ceramics at Limoges and textiles at Roubaix. In Paris there are three schools which afford instruction in industrial art—the Ecole Nationale des Arts Décoratifs, the Ecole Germain-Pilon, and the Ecole Bernard-Palissy; the first to teach the principles of design in relation to industrial art as a whole, the last with direct reference to certain trades, with a liberal amount of workshop and laboratory practice. The great schools of the Government Science and Art Department (now under the Board of Education for England and Wales) at South Kensington represent the most important provision for instruction in industrial art in Great Britain. The work of these schools consists largely of drawing, painting, and modeling, and although the application of art to industry is counted as the main purpose of the institution, no practical work is attempted. A large number of smaller schools patterned upon the same model exist in other parts of Great Britain under the guidance and financial assistance of the Science and Art Department.

In the United States schools of applied art are not numerous, and in few cases is a training in the practical application of design attempted. Prominent among the institutions affording instruction in this field are the Cooper Union (q.v.), of New York City; the School of Industrial Art of the Pennsylvania Museum; Pratt Institute (q.v.), Brooklyn, N. Y.; Drexel Institute (q.v.), Philadelphia; the Maryland Institute, Baltimore; the Art Academy, Cincinnati; the Chicago Art Institute; the Rhode Island School of Design, Providence; and the Lowell School of Design, Boston.

Evening classes in science, drawing, design, and technical studies may well be considered in this second general group of schools. The *Fortbildungsschulen* of Germany and Austria are both day schools and evening schools. Many communities make attendance upon such schools compulsory for both boys and girls between fourteen and seventeen years old, and such attendance is often a condition of employment. Freehand and mechanical drawing, and special instruction relating to the trades of the locality, are the principal subjects taught in such schools. In Vienna every prominent trade is represented by a special Fortbildungsschule, and Berlin supports a great number and variety of similar schools. Evening industrial schools play an important part in the thickly populated manufacturing centres of Belgium, where, in such towns as Liège, Brussels, and Seraing, thousands of workmen nightly receive scientific and technical instruction bearing on their trades. There are many technical schools in Paris and other cities and towns of France that provide evening instruction. In most cases such evening classes are supported by commercial or industrial societies and bear upon the local industries.

Nowhere else is the organization of evening industrial classes carried to so high a point as in Great Britain. Through the system of examinations and grants directed by the Science and Art Department, classes in drawing, modeling, design, mathematics, and many branches of science, are maintained throughout the United Kingdom. From 1879 to 1890 the City and Guilds of London Institute performed a similar function for technical and industrial classes. By their liberal financial assistance through examination grants, not only were all manner of technical courses organized throughout the country, but practical trade classes were opened to broaden and further the experience of those engaged in the trades. The act of 1889 which authorized local authorities to build and maintain technical schools, and to contribute to evening technical classes out of the local rates, followed by the law of 1890 which set aside a portion of the excise duties for the support of such schools, rendered the financial assistance of the Institute no longer essential, and since 1890 that association has confined its grants to classes in the city of London. The Institute continues its functions as an examining body, and is recognized as setting the standard for all work in this field.

In the United States such evening schools are rapidly assuming an important place. The free evening classes of the Cooper Union have provided an opportunity for thousands of young men to advance themselves. The evening classes of the Pratt Institute, Brooklyn, N. Y., represent an important and highly developed example of such instruction. Worthy of mention are also the Drexel Institute, Philadelphia; the General Society of Mechanics and Tradesmen, New York City; the drawing school of the Franklin Institute, Philadelphia; the Lewis Institute, Chicago; and the evening classes conducted by Young Men's Christian Associations all over the country.

The Trade School is an institution that has come into existence almost entirely since the middle of the nineteenth century. The industrial conditions produced by an era of quantity of production and division of labor have developed the real problem of the trade school. In the days of the old guilds, when both production and exchange were in the hands of the master-workman, the natural provision for trade training was found in the apprenticeship system. As soon, however, as the master-workman ceased to be both merchant and craftsman, the apprentice began to lose his natural position in the industrial order. In most trades the master-workman has developed on one side into the director of an industrial establishment, or has become the foreman of a large number of workmen. From this situation, and from the fact that the specialization of labor in most trades dependent upon machinery renders any comprehensive training in such trades under ordinary conditions impracticable, and also because of the restrictive regulations of trades unions as to apprentices, arise the modern demand for the trade school. Manual dexterity and knowledge of processes are naturally the primary object in such schools. Examples of this kind of school, in spite of a general notion to the contrary, are not numerous even on the Continent of Europe.

In Germany and Austria it is considered unwise to introduce purely technical instruction into the period of the common school, so that all schools for technical training admit only pupils more than fourteen years of age. Beside the *Gewerbeschulen*, of a secondary grade, are the *Fachschulen*, or schools which deal with the training for some one special trade. These schools are distributed in industrial centres throughout the two empires according to local needs. In some of these schools the courses range from two to four years, and include instruction in drawing, elementary mathematics, science, and the technology of the particular trade. From the nature and range of instruction, many of these would be more properly classified as technical schools, and even in the cases where the object is simply to combine the elements of a general education with the training of a craftsman, the length of time required prevents any large attendance of the artisan class. The actual effect is consequently to train a few foremen and superior workmen, rather than to feed the ranks of the large army of workers. In some of the large cities, notably in Berlin, numerous evening trade classes are maintained, which afford the learner already apprenticed at a trade most practical opportunities to increase his skill, as well as to broaden his knowledge. In Belgium several distinctive trade schools exist, among which those at Tournay and Ghent are prominent. To these schools are admitted boys from thirteen to sixteen years old, who spend three years in the practice of a particular trade, together with study of general branches and drawing. Trade schools for girls have also received much attention in Belgium. In certain special trade schools in Belgium the experiment of paying the pupils for coming to the schools, in order to compensate for the loss of wages, has been made.

But it is in France that the question of training for the trades has received the greatest official attention and that the organization of schools for such training has reached the highest point. By the law of 1880, provision was made for the establishment of *écoles manuelles d'apprentissage* as a distinct class of the *écoles primaires supérieures*. These schools were intended either to prepare for or to shorten the period of apprenticeship, and were placed under the joint control of the Ministry of Public Instruction and the Ministry of Commerce and Industry. In them workshop training plays a prominent part, but a liberal amount of general instruction is also given during the three years' course. Pupils are admitted when twelve or thirteen years old. By an administrative blunder, the feature of the law of 1880 creating such schools remained inoperative until 1888, except in Paris, where the municipality early equipped and developed three successful trade schools, one for wood and metal working, one for furniture-making, and one for the book industries. After 1888 apprenticeship schools began to appear in the provinces, but inasmuch as no common programme has been defined, the amount of practical instruction varied considerably, and in many cases was far too small to serve as a substitute for apprenticeship. In 1892 the failure of these provincial schools to fulfill their intended function led to a new law, which provided that all the *écoles primaires professionelles,* in which practical work formed an important part, should be made into a new class of schools called *écoles pratiques de commerce ou d'industrie,* to be placed under the sole control of the Ministry of Commerce and Industry. The organization of such schools, in which the amount of practical instruction is increased to thirty or thirty-three hours a week, represents a deliberate attempt to establish a comprehensive system of primary trade schools under State control. In Switzerland the State and municipalities support numerous trade schools, mainly for watchmaking, in which the training both practical and theoretical is of a very thorough character. Another feature connected with trade training in Switzerland, and one that has to some extent been copied in Germany, is a system of apprentice examinations supervised and supported by the State. These examinations in many cantons are made obligatory upon every apprentice, and consist of an examination held at the end of the term of apprenticeship upon the practice and theory of his trade. The trade school can hardly be said to have gained a foothold in Great Britain, where the sentiment almost universally prevails that the shop is the only proper place for learning a trade.

In the United States a distinctive type of trade school was developed in the foundation of the New York Trade Schools in 1881. Both day and evening classes are conducted in this institution. The evening classes, although admitting beginners, are largely made up of young men already started at their trades. In the day classes young men are admitted only at an age —from seventeen to twenty-five—when they will be able to learn rapidly, and so acquire sufficient skill in short courses of four months to enter at once upon practical work. The purpose is to give a thorough grounding in the practice and theory of a trade which may be perfected by later experience in regular work. The school instruction is confined entirely to practical work. Evening schools similar to those of the New York Trade Schools have been established by the Pratt Institute, Brooklyn, the Philadelphia Master Builders' Exchange, and the Massachusetts Charitable Mechanics' Association of Boston. To these should be added the first instance of public support of such an institution in the Evening School of Trades at Springfield, Mass.

Another type of trade school has made its appearance in the United States in the Williamson Free Schools of Mechanical Trades (q.v.) near Philadelphia. Institutions similar in plan to some of the European trade schools, in which the aim is to combine the teaching of a trade with a general education, are represented by the California School of Mechanical Arts and the Wilmerding School of Industrial Arts of San Francisco.

In addition to the regular institutions, noted above, several instances exist in Europe and the United States of factory or employees' schools. These schools are almost uniformly conducted in the evening, and in the main provide instruction of a nature related to the practical work of the employees, such as drawing and mathematics. Examples of such schools in the United States are those conducted by R. Hoe & Co., printing press manufacturers, of New York City, and the Cleveland Twist Drill Co. The Ludlow Manufacturing Co., of Ludlow, Mass., which employs large numbers of women and girls, supports an evening school giving instruction in cooking, sewing, and physical culture. Somewhat similar classes are carried on by the National Cash Register Co., of Dayton, Ohio. Employees' schools in which specialized technical instruction is given are conducted by several associations of employees and also by individual manufacturing concerns in various parts of France. Quite different from such schools are the schools for the children of employees, which are maintained by a number of large industrial corporations in Great Britain, France, and Germany. Notable among these are the schools of Lever Brothers, Port Sunlight, England; of the Krupp Works, Essen; and the Trade School of the Northern Railway Co., Paris.

Bibliography. It is impossible to indicate even in the most limited way a satisfactory bibliography of technical education. Some of the more important data are contained in the following: *Reports of the U. S. Commissioner of Education,* 1895-96, vols. i. and ii.; 1896-97, vol. i.; 1897-98, vol. i.; 1898-99, vol. i.; 1899-1900, vol. i.; *Seventeenth Annual Report of the U. S. Commissioner of Labor;* "Education in the Industrial and Fine Arts in the United States," *U. S. Bureau of Education; Report of the Royal Commission on Technical Education for Great Britain; Proceedings of the International Congresses for Technical, Commercial, and Industrial Education;* Magnus, *Industrial Education* (London, 1888); Nördling, *Ueber das technische Schul- und Vereinswesen Frankreichs* (Vienna, 1881); Mortimer d'Ocagne, *Les grandes écoles de France* (Paris, 1887); Schoenhof, *Industrial Education in France* (Washington, 1888); Holzapfel, *Die technishen Schulen und Hochschulen und die Bedürfnisse der deutschen Industrie* (Leipzig, 1897); Rein, *Encyklopädisches Handbuch der Pädagogik* (Langensalza, 1902).

TECUCIU, tȧ-ko͞o′chē̇. A town of Rumania, in Moldavia, 40 miles northwest of Galatz, on the right bank of the Berlad River (Map: Balkan Peninsula, F 2). It has an active trade. Population, in 1900, 13,405.

TECUMA PALM. See Astrocaryum.

TECUM'SEH (Flying Panther, Meteor), Tecumthe, or Tecumtha (c.1775-1813). A famous Indian chief, born near the site of the present town of Springfield, Ohio. His father was a Shawnee warrior, and his mother a Creek or Cherokee squaw captured and adopted by the Shawnees. Having by his unusual talents for leadership gained great influence among his people, Tecumseh, when about thirty-five years of age, formed a plan for a great confederacy of the Indians against the whites, which should have jurisdiction, among other things, over the alienation of Indian lands. In this work he was assisted by his brother Elkswatawa, commonly known as 'The Prophet.' He was also assisted by British agents, and found the Indians the more willing to adopt his schemes because of the general dissatisfaction over the continual encroachments of the whites upon the Indian lands.

In the summer of 1808 Tecumseh and his brother established a village near the mouth of Tippecanoe Creek in Indiana, and here Tecumseh put into practice some of his ideas for returning to the virtuous primitive condition of the Indians by prohibiting the use of whisky and other demoralizing practices introduced by the whites. Two years later he went on a visit to the southern Indians, especially the Choctaw, Creek, Cherokee, and Seminole, and by his wonderful eloquence is considered to have kindled among them the flame that in 1813 burst into the Creek War. In his absence, however, his followers were defeated on November 7, 1811, by a force under General William Henry Harrison. (See TIPPECANOE, BATTLE OF.) In the following year he joined the British at Malden, and early in August routed a force of Ohio militia, but was defeated and wounded in the skirmish of Maguaga. Despite his defeat, however, he was commissioned a brigadier-general in the British Army, and with several hundred Indians assisted in the capture of Detroit. In January, 1813, he played an important part in the siege of Fort Meigs (q.v.), and prevented the massacre of prisoners taken in the sortie from the fort. After Perry's victory on Lake Erie Tecumseh protested against the British retreat from Malden. He accompanied the retreating army, however, and at the battle of the Thames (q.v.) was killed while bravely resisting the attack of the mounted Americans under Colonel Richard M. Johnson. Tecumseh was a man of many high qualities, with impressive manners and wonderful natural eloquence. The part he played in the War of 1812 was an exceedingly important one. Indeed, as a Canadian historian has pointed out, it is quite conceivable that had it not been for Tecumseh, the Americans would have conquered Canada. Consult: Drake, *Life of Tecumseh and His Brother, the Prophet, with an Historical Sketch of the Shawnee Indians* (Cincinnati, 1841); and Eggleston, *Tecumseh and the Shawnee Prophet* (New York, 1878).

TEDAS, tä'däz. The northern division of the Tibbus (q.v.), living in Tibesti and the adjoining oases of the Eastern Sahara, and connected with the outside world by the main camel route between the city of Tripoli and Lake Chad. In this portion of the Great Desert are inexhaustible supplies of rock salt, and the Tedas employ thousands of camels in conveying this material throughout Central Africa.

TED'DINGTON. A town in Middlesex, England, on the Thames, 2½ miles southwest of Richmond (Map: London and vicinity, F 4). The municipality maintains reading rooms and recreation grounds, and provides garden allotments. The National Physical Laboratory was inaugurated here in 1902. Population, in 1891, 10,052; in 1901, 14,029.

TE DEUM. A well-known hymn, so called from its opening words (*Te Deum laudamus, te dominum confitemur,* We praise Thee, O God, we acknowledge Thee to be the Lord), commonly sung on all occasions of triumph and thanksgiving, and a theme upon which the most celebrated composers have exercised their musical genius. The hymn is one of the most simple, and at the same time the most solemn and majestic and most admired in the whole range of hymnology. Its authorship is uncertain. Picturesquely and uncritically it has been described as the joint production of Saints Ambrose and Augustine, into which they both burst forth by a common inspiration on occasion of the baptism of Augustine. From this supposed origin, the Te Deum is commonly called the Ambrosian hymn. It is ascribed by other authorities to Hilary of Poitiers, but is most probably considerably later. Besides its general use on occasions of joyous celebrations, the Te Deum forms part of the daily matins of the Roman breviary, and is recited at the end of matins on all festivals, and on all Sundays except those of Advent and Lent. With a similar exception, it forms part of the morning prayer of the Anglican Prayer Book, being sung after the first lesson. Its use dates from the sixth century.

TEES. A river of Northern England. It rises on Cross Fell, Cumberland, and flows east between the counties of Durham and York. It enters the North Sea 10 miles below Stockton, to which town it is navigable for small vessels. Length, 80 miles (Map: England E 2).

TEETH (AS. *tōþ*, Goth. *tunþus*, OHG. *zand*, *zan*, Ger. *Zahn*, tooth; connected with OIr. *dēt*, Bret., Welsh *dant*, Lith. *dantis*, Lat. *dens*, Gk. ὀδούς, *odous*, ὀδών, *odōn*, Skt. *dantc*, tooth, probably originally the pres. part., with loss of the initial vowel, of Skt. *ad*. Gk. ἔδειν, *edein*. Lat. *edere*, to eat, OChurch Slav. *yamĭ*, Lith. *edmi*, *edi*, I eat, OIr. *ith*, Goth. *itan*, OHG. *ezzan*, Ger. *essen*, AS. *etan*, Eng. *eat*). Calcareous organs imbedded in the skin within or near the mouth in most vertebrates, acting primarily for the prehension and trituration of food. Some teeth, such as the tusks of the wild boar or of the elephant, have secondarily acquired another function, namely, that of offensive and defensive organs, especially with reference to combats between rival males.

Teeth are dermal structures, homologous with the placoid scales or denticles which cover the entire body of fishes (q.v.). At the anterior end, say of the body of a dogfish, the skin turns in to form the lining or mucous membrane of the mouth and with it the scales are carried. In fishes these dermal denticles appear in the skin very early both in their ontogenetic and phylogenetic history, but do not occur in Amphioxus or in cyclostomes. They first appear in selachians in the form of small denticles or spines arranged in longitudinal and transverse rows, each attached to a basal plate, and directed caudad. Both ectoderm and mesoderm take part in the formation of these dermal denticles, as in the case of the teeth of the higher vertebrates. The name 'tooth-germ' is given to the tissue that is destined to develop into the teeth. The mesoderm forms a papilla which secretes dentine in its outermost layer. Within the dentine there is a cavity filled with mesodermal tissue and blood vessels. From this cavity fine tubules pass into the dentine. Outside the dentine is a layer of enamel secreted by ectodermal cells. The first impulse toward tooth-formation seems to reside in the derma. As the dermal papilla grows it comes to be covered by a layer of large columnar cells from the epidermis. The enamel is secreted from the lower surface of these epidermal cells. As the dermal cells multiply, they give rise to an elongated papilla which projects backward. The deep-lying connective-tissue layers of the derma at the same time secrete salts of lime and thus a sort of connective-tissue bone (the so-called 'tooth-cement') is produced, and by means of it the spine gains a firm support. The basal plates of tooth-cement form a shield of considerable protective value, and in some fishes, such as the bony ganoids, a hard protective skeleton is thus produced. In the higher vertebrates this bony covering is lost over most of the body, but persists in the head region, and becomes some of the most important bones of the skull.

In fishes the teeth are usually abundant, and are either spiny or blunt, and may be set close together like a cobble-stone pavement (see CESTRACIONT) to fit them for grinding up shells. In the swordfish they form the teeth of the sword. Amphibians possess few teeth. They are conical, end in a single or double apex, and are usually present on the premaxilla, maxilla, mandible, vomer, and palatine bones, and occasionally on the parasphenoid. They occur in additional locations in the larvæ of some forms. Teeth are present in all groups of reptiles except the Chelonia, and even there exist for a time in the embryonic stage of Trionyx, showing that the toothless state has been secondarily acquired by the turtles. The reptilian teeth are usually larger and stronger, and are limited to more special regions, than among lower vertebrates. The teeth of reptiles, as well as those of fishes, are in general 'homodont,' or alike throughout the series. In reptiles the teeth are connected with their support in two ways: either the teeth are firmly fused to the bone, or else they lie in cup-shaped sockets of the bone, the 'alveoli.' This condition exists in the so-called 'thecodont' reptiles. The teeth, which are fused to the bone may either lie in a furrow at the inner side of the jaw-bone ('pleurodont' type) or else they arise from its free upper edge (in the case of the lower jaw), and are 'acrodont.' In many kinds of snakes certain of the maxillary teeth of the upper jaw are differentiated into organs of offense and defense. These are the 'fangs' or poison-carrying teeth. (See SNAKE.) Birds have no teeth. Fossil birds (q.v.), however, possessed teeth, which were either imbedded in grooves (Hesperornis) or in definite alveoli (Ichthyornis).

The dentition of mammals is highly variable, and the differentiation of the teeth in the various forms is to be explained by adaptation to the character of the food. All the teeth are imbedded in alveoli of the jaw-bones, to which the growth of teeth is confined. The teeth are so arranged that those of the upper and lower jaws alternate. The teeth of one jaw oppose the interspaces between the teeth of the other jaw. Thus each tooth presses against a portion of two teeth of the opposite set. When all opposing pressure fails the tooth thus rendered functionless tends to be extruded. This alternating arrangement prevents the loss of one tooth from greatly affecting the teeth of the opposite set. Most mammals are 'diphyodont'—that is, possess two sets of dentition—namely the deciduous or 'milk' dentition and the permanent teeth. In most of the fishes as well as in many of the Amphibia and reptiles the teeth can be renewed indefinitely. A few mammals, namely the Cetacea and Edentata, are 'monophyodont,' that is, possess only one set of teeth. The milk teeth are supplanted by a process of absorption which goes on in certain cases to such an extent that the root is practically removed. This removal is effected by giant cells analogous to, if not identical with, the osteoclasts that tear down bone. The teeth usually cease to grow after being fully formed, but in edentates and rodents growth continues throughout life, and is necessary in order to supply the wear on the teeth brought about by the gnawing habits of these animals.

Mammalian teeth are classified according to their shape and function into incisors, canines, premolars, and molars. The four front teeth in the case of man are blunt, flattened, and chisel-shaped, and are fitted for cutting or dividing the food. They are the 'incisors.' In recently cut incisors the cutting edge is raised in three scallops, which soon wear away. The edge of the incisor is formed by a beveling off of the dentine on the inner or lingual surface. The two central upper incisors in man are slightly larger than the two laterals. This difference is more marked in anthropoid apes. The lower central incisors are narrower than those of the upper jaw. The lower lateral incisors are larger than the lower central pair. The two canines or 'eye-teeth' on each jaw are stronger both in root and crown than the incisors. The crown is blunt and pointed. The canines are succeeded by two premolars or 'bicuspids' on each side of the jaw, which correspond to the three and four premolars of the typical mammalian dentition. Their crowns possess two cusps. The root is normally single, but is often grooved or cleft by a longitudinal furrow into two or even three roots. The premolars of the lower jaw are smaller than those of the upper. The molars are three in number on each side of the jaw. The form of the first molar is the most constant. The roots are three in number. The third molar, or 'wisdom tooth,' is the most variable as to its time of appearance; it may be cut almost as soon as the other molars, or many years later, or not at all.

In existing mammals there is a certain degree of gradation between the forms of the teeth. The typical number of mammalian teeth is 44. The human number is 32 in the permanent set and 20 in the milk set. In the human set the third incisor and the first two premolars of the typical mammalian set are absent, hence at the canines in man there is an abrupt change both in front and behind. For convenience and brevity the number and kinds of teeth of mammals are usually designated by means of a formula as follows:

For marsupials:

$$i\,\tfrac{3}{3}\;c\,\tfrac{1}{1}\;pm\,\tfrac{3}{3}\;m\,\tfrac{4}{4} = 44.$$

For eutherian mammals:

$$i\,\tfrac{3}{3}\;c\,\tfrac{1}{1}\;pm\,\tfrac{4}{4}\;m\,\tfrac{3}{3} = 44.$$

For man:

$$i\,\tfrac{2}{2}\;c\,\tfrac{1}{1}\;pm\,\tfrac{2}{2}\;m\,\tfrac{3}{3} = 32.$$

It is often very difficult to determine which teeth are to be accounted incisors, canines, etc., and the following rule is sometimes employed:

Incisors, upper jaw, on premaxilla.

Incisors, lower jaw, correspond to upper.

Canines of upper jaw, next tooth immediately behind suture of maxilla and premaxilla.

Canines of lower jaw, close in front of upper canine.

Premolars replace milk molars.

Molars, behind milk molars (when present).

A tooth is usually described as consisting of three parts—the crown, neck, and root—and is composed of three hard secretions—the dentine, enamel, and cement—and a central pulp cavity. The human tooth fits into the jaw-bone much like a peg into its socket. This manner of union is termed 'gomphosis.' The tooth does not, however, occupy the entire socket, for there is besides a lining of periosteum, which at the root turns upward around the tooth as far as the neck, where it becomes continuous with the gums. This packing around the tooth is somewhat elastic and allows of slight motion. The elasticity of the packing doubtless diminishes the shock which would be caused in mastication were the teeth rigidly attached in their bony sockets. When the periosteum is inflamed the swelling pushes the tooth outward in the socket and loosens it. The dentine forms the great mass of the tooth, surrounds the pulp cavity, and is covered, in the human tooth by a layer of enamel, the hardest of animal tissues; in other mammals this layer of enamel may cover all or only a part of the exposed portion of the tooth, or may be absent. The condition that more commonly prevails is that the enamel envelops the entire crown of the tooth and stops rather abruptly at about the level of the gum.

In its finer structure dentine is in some cases difficult to distinguish from true bone. Typical dentine, such as exists in human teeth, differs from bone both in structure and in chemical composition, and is known as 'hard' or 'unvascular' dentine. It is hard, elastic substance with a yellowish white hue, which is made up of a number of minute, wavy, branching tubules, parallel to one another and opening internally into the pulp cavity. These tubuli contain finely cylindrical prolongations (dentinal fibres) from cells in the pulp cavity, intimately connected with the nerves of the pulp. The different kinds of dentine have been classified as (1) hard or unvascular dentine; (2) plici-dentine; (3) vaso-dentine; (4) osteo-dentine. The unvascular dentine has been described above. In the second class the pulp cavity is irregular in outline, with many tubes and canals traversing the dentine in various directions, some carrying blood-vessels. Such a condition obtains in many of the lower vertebrates and in some mammals. The osteo-dentine closely approaches bone in structure. In it pulp and calcified tissue are mixed up, for there is no distinct pulp cavity. Such dentine is found in the teeth of many sharks.

The cement forms a coating over the roots of the teeth and when unusually thick may even unite the roots of contiguous teeth. In the human teeth it extends upward to cover the edge of the enamel. It covers, at first, the entire teeth of certain vertebrates, such as the elephant, and covers the crowns of the teeth of ruminants. It is derived from the tooth-follicle and is closely allied to bone.

The cavity of the tooth is filled with the tooth-pulp, which is composed of a gelatinous matrix and contains cells, nerves, and blood-vessels. The outermost cells, known as 'odontoblasts,' form a layer next the bone. These cells are connected by processes with one another and with deeper lying cells and on the periphery the processes extend into the dental tubuli.

The gums are continuous with the mucous membrane of the mouth, but are much thickened. Within the gums are tendinous faciculi, and others extend up into them from the periosteum. These give the gums hardness. They are richly supplied with blood-vessels, but have few nerves. The gums are continuous with the periosteum of the alveoli, a connective tissue richly supplied with blood-vessels and nerves.

BIBLIOGRAPHY. Tomes, *Manual of Dental Anatomy, Human and Comparative* (London, 1876); Owen, *Odontography* (London, 1840-45). See INTEGUMENT; SKELETON; DENTISTRY.

TEFFT, BENJAMIN FRANKLIN (1813-85). A Methodist Episcopal clergyman. He was born near Utica, N. Y., and graduated at Wesleyan University, Middletown, Conn., 1835. He taught in the Maine Wesleyan Seminary, Kents Hill, Me., 1835-1839; was principal of Providence Conference Seminary, East Greenwich, R. I., 1841; professor of Greek and Hebrew languages and literature in Indiana Asbury University (now De Pauw University), Greencastle, Ind., 1843-1846; editor of *The Ladies' Repository*, Cincinnati, O., 1846-50; president of Genesee College, Lima, N. Y., 1851-1854; chaplain of First Maine Cavalry, 1861; United States consul at Stockholm and acting Minister to Sweden, 1862; Commissioner of Immigration from the North of Europe for the State of Maine, 1864; and editor of *The Northern Border*, Bangor, Me., 1873-1878. He wrote: *The Shoulder Knot* (1850); *Hungary and Kossuth* (1851); *Webster and His Masterpieces* (1854); *Methodism Successful* (1860); *The Present Crisis* (1861).

TE'GEA (Lat., from Gk. Τεγέα). An ancient city of Southeastern Arcadia, Greece. Its territory included the southern part of the great eastern plain of Arcadia, of which the northern part was occupied by Mantinea (q.v.). It was a place of considerable size, and it appears to have included the modern villages of Hagios Sostis, Palæo-Episkopi, Piali, and Ibrahim Effendi, south of Tripolitza, though but few remains are visible, partly because of a deep deposit of alluvium, and partly from the destruction due to the later inhabitants. The most important ruins are those of the great temple of Athena Alea, built by Scopas (q.v.), and now (1904) in process of excavation by the French School at Athens. The dimensions of the temple (about 163 × 70 feet) and important fragments of its sculptures were determined by Milchhöfer in 1879. The city was celebrated in the heroic legends, and for a long time seems to have opposed Sparta on equal terms, but during the sixth century B.C. was forced to join the Spartan league. At Thermopylæ, we are told, were five hundred Tegeans, and at Platæa three thousand, of whom one-half were hoplites. Later they were again involved in war with Sparta, and after two defeats remained true allies until the invasion of Epaminondas (B.C. 370), when a democratic government replaced the aristocracy, and the city joined in the foundation of Megalopolis. Later we find Tegea in the Ætolian League, in alliance with Sparta, forced into the Achæan League, at war with Sparta, and sharing in the confused politics which mark the history of the lesser Peloponnesian cities during the third and second centuries. A good account of the place was given by Pausanias in the second century of our era, and it seems to have been one of the most flourishing towns of Arcadia till it was sacked by Alaric. Consult, besides the larger works on the Peloponnesus (q.v.) by Dodwell, Leake, Curtius, and others, and Schwedler, *De Rebus Tegeaticis* (Leipzig, 1889).

TEGERNSEE, tā′gĕrn-zā. A village in Upper Bavaria, charmingly situated on the lake of the same name, with an imposing castle, formerly a Benedictine abbey, founded in 719 and suppressed in 1804, and now the property of Dr. Charles Theodore, Duke of Bavaria, who is a skillful oculist and has established an ophthalmic infirmary in the village, where he examines and performs operations on patients gratuitously. The beautiful walks in the environs attract numerous visitors in the summer. A favorite point is the Grosse Parapline, 2680 feet high and affording an admirable view of the lake and the encircling mountains. At the northwestern end of the lake lies Kaltenbrum, the model farm of Duke Charles Theodore.

TEGETMEIER, tĕg′ĕt-mī′ēr, William B. (1816—). A British naturalist and author. He received a medical education, but turned his attention to natural history, and became a coworker with Darwin in experiments and observations on the question of variation (q.v.) and other scientific problems. To these he contributed mainly by study of domestic animals and especially of pigeons, and was instrumental in advancing the breeding and improvement of carrier pigeons and of fine poultry. In 1857 he became a leading editor and essayist of *The Field* (of London). He wrote several important works on ornithology and the rearing of domestic animals.

TEGETTHOFF, tĕg′ĕt-hôf, Wilhelm, Baron (1827-71). A distinguished Austrian admiral, born at Marburg, in Styria. He entered the Austrian navy, distinguished himself in the naval encounter with the Danes off Helgoland in 1864, became rear-admiral, and in the war of 1866 commanded the Austrian fleet in the Adriatic. On the 20th of July he attacked and defeated the Italian fleet under Admiral Persano off the island of Lissa, although the Italian fleet was superior in the number of iron-clads to the Austrian. For this brilliant victory Tegetthoff was promoted vice-admiral. In 1867 he was sent to Mexico to obtain from the Government the body of the Emperor Maximilian, and in 1868 he was made commander-in-chief of the navy.

TEGNÉR, tĕg-nâr′, Esaias (1782-1846). A Swedish poet, born at Kyrkerud, in Wermland. Tegnér graduated from the University of Lund (1802) and in 1805 became sub-librarian of the university and lecturer on æsthetics. In 1811 his poem on Sweden (*Svea*) won him universal admiration and an academic prize. Already his war-songs and national odes had attracted the attention of the King and Government. In 1812 he was made professor of Greek at Lund, and for the next decade gave himself almost wholly to clerical duties and theological studies. During these years he wrote the remarkable religious idyls, *The Priest's Consecration* and *The Children of the Lord's Supper* (*Nattvardsbarnen*, 1820), as well as the fine romantic poem *Axel* (1822). His fame, however, rests on the *Frithjof's Saga*, finished in 1825, which remains the most popular poem in Swedish, though it lacks originality and unity, adhering very closely to the legend on which it is founded and being less an epic than a series of ballads and odes. Even while unfinished it had sufficed to secure for Tegnér the nomination of the clergy to the Bishopric of Wexiö (1824). In 1840 the insanity that afflicted his family unmistakably asserted itself. After a period in an asylum he returned for a little while to active work, but soon became paralytic and so lingered till death. Thus it appears that Tegnér's significant production is confined to the years 1811-25, and more strictly speaking to the last six of these, which saw *The Priest's Consecration, The Children of the Lord's Supper, Axel, Frithjof. Frithjof* has been rendered into many languages and nineteen times into English, best by Longfellow, who also translated *Nattvardsbarnen.* It was effective in banishing classical French taste from Sweden and in introducing the literary ideals of the Romantic school, though Tegnér always kept the clearness and artistic finish that go with calm objectivity. His verse is melodious, graceful, dignified, yet fresh, vigorous, and not without national or religious enthusiasm, in spite of its impersonality. See Swedish Literature.

Tegnér's *Works* were collected in 7 vols. (Stockholm, 1847-51). Three volumes of supplementary writings were printed (ib., 1873-74), and a new collected edition made of the works in 8 vols. (ib., 1882-85). The more important poems are in English, French and German translations. A *Life* by Böttiger is prefixed to the first collected edition of the *Works.* Consult also Brandes, *Eminent Authors*, trans. (New York, 1886); and Erdmann, *Esaias Tegnér* (Stockholm, 1896).

TEGUAN. One of the local names of a flying phalanger of New South Wales (*Petanrista volans*), which is black and about the size of the large Indian flying squirrels. It resembles the other flying phalangers (q.v.) in the possession of an effective parachute, and in its habits. Also spelled 'taguan.'

TEGUCIGALPA, tā′gōō-sē-gäl′pȧ. The capital of Honduras, Central America, situated on the left banks of the upper course of the Choluteca, seventy-eight miles from its seaport, Amapala, on the Gulf of Fonseca (Map: Central America, D 4). It has a healthful location on a table-land 3250 feet above sea-level, in the most thickly populated portion of the Republic. The region is known for its agricultural resources and its mines of gold and silver and marble, though the latter have largely lost their former importance. During the closing years of the eighteenth century their annual output averaged $25,000,000. The most important structure in the Republic is its cathedral. There are a national university and a ladies' seminary. Tegucigalpa was an Aztec city and a place of some importance during the eighteenth century. It became the capital of Honduras in 1880. Population, about 18,000.

TEHERAN, or **TEHRAN,** tĕ-h′-rän′. The capital of Persia and of the Province of Teheran, 70 miles due south of the Caspian Sea, in latitude 35° 41′ N., longitude 51° 25′ E., on a sandy and stony plateau, 90 by 40 miles in extent (Map: Persia, D 3). Its elevation is 3800 feet. In 1869 the Shah caused the mud walls of the city to be torn down and five years later it was surrounded by a ditch and 58 bastions, after the method of Vauban. It is now in the form of an irregular octagon, inclosing 7½ square miles, and having twelve gates. Several broad, handsome boulevards have been laid out, and are lighted by gas, and a beginning has been made in the Western style of architecture. The sanitary conditions have likewise become improved. The bazaars are the centre of life. There are seven miles of tramways, and a railroad to Shah-Abdul-Azim, six miles south of the capital. The 'Ark' or fortified palace of the Shah, in the northern quarter of Teheran, contains prisons, a military school, beautiful gardens, baths, kiosks, and several other handsome buildings, including the harem. The wealthy citizens dwell in elaborate and costly establishments with lovely gardens, tiny ponds, and ventilating towers. The town has a library, founded in 1850, a normal school, a military college, and Kings' College, a polytechnic school, dating from 1849, with European professors, where Arabic, English, French, and Russian, mathematics, telegraphy, engineering, military tactics, music, and painting are taught. To some of the many mosques are attached 'Madrasahs' (colleges). The mosque called Masjid-i-Shah (mosque of the King) with a beautiful enameled façade, and the Masjid-i-Madar-i-Shah (mosque of the King's mother) deserve mention. There are many baths, Mohammedan and Armenian, the Europeans using the latter. During the summer, on account of the unhealthfulness of the town and the intolerable heat, the embassies, as well as the wealthier inhabitants, move to the slopes of the neighboring mountains.

Water is furnished by numerous underground watercourses leading from the mountains. The supply, however, is not regulated, because of the private ownership of many of these canals. The town accordingly suffers from a lack of water in summer and has a superfluity in winter. Irrigation is thus provided for, however, and the surrounding country has been made highly productive. Teheran manufactures cotton, linen, carpets, shoes, hats, and ironwork, but is not a leading centre of manufacturing. It has, however, an important general caravan trade. An excellent highway 217 miles long, constructed by Russian capital, and completed in 1899, extends from Resht on the Caspian to Teheran. To the south lie the ruins of Rei, the birthplace of Harun-al-Rashid, known in the time of Alexander the Great as Ragæ, the Rhages of Scripture, the capital of Parthia. The population varies from 160,000 in summer to 250,000 in winter. This includes 500 Europeans, 4000 Armenians, and 4000 Jews. There is a Catholic mission school. Teheran, according to Morier, is the Tahors of the Theodosian Tablets.

TEHRI, tā′rē, or, more properly, GARHWAL. A native State of British India included territorially in the United Provinces of Agra and Oudh. It borders upon Tibet, and lies wholly within the Himalayas, around the sources of the Ganges, being a highly elevated and rugged mountain region. Area, 4180 square miles. Population, in 1901, 268,885. Capital, Tehri.

TEHUANTEPEC, tâ-wän′tâ-pĕk′, ISTHMUS OF. The narrowest portion of Mexico as well as of the American continent north of Costa Rica. It stretches in an east and west direction between the Gulf of Campeachy, an arm of the Gulf of Mexico west of Yucatan, on the north, and the Gulf of Tehuantepec, an arm of the Pacific Ocean, on the south. Its least width, from Coatzacoalcos to the head of the Lago Superior, is 120 miles. The plateaus of Mexico and Guatemala are here separated by a depression falling to an altitude of 680 feet. This fact as well as the geographical position of the isthmus has led to numerous schemes for some means of interoceanic communication at this point, including projects for a ship canal. (See TRANS-ISTHMIAN CANALS.) A railroad across the isthmus was completed by the Mexican Government in 1894, and recently large sums have been expended upon it in order to bring it up to the needs of a great traffic.

TEHUELCHE, tâ-wĕl′châ. A general term for several different Patagonian tribes, who are, however, probably closely related. There is some evidence that the Tehuelches are immigrants from the more northern portions of South America, but their origin is still doubtful. Within recent years the encroachments of Europeans and Gaucho mixed-bloods have driven the Tehuelches far to the south until now they occupy a relatively small territory between the Strait of Magellan and the Santa Cruz River. They are noted chiefly for their very tall stature, being often considered the tallest of human races. Accurate observations on this point are few, but it is probable that the average stature of male Tehuelches is not far from 1.75 m. They are also very brachycephalic in head form. In culture they are low. Consult: Masters, *At Home with the Patagonians* (London, 1871); Lista, *Viage al pais de Tehuelches* (Buenos Ayres, 1878).

TEIGNMOUTH, tĭn′mŭth. A seaport and watering place on the south coast of Devonshire, England, situated on the English Channel, at the mouth of the Teign, 15 miles south of Exeter (Map: England, C 6). The harbor is safe and commodious, though difficult of entrance. There is a considerable sea and river fishery. An average of 1200 vessels clear the port annually. The town received a market grant from Henry III. It was burnt by the Danes in 970 and by the French in 1340 and 1690. Population, in 1901, 8636.

TEIGNMOUTH, JOHN SHORE, First Baron (1751-1834). An Anglo-Indian statesman. He was born in London, was educated at Harrow, and in 1769 entered the civil service of the East India Company. From 1775 to 1780 he was a member of the revenue council at Calcutta, and was appointed by Warren Hastings one of the committee of revenue which superseded the council. After a visit to England in 1785-86 he returned to India in 1787 as a member of the supreme council of Bengal. The organization of the revenue and judicial systems of Bengal and the measure on *Zamindari* proprietorship of the soil which was ratified by Lord Cornwallis, were largely due to Shore's initiative, and on Cornwallis's retirement in 1793 Shore was made Governor-General of India. He was created a baronet in 1792. On his retirement in 1798 he was raised to the peerage as Baron Teignmouth. He was the first president of the British and Foreign Bible Society from 1804 until his death. He wrote *Memoirs of the Life, Writings, and Correspondence of Sir William Jones* (1804). Consult Teignmouth, *Life and Correspondence of*

John Shore, first Baron Teignmouth (2 vols., London, 1842).

TE′JA, or **TEIAS.** The last King of the Ostrogoths. He was chosen King after the death of Totila (q.v.) who fell in battle against the Byzantines under Narses, at Tadino, A.D. 552. The Gothic kingdom received its death blow in that battle and it was left to Teja only to prolong the hopeless struggle. He sought to gain the aid of the Frankish King Theudebald, but failed. While marching to the relief of Cumæ he was met by the Imperial army under Narses and thereupon took up an impregnable position near the foot of Mount Vesuvius, where the Goths were invested by the enemy. After two months want of food compelled the Goths to abandon their position and they retired to the Lactavan Hill, whence they made a desperate onslaught on the Romans. In the two days' battle Teja perished after performing wonderful deeds of valor (553). The remnant of the Goths were permitted to leave Italy. See GOTHS.

TEJADA, tȧ-hä′dȧ, LERDO DE, President of Mexico. See LERDO DE TEJADA.

TEJON. The Mexican name of the local species of badger (q.v.).

TEJU (abbreviation of *Tejuguacu*, the native name). One of the large and powerful South American lizards of the family Tejidæ, and especially of its principal genus, Tupinambis. This family comprises nearly 40 genera with more than 100 species, and exhibits great diversity, as might be expected when it is known that its range covers the whole of South and Central America, the West Indies, Mexico, and the Southwestern United States. The largest of the family (*Tupinambis teguexin*) is three feet long to the end of its long, terete, tapering tail; is bluish black with irregular yellow cross-bands, and reddish yellow underneath. They frequent woodlands and plantations, and live in burrows. They are carnivorous and are able by their swiftness and agility to capture most small animals.

TEKELI, tĕk′ĕ-lĭ. An Hungarian patriot. See TÖKÖLY.

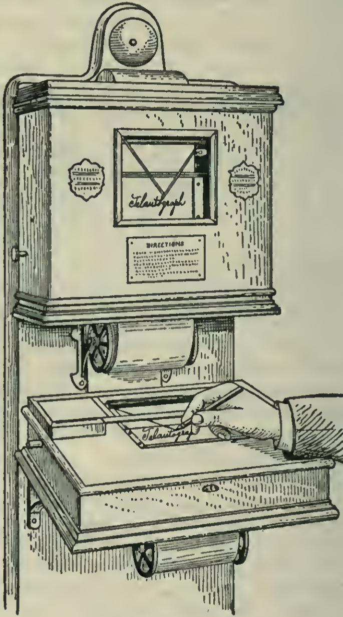
TEKIYE, tȧ-kē′ye. A Mohammedan monastery inhabited by dervishes (q.v.) or other ascetics. It is usually built about a court inclosed by a colonnade, beyond which are the chambers, sometimes covered with domes. Well-known examples are the tekiye of the dancing dervishes at Pera and the one built near Damascus by Sultan Selim in 1516.

TEKNONYMY (from Gk. *τέκνον*, *teknon*, child + *ὄνυμα*, *onyma*, *ὄνομα*, *onoma*, name). A custom found among certain savage groups whereby a father (in some cases both parents) after the birth of a child gives up his own name and is known by the name of the child. The custom is seen most completely developed in Java, Sumatra, Borneo, Celebes, and the neighboring islands. It is also found among Arabs and Persians, in Alaska, Polynesia, Australia, and in isolated groups in other parts of the world. The more commonly accepted explanation of the custom is that the assumption by the father of his child's name is an assertion on his part of his fatherhood and is indicative of the growth of the patriarchal idea. The chief opposing view is that it is nothing more than an expression of the desire, prevalent in all stages of culture, to be distinguished by one's most valued possession. The probabilities are that a number of customs of diverse origin are included under the term.

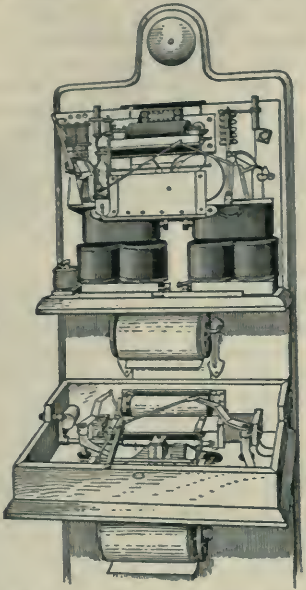
TEKUTCHIU, tȧ-kōō′chē. A town of Rumania. See TECUCIU.

TEL′AMON (Lat., from Gk. Τελαμών). In Greek mythology, the son of Æacus. Having been driven out of Ægina for helping Peleus to kill their half-brother Phocus, he married Glauce, daughter of the King of Salamis, and became King of the island. He was the father of Ajax, took part in the Calydonian Hunt and the Argonautic Expedition, and went with Hercules against Troy and the Amazons.

TELAUTOGRAPH (from Gk. Τῆλε, *tēle*, afar + *αὐτός*, *autos*, self + *γράφειν*, *graphein*, to write). An instrument invented by Elisha Gray for electrically reproducing at a distance handwriting, drawings, figures, and the like. A transmitter and receiver are associated together for use at each station, and are connected by two line wires with a similar set at the distant station or with a central exchange. Power corresponding to the amount used in two ordinary incandescent lamps is taken at each end from the electric lighting circuit. The motion of a pencil in writing is resolved into two component motions by connecting to the pencil points two light levers, hinged at their junction to the pencil. The motion of these rods is communicated to two rotary shafts, to which are attached arms, carrying at their outer ends contact rollers, which move to and fro upon the surfaces of two arc-shaped plates, upon which are wound resistance wire, forming part of the power circuit. The motion communicated to the rollers by the pencil serves to cut resistance in or out of two circuits, and thus two independent, variable currents are obtained, which depend for their



TELAUTOGRAPH.



TELAUTOGRAPH WITH CASE REMOVED SHOWING MECHANISM.

strength upon the position of the pencil on its writing surface. At the receiver are two strong electro-magnets, each one having one of its poles inclosed by the other, forming two annular spaces, across which the magnetic fields are uniform and constant. In these annular spaces are suspended two light coils of copper wire attached to bell-crank devices and light rods to a set of shafts and levers, similar to those at the transmitter. The pull of each magnetic field upon these suspended coils is opposed by a retractile spring, and the pen at the receiver is thus caused to take a position in its writing field exactly corresponding to that of the transmitter pencil. The switching on of the transmitter by means of a switch at the transmitter end automatically brings fresh paper to the writing surface from a roll beneath the transmitter, throws the receiver at the distant end into operating position, shifting its paper and raising the pen from the ink-well ready to write. When the transmitter is switched off no current is consumed at either end. A small switch placed beneath the writing surface at the transmitter is opened and closed by the pressure of the pencil thereon, and serves to control by means of induced vibratory currents and a suitable relay, the receiving pen, causing it to be raised from the paper or lowered to it, in unison with the movements of the transmitting pencil. The ink is automatically supplied to the receiver pen, and when not in use the pen rests with its tip immersed in the ink, and thus is always ready for service. The writing field is 2 inches by 5 inches, thus affording space for three lines of ordinary writing, each 5 inches long. Upon this field the writing is done and when filled a simple movement of the switch at the transmitter brings fresh paper into service at both ends of the line. A small push button serves to operate a call bell, by which all signaling is done.

The instrument is used by the United States Army in transmitting messages from the range-finding stations in the coast defenses to the high-power guns, telephones having been found unsatisfactory for this service, because disabled by the unavoidable shock. In commercial work the telautograph can be conveniently employed, as it makes a double record of each message, one for the sender and one for the person addressed.

TELAV, tyĕ-lȧf′. A district town in the Government of Tiflis, Russian Transcaucasia, 63 miles east-northeast of Tiflis (Map: Russia, G 6). It was formerly the capital of Kachetia and has ruins of old palaces. Population, in 1897, 11,810, chiefly Armenians and Georgians.

TELEDU. See BADGER.

TELEG′ONUS (Lat., from Gk. Τηλέγονος). The son of Odysseus by Circe. Having been sent to Ithaca to find his father, he failed to recognize him in combat and slew him, afterwards taking the body home, together with Telemachus and Penelope, whom he married. He was looked upon as the founder of Tusculum and Præneste, and, through his daughter Mamilia, as the ancestor of the Roman Mamilii. His story is the theme of the *Telegonia*. See TROJAN WAR.

TELEGONY (from Gk. τῆλε, *tēle*, afar + -γονία, *-gonia*, generation, from γόνος, *gonos*, seed, from γίγνεσθαι, *gignesthai*, to become, to be born). The influence of the first or of a previous sire on the subsequent progeny obtained by other sires. That the first impregnation has a lasting influence has been generally accepted by breeders. Weismann, however, states that the most competent judges in Germany, such as Stettegast, Nathusius, and Kühn, in spite of their extensive experience in breeding and crossing, have never known a case of telegony, and doubt its reality.

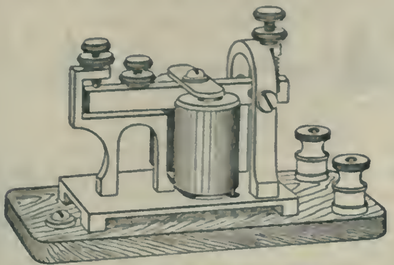
TELEGRAPH (from Gk. τῆλε, *tēle*, afar + γράφειν, *graphein*, to write). The transmission of messages by means of electricity. With the discovery that electric currents could be transmitted instantly over long distances came the idea of employing them for signaling, and in 1774 Bishop Watson made some experiments in discharging Leyden jars through 10.600 feet of wire, suspended on wooden poles, in the neighborhood of London. In the *Scots Magazine* in 1753 a detailed description of a plan for electric telegraphy is given, and in 1774 a telegraphic line was erected by Lesage at Geneva, Switzerland, which consisted of twenty-four wires connected to pith-ball electroscopes (q.v.), each representing a letter. When the connection between the frictional machine or charged conductor and any electroscope was made the pith-ball was repelled. The difficulty of using frictional machines, the only method for producing electricity then known, however, prevented the attainment of any practical results in this direction before the discovery of the voltaic cell. In Germany the invention of the telegraph is credited to Sömmering of Munich, whose original apparatus, constructed about 1809, was exhibited in operation at the Congress of Electricians at Frankfort in 1891. This instrument consisted of a series of voltameters each corresponding to a certain letter or signal. On closing the key in any circuit the signal was transmitted to the corresponding voltameters and the water in the appropriate tube was decomposed. A similar plan was proposed about the same time by Dr. J. R. Coxe, of Philadelphia. Immediately after the discovery of electro-magnetism by Oersted, in 1820, Ampère determined to apply the idea to telegraphy, and read a paper before the Paris Academy of Sciences on the use of coils of wire surrounding magnetic needles instead of voltameters for this purpose. Baron Schilling in 1832 exhibited a telegraphic model in Russia in which the letters were represented by the deflections of a single needle. Weber and Gauss modified this plan by using a magnet suspended horizontally, to which a mirror was attached. This arrangement enabled the passage of extremely weak currents to be observed as a beam of light from a lamp was reflected from the mirror mounted in connection with the suspended needle and produced a bright spot which moved along a screen with any deflection of the needle under the influence of the current. The idea was subsequently employed by Thomson in the reflecting galvanometer. Steinheil of Munich was the first to notice the important fact that by using the earth as a conductor no return wire was needed. He also invented a code of using but two elementary signals in different combinations, and an instrument for recording the characters on a moving strip of paper in the shape of two rows of dots. In America the invention of the telegraph is generally attributed to S. F. B. Morse (q.v.), though the principles on which it is based were first discovered by Joseph Henry (q.v.), who, however, failed to make any practical application of his discoveries. The electromagnet on which the action of the telegraph depends was devised by Sturgeon of England and consisted of a piece of iron of horseshoe form surrounded by coils of wire. Henry, however, was the first to construct electro-magnets in a useful form, so that they were able to sustain considerable weights and to produce this magnetic effect by the action of a distant battery. In the Albany Academy in 1832 he had a mile of wire strung, through which he passed a current which flowing through an electric magnet caused it to attract an armature and strike a bell, thus giving an audible signal. In 1835 at Princeton, where he became professor, he used one circuit with an electro-magnet to open and close another circuit containing a battery and powerful magnet. He also had a wire stretched across the campus through which he transmitted the current, using the ground for a return. In 1832 Morse first conceived his idea of the telegraph, and for a number of years was engaged in bringing the invention to a successful outcome, it being publicly shown in 1837 in New York and other cities. In the development of the invention Morse was assisted by Alfred Vail, who was a partner in the enterprise and supplied much of the mechanical skill necessary for the construction of the apparatus, as well as capital, and many of the most important features are due entirely to his ingenuity. The telegraph was established as a commercial enterprise in Germany with Steinheil's system, in America with Morse's, and in England with Wheatsone and Cooke's. The first *telegraph line* in commercial operation was between Paddington and Drayton, in England, in 1837, and was thirteen miles in length. This antedated by about seven years the Morse line, which was constructed between Washington and Baltimore and successfully inaugurated in 1844. The printing telegraph was first suggested by Vail, in 1837, and in 1841 Wheatstone made an instrument for this purpose, though in neither case did the invention come into extended use. The Wheatstone apparatus did not work well, except through comparatively short distances, and at a very low rate of speed, being altogether inferior to the Morse telegraph. The superior efficiency of the latter in working direct through long distances was caused by the application of the relay and local circuit. In October, 1851, a convention of deputies from Austria, Prussia, Bavaria, Württemberg, and Saxony met at Vienna to decide upon a common and uniform telegraph system. By this convention it was decided that the Morse system was practically the best, and it was therefore adopted, and at the present time this Morse system, or a modification of it, is in general use throughout the world.

In the Morse system the temporary magnetic attraction produced when a current of electricity sent along the wire is passed through a coil was used to impart a slight movement to a lever placed near the magnet, thereby giving a visible indication each time the current was sent through the wire at the distant station. Different combinations of current, each impulse being of momentary duration, were arranged to represent the letters of the alphabet, and by this means messages were spelled out over the wire from Washington to Baltimore. This is the foundation of all electric telegraphs, though the application of the principle is modified in innumerable ways, for the purpose of permitting the transmission and the reception of messages to be done in various methods that are convenient for special places and uses. The numerous instruments so employed may be classed under two heads—namely, those which record the signals so that they may be read at any time after the message is received, and those which give only a passing signal, indicated by a sound or a motion, and which, therefore, require the constant attention of a receiving operator. Among the former are several kinds—namely, those giving a record in arbitrary signs—i.e. in the dots and dashes of the Morse alphabet; those which print the message in ordinary type, such as the modern type-printing instrument, and lastly, a class of instruments giving a facsimile of the message, which, however, are not much used. See TELAUTOGRAPH.

THE MORSE TELEGRAPH AND MORSE INSTRUMENTS. The leading principle in the Morse instruments is that by the depression of a key, or by other means, at the sending station an electric circuit is 'closed' or completed, and a signal is transmitted along the wire to a distant receiving station, where on its arrival it reproduces the signal by the action of an electro-magnet, or otherwise.

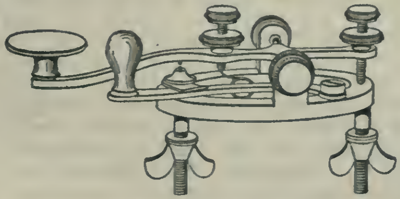
In its simplest form the Morse telegraph includes a battery or other source of current, a key to break the circuit, and a line wire connecting with a sounder or recording apparatus at the distant station, the return circuit to the battery being formed either by another wire or by the ground. To send signals in either direction a sounder and key must be provided at each station.

THE SOUNDER or receiver used is shown in the illustration, and consists of an electro-magnet of horseshoe form firmly mounted on a base. The coils are wound with insulated wire and are inclosed in cylinders of hard rubber or vulcanite. Supported by an upright casting of brass is a lever balanced on the points of two screws, which carries transversely to its length an armature of soft iron. This piece of iron is directly above the poles of the electro-magnet, so that when the current passes through the coils it is attracted with sufficient force to produce a sharp click when a screw at its end strikes the surface of the metal. By means of a spring, whose tension can be adjusted, the lever is held in such a position that the armature does not come in contact with the poles of the electro-magnet until the latter becomes magnetized by the passage of the current and attracts it. When the current ceases to flow and the core is demagnetized, the spring brings the lever back to its former position and another click results as the lever strikes a screw in the frame. If the sounder is to be used on a local circuit, as will be explained below, its resistance is generally about four ohms, but when it is on a main line where there are no relays it has a resistance of about twenty ohms, though these resistances are varied to suit conditions of line and battery or dynamo. In order to obtain a clear, loud click from the sounder it is necessary to have about one-quarter of an ampere of current flowing through the coils.



SOUNDER.

The Transmitting Key. The 'key' by which signals are transmitted from the operator at the sending office is shown below in its usual form. It consists of a lever pivoted near the middle and carrying at one end a knob by which it is manipulated by the operator in sending signals. Two platinum contacts are fastened respectively to the under side of the lever and to an insulated piece on the upper side of the base. These contacts are exactly opposite to each other, so that they come together every time the key is depressed. The lever is held up, when the key is not depressed by the operator, by a small spiral spring. One end of the line wire is connected to the sounder and then to the metallic base of the key from which the current passes through the pivots to the lever and the small contact point attached to its under side. One terminal of the battery is connected with the small insulated piece supporting the lower contact while the other goes to the ground or return wire. By this arrangement no current can pass through the line until the key or lever is depressed, since the terminal of the wire which is fastened to the contact is insulated and the current has no means of reaching the other part of the wire. When it is desired to send the current the knob is depressed, and the current from the battery, finding a passage between the two contacts, passes from one end of the wire to the other and proceeds upon the line wire to the distant station. The length of time during which the key is depressed determines the length of time between the upward and downward clicks of the sounder at the other end of the line. Thus if the operator presses down the handle and releases it quickly the keeper of the sounder will go down and up, immediately indicating a 'dot' or the letter 'E,' while if he presses the key and holds it down a moment before releasing it, there will be a longer interval between the downward and upper clicks of the sounder, and a 'dash' or the letter 'T' will be produced. In early instruments, before the operators read the messages by the clicks, the receiving instrument was arranged to make a record of the signals upon a moving strip of paper. For this purpose a pen or sharp point was attached to a lever, and a strip of paper, kept in motion by clockwork, was arranged to pass under the pen, so that a mark was produced by the pen every time the lever was pulled down by the magnet. If the lever was immediately released a dot was recorded, but if the lever was held down a moment a longer mark called a dash was produced.



AMERICAN MORSE KEY.

The signals used at first were arranged for making a record with a crude instrument of this kind, and while the increasing skill of the operators soon enabled them to read the signals directly from the clicking of the instrument without looking at the tape, the signals are still spoken of as consisting of so many dots and dashes, as if recorded on paper. These registers are to-day but little used, being seen occasionally in district telegraph stations or with fire-alarm apparatus.

The Morse Alphabet. Before going further the details of the alphabet may be given. The only elements which can be combined for making telegraphic signals in the Morse system are the dot, the dash, and the space, and the alphabet is made up of the simplest combinations of these that can be made. The preference of the shortest combinations is given to the letters which are most frequently used. This alphabet or code of signals was due to Morse's assistant and collaborator, Alfred Vail, and was based on the frequency with which the different letters occur. This was verified by consulting with printers and examining their type cases. The simplest signal, a dot, was given to 'E' and the next simplest, a dash, to 'T,' those letters occurring most frequently in our language. Between the separate signals of every single letter comes the space which is equivalent to a dot except in the case of C, O, R, Y, Z, when a lengthened space equivalent to two dots is used.

American Morse Characters

·	E	—	T
··	I	——	M
···	S	———	5
····	H	⸺	L
·····	P	⸻	cipher
······	6		
·—	A	—····	8
··—	U	—·	N
···—	V	—··	D
····—	4	—···	B

· ·	O	·—·	F	——·	G
· ··	R	· ·—·	Q	———·	I
· ···	&	· · ·—·	3	——· ·	7
·· ·	C	·—· ·	X	·——	W
··· ·	Z	· ·—· ·	2	——·	1
·· ··	Y			· ·——· ·	"Period"
				—·—	K
				—·—·	J
				·—·—	"Comma"
				—··—	9
				—··—·	?

Owing to the fact that in some of the early telegraphs used in Europe the space could not be employed as part of any of the signals without causing confusion, it was necessary to rearrange the combinations of dots and dashes, so as to form the whole alphabet with the dot and dash without the use of the space. This alphabet is known as the Continental Morse alphabet. It is used throughout Europe and in all submarine telegraphy, having been adopted by an international conference.

Continental Morse Alphabet

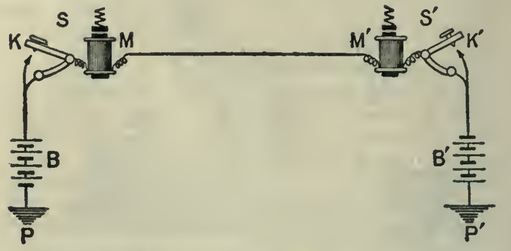
·	E	—	T
··	I	——	M
···	S	———	O
····	H	————	Ch
·—	A	—·	N
·——	W	—··	D
·———	J	—···	B
··—	U	——·	G
···—	V	——··	Z
·—·	R	—·—	K
·—··	L	—·—·	C
·——·	P	—·——	Y
··—	F	—··—	X
		——·—	Q

1, ·————	6, —····
2, ··———	7, ——···
3, ···——	8, ———··
4, ····—	9, ————·
5, ·····	0, —————

The Battery. For the generation of power in the electric telegraph, the gravity batteries (see Voltaic Cell or Battery) are chiefly employed in the United States. Various forms of the Daniell battery are also used, especially in Europe. The number of cells employed varies with the length of the line, the conditions of the wire as regards insulation, and the nature of the instruments used. It is quite common in the United States, especially in cities where many lines centre, to employ dynamos driven by steam engines for generating the current in place of batteries, or to make use of storage batteries.

The Circuit. The mode of joining up two or more stations by means of the line wire is shown in the figure. It being necessary to furnish a complete circuit or path for the current from the battery over the line and back to the battery, a return connection is required. In practice, this return connection is made by simply connecting the instruments at each station with the earth.

Assuming S and S′ to be the telegraph stations, with the wires grounded at P and P′ (see subsequent paragraph), B and B′ are the batteries, M and M′ the sounders, while K and K′ are the transmitting keys. The connection at the key is always completed by a supplementary switch, when the key is not being used to send a message, in order that the path may be complete for the reception of any message from the other office.



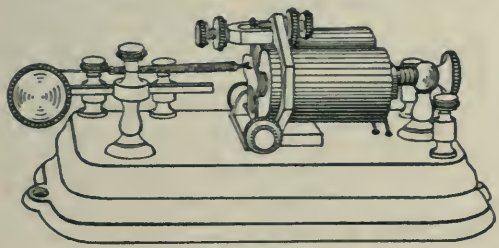
In sending a message the switch is first opened and then the key is depressed. A current of electricity will pass from the battery along the line wire, around the magnets, drawing down the armature and making a click; thence down to the earth plates and through the earth back to the battery.

The operator at the sending station in transmitting a message opens his switch and depresses his key, so as to send a series of dots and dashes corresponding to the letters to be sent to the distant station. These are heard by the receiving operator, who writes down their meaning as fast as received. The above represents the closed-circuit system, such as is employed in the United States and Canada. In the open-circuit system the current flows over the wires and through the instruments only when the sending operator depresses his key. This involves a battery at each station, which is used, however, only when signals are being transmitted.

The Line. The wire or series of wires are usually supported on poles placed along the sides of a road or railway. In cities the wires are sometimes carried over houses or in underground pipes or conduits, the conductors in the latter case being insulated by means of a gutta-percha or other suitable covering. In pole and over-house lines, the wires are kept from each other and the current from escaping to the earth by insulators of glass. In Europe white porcelain and brown stoneware insulators are used, and the former substance, when of good quality, well glazed and well burned, is perhaps the most perfect of all insulating materials, and does not deteriorate with age. The fewer the poles on which the wires are suspended, the better is the insulation and the less the cost, but the liability to accident is greater. The number of poles used varies from 30 to 50 per mile, and is governed by the number of wires carried, the configuration of the road or track, and other considerations. On road lines, the number of poles is generally larger than in the case of wires carried alongside railways, the greater level and straightness of the latter reducing the number of supports required, and thirty-five to forty to the mile is considered an average. The wire chiefly used for overland telegraph purposes is of iron, galvanized, and of No. 8 (1-8 inch) or No. 6 (1-6 inch) gauge, or copper of somewhat smaller diameter, the latter being preferred on account of its greater conductivity. The conductivity of a wire increases in the ratio of the square of its diameter (the resistance decreasing in inverse ratio), and the advantage of using a thicker wire on the longer lines is thus seen. No. 4 wire is, for this reason, used on some of the longer lines.

THE EARTH—EARTH CURRENTS. Mention has been made of the 'earth' in the preceding description. This is the technical term used in relation to the fact, discovered by Steinheil in 1838, that the earth itself serves the purpose of completing the circuit, and renders the employment of a second or return wire unnecessary. The 'earth' may consist of a buried plate of metal connected with the battery or line wire, and of sufficient surface to afford the necessary contact, with sufficient earth to make a good connection, it being understood that a small quantity of earth does not connect well. Gas or water pipes form excellent 'earths,' care being taken that the connection is made with the main pipe itself, and not with a branch, where a badly made point might spoil the connection. Where similar 'earths' are in use, as, for instance, a copper plate at one end and an iron pipe at the other, a *quasi* battery is created, and minute currents pass along the line, these, however, are too weak to be of consequence. The earth, being of great size, offers no sensible resistance to the passage of the current, in the same way that a large wire offers less resistance than a thin one. While this quality of the earth is one of the most valuable aids to telegraphy (reducing so materially the cost of wire erection), it presents at times those embarrassing interruptions known as *earth currents*. These currents, at all times unwelcome visitors to a telegraph office, are very variable, changing rapidly from positive to negative, altering their direction with the hour of the day, and leaving one circuit to appear on another in a manner not explainable.

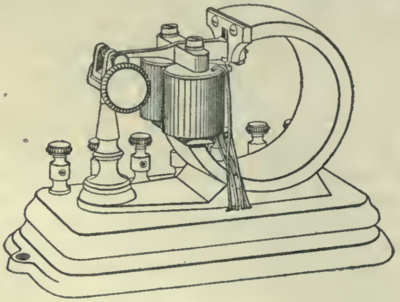
THE RELAY. There are several methods by which the transmission of signals is facilitated or accelerated. First among these may be placed the *relay*. In the previous description of the Morse system, we have assumed the instrument to be worked directly by the current sent along the line. On long circuits, however, direct working could only be accomplished by great battery power, owing to inevitable loss by leakage, experienced by a current before it reaches its destination. Consequently what is known as a receiving instrument connected to the line, instrument is worked by a 'local current' derived from a local battery at the receiving station. This is accomplished in the following way: The receiving instrument connected to the line instead of being made heavy enough to give an audible sound by which the signal may be understood, is made extremely light and delicate so that it can be operated by a weak current.


RELAY.

This relay consists of an electro-magnet wound with a large number of turns of insulated wire and an armature on a lever to which is attached a contact point which strikes another stationary contact when the lever is drawn toward the magnet, closing a circuit through these extra points in precisely the same way that the usual signaling key is worked. These contacts are connected by short wires with a regular sounder and a small battery. Whenever the lever of the relay is attracted it closes this extra or local circuit and causes the sounder to respond to every signal precisely as if it were connected directly to the main line.

DUPLEX-WORKING. The first suggestion of using a single line for more than one message was due to Moses G. Farmer of Boston, who in 1852 devised a method for this purpose and carried on successful experiments on a small scale. In 1853 Dr. Wilhelm Gintl first made use of the differential relay, and on the line between Vienna and Prague worked a method from which the modern practice of duplex telegraphy may be said to date. This system was rendered more successful in the following year by Carl Fischen of Hanover, and his invention was acquired by Siemens and Halske of Berlin, who had almost simultaneously devised a similar method. This improved system was introduced into Austria and from time to time there followed improvements devised by Stark and others. In England a duplex system was invented by Preece, while in other countries various methods from different inventors were forthcoming. In 1868 J. B. Stearns of Boston invented a system of duplex telegraphy which has since been used most successfully on many lines throughout the United States. The theory and practice of modern duplex telegraphy are somewhat complex and difficult to understand, but an outline of the principles involved may be given. In the differential method, which is largely used on land lines, there is what is known as a differential relay, that is a relay wound with two sets of coils in each of which the current flows in a different direction. Consequently when two currents of equal intensity pass through such a relay their effects are neutralized and the wire does not become magnetized. At each station a relay of this kind is provided, and there are two complete circuits, one of which includes the line wire, while the other consists of resistance coils equivalent in resistance to the line and known as the artificial line. The key and battery are common to both circuits, the points of divergence being at the relay and at the ground. If the key at one station is depressed the current will flow througn both sets of coils of the relay at this station without producing any magnetizing effect, but at the distant station it will traverse but one set of coils and will accordingly cause the relay to operate the local sounder. The same thing of course holds good for the distant station. If both keys are depressed simultaneously the two batteries will combine to produce an increased strength of current flowing through one set of the differential coils of each relay, and by virtue of this preponderance of current the armature of the relay will be magnetized. A modification of this method is known as the polar duplex system and employs at each station two batteries or dynamos, so arranged that the direction of the current flowing in the line depends on whether the key is at rest or depressed. The current divides as before at the relay, which, instead of being wound differentially, is known as a poor relay. Normally the currents going to the line flow from each station in such directions that they neutralize each other, while the other portions of the divided circuit flow over an artificial line and into the ground. Now when a signal is to be sent, the operator by means of a key or pole changing instrument reverses the direction of the current, which passes through his relay without effect, but disturbs the conditions in that instrument at the distant station and causes an increased current in one of the sets of coils. This moves the armature and closes a local circuit, producing a click from the sounder. When both keys are depressed the currents in the two sets of coils of the relay connected with the line are neutralized as before, but the current flowing through the coils connected with the artificial line is greater and in the opposite direction, so it affects the relay and closes the circuit of the sounder. In addition to these methods there is also the bridge method, founded on the principle of the Wheatstone bridge. This method is used in the operation of the submarine cables. Duplex-working led to *diplex*, that is, two messages passing over a wire in the same direction at once, and this was followed by quadruplex and multiplex telegraphy. Quadruplex-working, whereby four messages were sent over one line, was the next development, and was first used by the Western Union Telegraph Company in 1874, and is now employed on all busy lines, particularly those between large cities. The first invention and one that has been most used was that of Edison, but improvement and new methods have been devised by Prescott, Gerrit Smith, and others.

One of the principal instruments used for the purpose of distinguishing different messages which are sent over a wire at the same time is the polarized relay, which has already been mentioned. The object of the instrument is to distinguish between messages sent with a positive current and those sent with a reversed current. Thus two such instruments can be placed in an office, connected to the same wire and adjusted so that one will respond only to the messages sent with the positive current, while the other will respond only to those sent with a negative current.



POLARIZED RELAY.

The way in which this is arranged will be seen from the illustrations. In the diagram n. s. is a hard steel permanent magnet, whose south end, s, has a slit in which the soft iron armature *a* is pivoted. To this armature a thin aluminum tongue, *b*, is attached, which by making contacts on either side completes either of two local circuits, and operates either of two sounders, according to which side the tongue is attracted. The coils on the magnet are so connected that a positive current attracts the tongue to one side, while a negative current attracts it to the other.

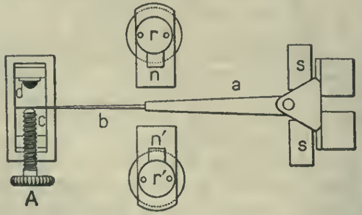
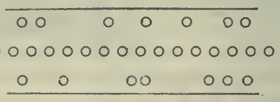


DIAGRAM SHOWING ACTION OF POLARIZED RELAY.

Automatic Transmission. The speed of the ordinary Morse instrument is limited to the rapidity with which the hand of the operator can move the key, and averages about 25 to 40 words a minute. To increase speed automatic apparatus is used which trebles, and in some cases quadruples the carrying capacity of a wire, securing at the same time mechanical accuracy in the relative size of the dots, dashes, spaces, etc. To effect this, three different instruments are required: First, there is a perforator, by which holes are punched in a paper slip to correspond with the signals required. The operator strikes three punches, the central one producing a central hole, which is of no avail electrically, only carrying forward the paper; the left-hand disk producing two holes, directly opposite to each other, on the sides of this central row, and that on the right producing two holes, placed diagonally to each other. The passage of the electric current is regulated by the position of the outer holes; those opposite each other admit of a momentary passage of the current through the 'transmitter' used in sending the message, while the holes diagonally placed produce a lengthened mark corresponding to the dash. The following diagram represents the word 'and,' as shown on the punched slip:



PUNCTURED TAPE.

This would be printed

.— —. —..
a n d.

The third portion of this instrument is the 'receiver,' in which the currents sent by the action of the punched slips in the transmitter are reproduced in the dots and dashes of the Morse code—the printing being, moreover, done with a mathematical accuracy which keying by hand cannot attain. The speed of transmission depends on the length of the line and state of the atmosphere; but the movements of the clockwork, both of the transmitter and receiver, are capable of adjustment to any speed below 120 words per minute.

A system of multiplex telegraphy invented by Delany and employed in Europe provides for the simultaneous transmission of a number of messages either in the same direction or part in one direction and the remainder in the opposite direction. The apparatus consists of a number of contact pieces arranged on a circular disk or table, some of which are connected with the separate sending or transmitting instruments, while others are connected with local relays and batteries and the ground. A trailer or rapidly revolving arm connected with the line wire passes over these contact points so that the circuit is successively completed through the different instruments at one station, while a similar device at the other station, revolving synchronously with the first, makes connections with an equal number of instruments. The speed of revolution of the trailers is regulated by two tuning forks or vibrating reeds of the same pitch, and an ingenious synchronizing device keeps them always in unison. In this way it is possible to operate twelve different sets of Morse transmissions over one wire, and it is accomplished in the following manner. The first operator closes his key, and as the trailer passes around, it will make contact with the line wire and his instrument will be connected about 36 times in one second, thus transmitting that number of impulses. Now, if he desires to send a signal corresponding to a dot, he would close his key for a brief interval, which may be one-twelfth of a second, thus allowing three impulses of current to be transmitted over the line wire to the corresponding instrument at the other station, which is only in a position to receive the signals from the one transmitter. The same is true for the other operators and their instruments, each one employing the wire for a certain fraction of the time. Numerous other systems have been devised, important among which is the multiplex printing telegraph of Rowland, which has been successfully used in Europe. It employs an alternating current and four transmitters and receivers can be used in connection with one wire. There is a mechanical keyboard somewhat similar to that of a typewriter, while the signals are received and printed on a tape or upon ordinary letter pages in 'typewriting' characters.

In the United States the telegraph is entirely in the hands of private companies. The first company was organized in 1845 under the name of the Magnetic Telegraph Company by Morse's supporters and associates. In that year the telegraph was constructed between Philadelphia and Morristown and in the following year it was extended to New York. The House printing telegraph was patented in 1846, and soon after numerous companies were formed to exploit both systems. This was the case all over the United States, and soon the competition became most sharp and the lack of thorough organization apparent. In 1856 the Western Union Company was formed by the Erie and Michigan Telegraph Company uniting with the New York and Mississippi Valley Printing Telegraph Company. From this time combination and consolidation was carried on, the efficiency of the service increasing continually. In 1816 the telegraph across the North American continent was completed and in operation. By 1866 consolidation had taken place to such an extent that there were three telegraph companies which enjoyed the largest part of the business in the United States. These were the Western Union, the American Union, and the United States. In 1881 the Western Union absorbed the American Union and the Atlantic and Pacific, and at later periods purchased or leased the lines of the New York Mutual Telegraph Company, the Baltimore and Ohio Railway Telegraph, American Rapid Telegraph, and the Northwestern Telegraph Company, all of which are now operated as part of the Western Union system. The telegraph business of the United States is at present controlled by the Western Union and Postal Telegraph-Cable companies. The former in 1901 had 193,589 miles of poles and cable, 972,766 miles of wire, 23,238 offices, transmitted 65,657,049 messages, had receipts aggregating $26,354,151, expenses amounting to $19,668,903, and profits of $6,685,248. The average toll per message in 1870 was 75.5 cents, while the cost of transmission was 51.2 cents. In 1900 these figures were 30.8 cents and 25.1 cents, respectively.

The Postal Telegraph-Cable Company in 1901 had in its system 43,850 miles of poles and cables, 243,423 miles of wire, 14,870 offices, and transmitted 17,898,073 messages.

LAND TELEGRAPH SYSTEMS OF THE WORLD (1902)

STATEMENT SHOWING MILEAGE OF LINES AND NUMBER OF MESSAGES DELIVERED IN EACH COUNTRY OF THE WORLD; ALSO THE NUMBER OF MESSAGES PER CAPITA

COUNTRIES	Miles of lines	No. of messages sent	Messages per capita
United Kingdom	46,295	89,576,961	2.15
United States	219,938	83,555,122	1.08
France	90,170	48,144,151	1.25
Germany	81,303	38,342,455	.68
Austria-Hungria	47.304	29,427,615	.65
Russia	98,570	18,376,969	.14
Japan	14,734	16,737,150	.38
Commonwealth of Australia	44,501	8,987,846	2.39
New Zealand	7.249	9,898,128	5.05
Italy	26,427	7,896,081	.24
Belgium	3,975	*14,411,487	2.15
Spain	19,885	†5,058,104	.28
Argentina	27,584	3,427,664	.71
India	52,909	6,237,301	.03
Netherlands	‡3,831	‡5,393,872	1.04
Mexico	§32,486	2,604,710	.19
Canada	35,628	5,181,680	.96
Switzerland	5,698	3,950,162	1.19
Turkey	23,440	3,624,775	.14
Bulgaria	3,270	1,356,041	.36
Egypt	2,365	4,250,571	.44
Roumania	4,344	2,224,539	.38
Cape Colony	7,467	3,562,039	1.51
Sweden	5,958	2,580,258	.50
Denmark	‡2,413	‡2,317,979	.94
Norway	¶9,040	2,267,915	1.01
Portugal	5,180	3,420,453	.63
Brazil	12,630	2,662,711	.02
Chile	14,592	‖1,286,936	.41
Greece	**5,300	1,771,506	.73
Servia	2,550	1,079,435	.43
Guatemala	3,400	796,192	.51
Cuba	2,300	....	......
Uruguay	4,601	397,493	.42
Colombia	8,600	††555,000	.14
Persia	4,800	152,837	.08
Peru	1,933	121,492	.03
Paraguay	600	83,560	.16
Venezuela	3,882	....	......

* Including official dispatches. † Including international and official messages. ‡ State offices and State lines, respectively, only. § Of which 19,085 miles were owned by the Federal Government. ¶ Including telephone lines and wires. ‖ Sent over State lines only. ** Including submarine lines. †† Estimated.

In striking contrast to the system of private companies of the United States is the governmental control of the telegraphs as practiced in Great Britain and other European countries. In Great Britain previous to 1870 the telegraph business was controlled by private corporations, but in 1868 a bill was introduced into Parliament and passed in the following year whereby the lines and property were acquired by the Government at an expense of £6,750,000. In 1869 there were about 7,000,000 messages sent, a number which increased to 22,459,775 in 1879, and 90,415,123 in 1900. In this last year the receipts from telegraphs were £3,460,492 and expenditures £3,748,930, leaving a deficit of £288,438. This deficit is due largely to the reduced rate at which newspaper messages are transmitted, there being an actual loss of over £250,000 on this class of business. With governmental ownership have come improved service and reduced rates. Where in 1870 it cost from 3 to 6 shillings to send a message from London to Dublin, now a message of 12 words can be sent anywhere in the United Kingdom for 6 pence. In 1867 the average charge for a message was a little over 50 cents; now it is slightly more than 15 cents. In 1900 the Postoffice Department controlled 11,188 telegraph offices, including 2337 railway offices, while the mileage of line is stated at 44,970, with 329,660 miles of wire.

BIBLIOGRAPHY. Houston and Kenelly, *Electric Telegraphy* (New York, 1896); Loring, *A Hand Book of the Electro-Magnetic Telegraph* (New York, 1900); Maver, *American Telegraphy: Systems, Apparatus, Operation* (2d ed., New York, 1899); id., *Quadruplex, with Chapters on the Dynamo Electric Machine in Relation to the Quadruplex* (New York, 1893); Pope, *Modern Practice of the Electric Telegraph* (16th ed., New York, 1899); Prescott, *Electricity and the Electric Telegraph* (New York, 1892); Culley, *Handbook of Practical Telegraphy* (8th ed., London, 1885); Preece and Sivewright, *Text Book of Telegraphy* (9th ed., London, 1891); Bright, *Submarine Telegraphy* (London, 1898); Reid, *History of the American Telegraph* (New York, 1882). See also ATLANTIC TELEGRAPH; TELEGRAPHY, SUBMARINE; and WIRELESS TELEGRAPHY.

TELEGRAPHERS' CRAMP. See NEUROSIS.

TELEGRAPHY, SUBMARINE. In submarine telegraphy there are many variations from the practice on land lines. (See TELEGRAPHY.) This is the case because the length of the line between stations is usually great and certain conditions attend the construction and laying of the cable bearing the conductor. The problem then involves the transmission of current along a conductor of great length and necessarily small cross-section with of course considerable resistance. In a long cable we have to consider the effect of the electrostatic inductive capacity as well as its conductivity. The cable acts as a condenser (q.v.), the core or conductor forming one of the plates or conducting surfaces, while the metallic sheathing acts as the other. As it takes a perceptible time for the cable to be charged and discharged when a current is sent through it, there is a certain limit to the speed of transmission of signals without their becoming confused and unintelligible. As the length of the cable increases, so does the time required for charging, and it was demonstrated by Lord Kelvin (1853) that the rate of signaling would vary inversely as the square of the length of the cable. So small is the current passing over the cable that it is impossible to use ordinary telegraph instruments on lines greater than 500 miles in length, and only up to 150 miles can an ordinary rate of signaling be maintained. It is necessary, therefore, to use some sensitive device such as a mirror galvanometer or a Thomson siphon recorder to receive the transmitted signals. The galvanometer (q.v.) or some modified or special form of this instrument when used in cable telegraphy is of high resistance and considerable sensitiveness. The ordinary mirror receiver resembles the Thomson reflecting galvanometer, and has one coil and a suspended mirror to which the magnets are attached. The action is precisely the same as in the galvanometer, the amount and direction of the deflection depending on the intensity and direction of the current. A galvanometer with a suspended coil may also be used, or, what is more usual, some form of siphon recording receiver. The siphon recorder was invented by Lord Kelvin in 1867 and has since been greatly modified and improved by various cable engineers. It consists essentially of a coil of light wire suspended between the poles of a powerful magnet, capable of being deflected from its position of rest upon the passage of a current. As the coil moves its motion is transmitted to a siphon formed by a fine glass tube, one end of which dips into a vessel containing ink, while the other is near or in contact with a strip of paper which is moved through the apparatus by a motor, either electrical or clockwork. This glass pen will trace on the tape a line where the movements of the coil are indicated by curves or waves marked on the paper. These curves are above or below the line of rest, depending upon the direction of the current which passes through the coils. Thus to produce a dot a positive current is sent over the wire and an upward curve is produced on the record. Reversing the current gives a dash, and employing the Continental Morse alphabet described under TELEGRAPHY, the various signals can be transmitted. With such recorders are employed either simple keys or automatic transmitters. The simple key consists of a pole-changing device by which a current in either direction can be sent over the circuit by simply pressing one of two keys. In automatic transmission, which is used on the transatlantic cables and other busy lines, the operator first punches in a paper strip holes corresponding to the proper signals, and then contact is made through the agency of rods or brushes as the tape is passed through the transmitter. These devices, however, can only be used on cables having heavy cores, but by their use a rate of 50 words or more a minute may be obtained.

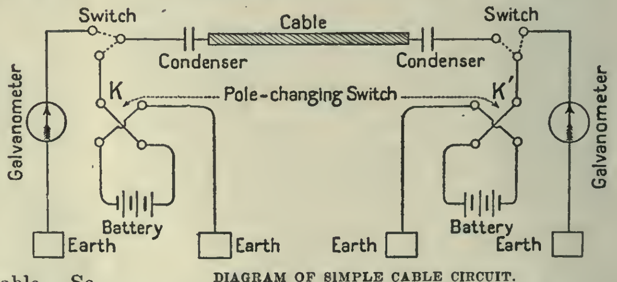


DIAGRAM OF SIMPLE CABLE CIRCUIT.

In working cables it was soon found that their efficiency was increased and the effect of earth currents eliminated by inserting a condenser (q.v.) between the transmitting instrument and the line. This idea, originated by C. F. Varley, was embodied in a patent in 1862 and put in practice in 1866. When first used at the receiving end it was found that the speed was considerably increased, and when placed at both ends the efficiency of the cable was practically doubled. Greater distinctness in the transmission of the signals was obtained as well as increased rapidity. The operation of a simple cable circuit will be seen from the preceding diagram of the connections.

The cable connected with a condenser at either end is shown above. From the opposite plates of the condenser connection is made with a switch through which the current may pass either to the earth through a galvanometer or recorder or to a transmitting key, K, and then to the battery and earth, depending on whether signals are being sent or received at the particular station. At K and K′ either pole of the battery can be connected at will to the line, or rather to the condenser, and the cable charged inductively. The corresponding signals are produced at the distant station, the galvanometer being connected to the line by the switch. Cables can also be worked duplex with facility and an increased speed of 90 per cent. attained, but as yet it is not possible to employ the quadruplex method in use on land lines. The duplex system was devised in 1875 and 1876 by Muirhead and Taylor and was first used on the Atlantic cable in 1878. Previously in 1873 experiments in this field had been carried on by J. B. Stearns.

History and Statistics. The feasibility of laying a line for the transmission of signals along the bottom of the ocean seems to have been first suggested in 1795 by a Spaniard named Salvia. Eight years later a nephew of the famous electrician Galvani performed experiments of a similar nature in the deep sea off Calais. The first really important experiments, however, bearing directly upon this subject are believed to have been those of Sömmering and Schilling, who in 1811 applied a soluble insulating material to a conductor which was laid across the river Isar near Munich. These investigators also used a submarine conductor to explode gunpowder by an electric current. In 1813 an Englishman named John Sharpe transmitted signals through seven miles of insulated copper wire laid on the bottom of a pond, but the first practical attempt to use such a conductor to transmit telegraphic signals was by Colonel Paisley of the Royal Engineers at Chatham, England, in 1838. He surrounded his conductor with strands of tarred rope and wrapped the whole with pitched yarn. In 1839 Dr. W. O'Shaughnessy at Calcutta laid across the Hugli River copper wire covered with bamboo and then coated with cotton and tar. In 1840 Wheatstone proposed a scheme similar to those of the last two inventors, and later suggested the use of gutta-percha as a covering for the wire, but was unable to put his idea into practice. Prof. S. F. B. Morse, of New York, laid an insulated cable between Castle Garden and Governor's Island, and as a result of his experiments came to the conclusion "that a telegraphic communication on his plan might with certainty be established across the Atlantic." The idea that submarine conductors for telegraphic purposes could be constructed was rapidly taking root, and in 1845 the Messrs. Brett, who were active in the construction of the first telegraphic lines across the English Channel and the first Atlantic cable, registered a 'General Oceanic Telegraphic Company' for the purpose of establishing telegraphic communication between England and America. In 1850 an experimental line was laid across the English Channel by the Messrs. Brett, and this was followed in 1851 by a permanent cable of such excellent construction that it survived for a number of years. Several longer lengths of submarine cable were laid within the next few years. Italy was connected with Corsica and Sardinia, and Sardinia with Africa. A Black Sea cable was laid in 1855, but operated only a short time.

Thus far attempts to lay submarine telegraph lines had been confined to comparatively short distances. In 1858, after repeated unsuccessful experiments, telegraphic communication was established across the Atlantic. After something over a hundred messages had been sent back and forth, the cable ceased to work. Although this cable was a comparative failure, yet its brief success proved two things: (1) That a cable could be laid through 3000 miles of deep sea; (2) that the electric current could be transmitted through a wire of that length. It was not until 1866 that a permanent cable was laid across the Atlantic. (The detailed history of this undertaking is described under Atlantic Telegraph.) A second Atlantic cable was inaugurated immediately after, the one which had broken in the laying in 1865 having been repaired. In 1859, after the first Atlantic cable had ceased to work, the Red Sea and East Indian Telegraph was laid, over a route 3043 miles long, but this also proved a dismal failure and was finally abandoned. The Malta-Alexandria cable was laid in 1861, and was in use till 1872, when, from repeated breakages in shallow water, its use was discontinued. The core consisted of a strand of seven copper wires, covered by three layers of gutta-percha; outside of this was a serving of tarred yarn; and, finally, 18 iron wires, constituted the sheathing. This was the first long cable successfully laid (its total length, in three sections, being 1331 miles); and it was also the first properly tested under water before being laid, and carefully constructed with constant watchfulness as to its electrical and mechanical conditions. In 1869 a cable 2328 miles long was laid from Brest, France, to the island of Saint-Pierre, south of Newfoundland; in 1873, one from Lisbon to Pernambuco, Brazil. In 1874 a third British Atlantic cable was laid, from Ireland to Newfoundland, and in 1875 a fourth, from Ireland to New Hampshire. In 1903 there were 19 cables across the Atlantic, of which three were no longer in use. Of these, two distinct lines, one of which is duplicated, connect Europe with South America.

In 1902 the British Pacific Cable between Australia and British Columbia, 7800 nautical miles in length, was completed, and in 1903 the first American cable was laid across the Pacific, with a length of 7846 nautical miles, by the Commercial Cable Company, between San Francisco and the Philippines, touching at Hawaii, Midway Island, and Guam. In 1903 the total length of submarine cable was estimated at over 250,000 miles, representing an outlay of over $300,000,000.

Construction of Cable. A submarine cable consists of three parts: (1) The central conductor, or core, to carry the current. This is made of copper wire, either solid or in strands. (2) A covering of insulating material to prevent the current from being dissipated. This is usually made of gutta-percha, although recently, in submarine telegraphy in the Philippine Islands, rubber has been used instead. (3) An outer covering to protect the insulating material from injury. This is usually of yarn, tape, or canvas. The cable is generally divided into three sections: the deep-sea section, the intermediate portion, and the shore end. The last portion has to be constructed with greatest care and strength, as in shallow water there is more danger of injury from rocks and other causes. It is estimated that a deep-sea cable weighs about one ton per nautical mile. Cables cost from $350 in deep sea to $1500 at the shore end per mile. The cost of maintenance is often heavy and requires the services of a fleet of vessels.

Bibliography. Consult Bright, *Submarine Telegraphy* (London, 1898), a thorough and interesting treatment of the subject from both the historic and scientific sides; also, "Submarine and Land Telegraph Systems of the World," in *Monthly Summary of Commerce and Finance of the United States*, July, 1903 (Washington, Treasury Department).

TELEGRAPHY, Wireless. See Wireless Telegraphy.

TEL EL-AMARNA, tĕl ĕl-ȧ-mär′nȧ. A place in Middle Egypt, on the right bank of the Nile, about midway between Thebes and Memphis. It includes the Arab villages Hagg-Kandil and Et-Tell and is the site of the ancient city of Khut-Iten (Horizon of the Sun), founded by the heretic King Amenophis IV. (q.v.), who abandoned Thebes and removed his residence thither. A splendid temple and palace were built, and the city increased so rapidly that it soon extended to the opposite bank of the Nile; but it had only a brief existence. After the death of Amenophis and the triumph of the orthodox religion, the royal residence was transferred to Thebes and the new city fell into decay as rapidly as it had risen. Fifty years after its foundation it was in ruins, and has never since been inhabited. The ruins of the temple and palace are still to be seen, and in the vicinity are a number of interesting rock-hewn tombs, richly adorned with sculptures and paintings, constructed for the courtiers of the royal founder of the city. In the winter of 1887-88 the archive chamber of Amenophis was discovered by some natives, and in it were found a number of cuneiform tablets containing the Asiatic correspondence of the King and of his father, Amenophis III. (See Amarna Letters.) The site was explored by Petrie in 1891-92. Consult Petrie, *Tel el-Amarna* (London, 1897); Baedeker, *Aegypten* (Leipzig, 1897).

TEL EL-KEBIR, tĕl ĕl kȧ-bēr′. A village of Northeastern Egypt, on the Sweet Water Canal, 18 miles east by south of Zagazig, noted as the scene of a battle between the English under Lord Wolseley and the Egyptian insurgents under Arabi Pasha (q.v.), September 13, 1882. See Egypt.

TELEMACHUS, tē-lĕm′ȧ-kŭs (Lat., from Gk. Τηλέμαχος). In Greek legend, the son of Odysseus (see Ulysses) and Penelope (q.v.). At the opening of the *Odyssey* he is represented as led by Athena in the guise of Mentor, a trusted Ithacan friend of Odysseus, in search of tidings of his long-absent father, since he was unable alone to expel the insolent suitors of his mother. Having visited Pylos and Sparta, Telemachus returned home to Ithaca, where he found his father in the guise of a beggar, at the hut of the faithful swineherd Eumæus. After Odysseus had revealed his identity to his son, they carried out a plan for the slaying of the suitors. In post-Homeric legend it was told how, after the death of Odysseus, Telemachus and his mother accompanied Telegonus to the island of Circe, where Telegonus wedded Penelope, and Telemachus Circe.

TELEMACHUS. A Syrian monk who in A.D. 404 leaped into the arena of the Coliseum during a gladiatorial combat, attempting to separate the contestants. He was stoned to death, but his heroic protest led Honorius to suppress gladiatorial fights; at least there is no evidence of their taking place after this time.

TÉLÉMAQUE, tȧ′lȧ′mȧk′, Aventures de (Fr., Adventures of Telemachus). A romance, with some political significance, by Fénelon (1699), founded on the adventures of the son of Odysseus and largely influenced by Barclay's *Argenis* (q.v.). The principal character represented the author's conception of an ideal youth and was meant as a model for his pupil, the son of Louis XIV.

TELEMETER (from Gk. τῆλε, *tēle*, afar + μέτρον, *metron*, measure). An instrument for measuring the distance to a remote object, used in surveying and in military operations by engineers and artillerists. In the Boulenge telemeter, the distance from the observer to a cannon or exploding shell is ascertained by measuring the time consumed by the sound in reaching the ear. There are many forms of telemeter, which consist for the most part of telescopes and mirrors by means of which angles can be read and the distance computed. Gautier's telemeter is a type of this class of instruments, and depends upon the double reflection of a beam of light, as in the case of the sextant, and the measurement of a short base line at the point of observation. The telemeter of the United States Coast and Geodetic Survey is more generally known among American engineers as the stadia (q.v.), and in Great Britain as a tachometer. It consists of a mounted telescope with two extra horizontal cross wires that intercept a certain number of divisions on the image of the graduated rod held upright at the distant point. The distance of the rod from the instrument is obtained by multiplying the reading by a constant factor which depends upon the construction of the telescope. Stadia measurements are particularly useful in making a rapid survey or reconnaissance and are accurate to about one part in 700. The name telemeter is also applied to an instrument which is connected electrically with indicating apparatus such as a meter or gauge and furnishes a similar record at a distant station. See Range-Finder. Consult Baker, *Engineer's Surveying Instruments* (New, York, 1892).

TELEOLOGY (from Gk. τέλος, *telos*, end, completion + -λογία, *-logia*, account, from λέγειν, *legein*, to say). A term used in philosophy to denote any theory which explains the world as in some way controlled by intelligent purpose. The question teleology answers in the affirmative is whether in the universe as a whole, or even in the phenomena of terrestrial organic life, there is some actually conscious being controlling the cause of events and shaping it to the realization of preconceived ends. It is certain that the tendency to interpret actions teleologically appears in very early childhood. But as the child grows older he has a right to criticise the interpretation he previously gave to these actions. The mere fact that it is natural for him in early childhood to do a thing is no proof that in mature life he is justified in continuing to do that thing. The criticism he gives to his early personifications results in the confirmation of some. He is confirmed, for example, in his conviction that all normal human beings have much the same mental constitution and much the same conscious control over their actions as he. But the increase in knowledge, which bears out his early interpretation of the actions of human beings, tends to discredit much of his interpretation of other phenomena. Fetishes tend to disappear with mental culture, while, in regard to the animal world, the child-fashioned, rough-and-ready explanation of instinctive action as consciously purposed has become obsolete in scientific circles. But the depersonifying tendency of scientific knowledge has been generally offset by the attempt to attribute to the universe at large a purpose which many individual parts of the universe are no longer alleged severally to show.

In fact, in its metaphysical aspect the question is removed to a plane where science and scientific considerations are only of secondary importance. In the old argument that the natural world reveals adjustments which could only have been provided for by the foreseeing wisdom of God, the teleological hypothesis was a form of scientific theory—that is, it was as much a description of the course of events as an interpretation of their causes. As treated in its broadest scope, however, teleology becomes an interpretation of the facts which it is the business of science to describe. Teleology is an interpretation of a particular kind; it argues that the facts which science describes can be adequately accounted for, causally, only by the assumption of an intelligent purpose of which human purpose furnishes the only analogy which we can understand. This does not mean that the purpose of the universe must be like human purpose, but that a purpose resembling human purpose is all that can make it intelligible to us.

Teleology, in this sense, and scientific theory in no way conflict. As a matter of fact, they are based upon very different rational principles. Science proceeds in its explanations upon the law of parsimony (q.v.), assuming the fewest possible hypotheses for the maintenance of its structures; teleology, on the other hand, proceeds on the principle of sufficient reason, which requires the fullest and most satisfactory explanation of phenomena as the probable truth. Again, science is primarily concerned only with the delineation of phenomena, with description of fact; teleology strives to discover a significance in these phenomena and facts which shall satisfy all the needs of the human mind. The same facts are dealt with in each case, but the form of their consideration is entirely different. This may be illustrated in the case of the doctrine of evolution, which, for science, is simply the specific statement of certain hypotheses—as, for example, the struggle for existence, the law of the survival of the fittest, etc.—which are supposed to describe the actual descent of animals; teleologically, however, evolution is viewed as a process planned and controlled by a foreordained intelligence analogous to ours. Frequently scientific theory, as in this case, contains elements of teleology, but this is due rather to the failure of exact description than to the proper character of scientific treatment. There is no logical interconnection of science and teleology and no possibility of any real contradiction between them. See MATERIALISM; MECHANISM.

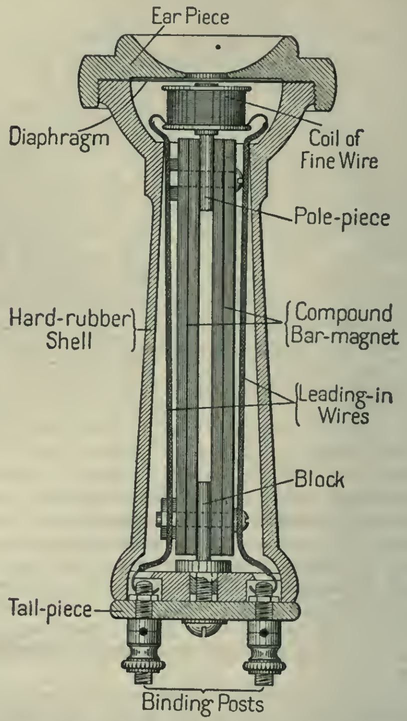
TEL'EOSAU'RUS (Neo.-Lat., from Gk. τέλεος, *teleos*, τέλειος, *teleios*, complete + σαῦρος, *sauros*, lizard). An extinct crocodile, fossil skeletons of which are found in the Jurassic rocks of Europe. The animal was small and had a much elongated tube-like snout armed with numerous small outward-curving teeth. The body was covered by tuberculated scutes. See CROCODILE.

TELEP'ATHY (from Gk. τῆλε, *tēle*, afar + πάθεια, *-patheia*, from πάθος, *pathos*, feeling). A term coined by members of the Society for Psychical Research: "We venture to introduce the words Telæsthesia and Telepathy to cover all cases of impression received at a distance without the normal operation of the recognized sense organs." (See PSYCHICAL RESEARCH, SOCIETY FOR.) E. Gurney, F. Myers, and F. Podmore in *Phantasms of the Living* (1886) say that "under particular conditions of excitement—the rationale of which we probably do not understand, though insensibility and the near approach of death are apparently some of the most effectual of these conditions—certain persons seem to have the faculty of communicating to other persons at a distance what is happening to them, often without any intention or consciousness of doing so on their own parts," and further, that "certain small experimental results can be produced," and that "certain impressive spontaneous phenomena are shown to belong to the same class." It seems now to be clearly enough demonstrated that only the experimental results are worthy of attention. There are many accounts of telepathic phenomena of earlier date. Thus the hypnotized subjects of Mesmer were said to have frequently obeyed the *silent* will of the operator; but all such reports are useless as evidence, on account of the lack of sufficient data, the neglect of suitable precautions, and the ignorance of the extreme suggestibility of the hypnotic subject. So, too, the countless stories as to the feats performed in the popular game of 'mind-reading' are of little significance, once the possibilities of 'muscle-reading' are clearly understood. The actual evidence upon which telepathy now rests is of an extremely fragmentary nature. It may be classified as (1) experimental, the communication from 'agent' to 'percipient' of simple visual impressions—diagrams, and color, suit, and number of playing cards, etc.; (2) certain striking cases of the induction of sleep at a distance, notably that of Madame B. or 'Léonie,' reported by J. Ochorowicz; (3) statistics of what are known as 'veridical hallucinations,' i.e. apparitions of a person to some distant friend at the time of the person's death; (4) the performances of certain 'test mediums,' especially of one, Mrs. Piper, whose case has been investigated at length by the Society for Psychical Research. (See their *Proceedings*, 1890, 1892, 1895.) All this evidence rests upon the assertion that the number of coincidences exceeds the number attributable to chance according to the law of probability; e.g. veridical hallucinations are said to be 440 times more numerous than they should be according to chance alone. The verdict of science is still, however, 'not proven.'

Bibliography. *Proceedings Society for Psychical Research, passim;* Beard, *The Study of Trance, Muscle-Reading, and Allied Nervous Phenomena* (New York, 1882); Jastrow, *Fact and Fable in Psychology* (Boston, 1900); Flammarion, *The Unknown* (Eng. trans., New York, 1900); Ochorowicz, *De la suggestion mentale* (Paris, 1887); Parish, *Zur Kritik des telepathischen Beweismaterials* (Leipzig, 1897); Podmore, *Apparitions and Thought-Transference* (New York, 1895).

TELEPHONE (from Gk. τῆλε, *tēle*, afar + φωνή, *phōnē*, voice, sound). An instrument for the transmission of speech or musical or other sounds by means of electrical vibrations corresponding to the original sounds. The first use of the word telephone is in a description of experiments by Wheatstone where sound was transmitted through wooden rods. In 1837 Page, of Salem, Mass., noticed that an iron rod suddenly magnetized and demagnetized would emit certain sounds which were due to a rearrangement of the molecules, and this phenomenon has since been known as Page's effect. Bourseul of France in 1854 conceived the fundamental idea of the telephone, but did not, however, put it into actual practice. He proposed a device in which a current interrupted by a vibrating disk under the influence of the voice would produce a similar vibration of a disk at the end of a conductor through the agency of an electro-magnet. In 1860 Philipp Reis, of Frankfort, invented an apparatus which he named 'Telephone,' with which he was able to reproduce sound at a distance. Reis's telephone, about which there has been much controversy, in his hands at least was able to transmit articulate speech, and he is entitled to credit for the principle of the instrument. For the practical development of the idea and the invention of an actual working telephone the honor must be given to Alexander Graham Bell, who, March 7, 1876, received letters patent for new and useful improvements in telegraphy in which a method for the transmission of vocal sounds is one of the most important of the claims. Few patents for inventions have been subject to more litigation than the telephone, and the literature on the subject is quite exhaustive; but Bell's rights have been sustained by the highest courts, and though he was closely followed by other inventors, notably Elisha Gray, he may fairly be entitled to the honor of the invention.

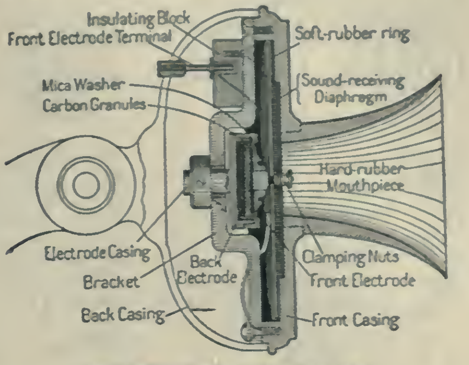
The Bell telephone, which has survived as the modern receiver, served both as transmitter and receiver in the early apparatus. A reference to the accompanying diagram showing a cross section of a modern unipolar receiver will make clear its action. There is a hard rubber case hollowed at its upper extremity and containing the soft iron diaphragm about $\frac{1}{100}$ inch thick and two and a quarter inches in diameter, with free part one and three-fourths inches across, which is tightly held at its circumference, but its centre is free to vibrate. A bar magnet, either single or compound, carries at its upper end a coil of fine silk-covered wire (No. 38 B. & S. gauge generally) with resistance of about 75 ohms, whose terminals connect with the binding posts. A more powerful receiver can be constructed by employing instead of a single magnet a horseshoe magnet with coils on each pole. In the Ader bipolar receiver, used extensively in Continental Europe, the horseshoe magnet is ring-shaped and outside of the diaphragm, and in front of the pole pieces a soft iron ring is placed with the object of strengthening the field of force between the poles. The diaphragm of a telephone receiver is in close proximity to the pole or poles of the magnet, but not in contact. When used as a transmitting instrument this diaphragm will vibrate under the influence of the voice, its movement being caused by the movement of the air known as sound waves. The diaphragm rapidly approaching and receding from the magnet consequently produces currents by induction in the wire of the coil. These currents will be transmitted over the line wire, and, flowing through the coil of the receiving instrument, will cause its magnet to become more strongly magnetized and the diaphragm to be attracted. The diaphragm of the receiver will accordingly move in unison with that of the transmitter, and consequently the sound wave which impinges on the latter will be reproduced. The ground can be used as a return or the circuit can be of wire throughout. The currents of electricity that were transmitted



SECTION OF RECEIVER WITH COMPOUND UNIPOLAR MAGNET.

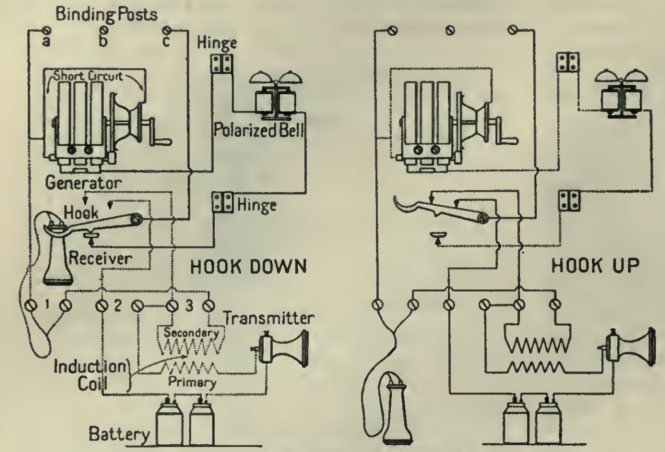
in this way were too feeble to produce satisfactory sounds at the receiving instrument when there was a line of any considerable length, and it was necessary to find a better transmitter. Accordingly there followed the carbon transmitter, where the change of resistance of carbon under pressure produces pulsations in the current corresponding to the vibration of the sound waves.

Previous to this, however, came Elisha Gray's transmitter, consisting of a needle mounted at the centre of a vibrating diaphragm and dipping into a liquid of rather low conductivity. The current passed through the needle and the liquid and the resistance of the circuit varied with the vibration of the diaphragm. This transmitter allowed variable but continuous currents to pass, and did not interrupt them entirely, as did the transmitter of Reis's telephone. The next transmitter was that of Berliner (1877), based on the variation of resistance with pressure, a diaphragm vibrating in contact with a metal knob; and then came that of Edison, where a button of compressed carbon was in contact with a small disk of platinum on the diaphragm. The microphone of Hughes (1878), where two bodies are in loose contact, has furnished the type of modern transmitters, where the carbon is in the form of finely divided granules held between two conducting plates, one of which is the diaphragm on which the voice strikes. The Edison form was, however, used for a number of years, but the Hunnings form or some modification was found necessary when long-distance telephoning came into practice. With such transmitters it was found necessary to introduce a secondary circuit instead of having the varying currents flow in the main circuit as was the case originally. The change in resistance then was small in comparison with the total resistance of the circuit and the effect on the receiver was not as marked as desired. Accordingly Edison conceived the idea of using an induction coil in the circuit with the transmitter. This induction coil consists of a primary coil with a few layers of coarse copper wire wound around a bundle of soft iron wire and a secondary coil of a large number of turns of fine wire. The diagram below, where the receiver has been removed from the hook (hook up), shows the general arrangement of the circuit. The current from the battery flows through the transmitter and the primary of the induction coil. Any difference of intensity in current caused by a change of resistance in the transmitter will give rise to induced currents in the secondary, which will affect the receiver correspondingly, and the original vibration of the sound waves will be reproduced. The addition of the coil renders the apparatus far more sensitive and the increase in voltage caused by the many turns of the secondary enables the sound to be transmitted to a much greater distance. The Blake transmitter, the invention of Francis Blake, of Boston, was used in the United States almost universally until the adoption of the transmitter with the granulated carbon, and is familiar in the older instruments, being incased in a wooden box. Its action depends upon the pressure on a button of a compressed carbon by a point in connection with a metal diaphragm. The transmitter in most general use at present is the White or solid back transmitter illustrated in the accompanying diagram. The construction of the transmitter will appear from the diagram. Between two disks of carbon is placed granular carbon. One disk is in contact with the solid back of the instrument, while the other is in contact with the diaphragm on which the sound waves impinge. The back of the transmitter forms one electrode, while the front plate is insulated from the rest of the apparatus and is connected with the other conductor. There are numerous other forms of transmitter, which are constantly increasing with the extending use of the telephone for interior use and by independent companies. These transmitters, require batteries, of which the Leclanche, some form of dry cell, or the Fuller bichromate of potash cell are generally employed, while for central stations and wherever possible storage cells are very desirable and useful.



WHITE SOLID BACK TRANSMITTER.

With the telephone must be included some sort of call-bell, and for this purpose a magneto-bell is usually employed. This consists of a small magneto-generator in which the armature is revolved by a few turns of a crank and a current of considerable voltage (that is, compared with the battery) is transmitted to the distant station, where there is what is known as a polarized bell. The current transmitted is alternating and the bell used is of the polarized ringing form, where the armature is alternately attracted by one pole and the other, depending on the polarity of the passing current. In the older form of circuit still in use in many exchanges where the central station must be called up by turning the crank the magneto machine and bell are in circuit as long as the receiver hangs on a hook which forms a switch. The circuit is shown below. When the handle of the magneto is turned a current is sent out through the bell and hook to the line. Then the receiver is taken down and placed at the ear and the bell circuit is broken, merely the telephone circuit being in connection with the line wire. With a number of subscribers an exchange or central station is necessary where the wires connecting the various subscribers or other stations can be joined at will. At these stations an annunciator, which may be either a falling flap with the appropriate number or an incandescent lamp, informs the operator of the call and by means of the switchboard to which all the wires are led the connections desired by the subscriber are made. Improvements in switchboards and their increased size to meet the growing demands of cities have been most marked, and this form of apparatus is now so complex as to be quite unintelligible except to a telephone engineer, as almost every part of the apparatus has been subjected to important improvements.



TELEPHONE CIRCUIT WITH HOOK DOWN AND WITH HOOK UP.

a and *c* binding posts connecting with the line. The post *b* forms the ground connection for lightning. The dotted lines indicate that part of the circuit cut out by the hook switch.

The use of a common battery at the central station has been one of the most important developments of recent years, as it does away with the magneto call at the subscriber's instrument, a saving of no small dimensions, as the magneto machine was the most expensive part of the equipment, the mere removal of the receiver informing the central operator of the subscriber's presence at the telephone. In the Hayes system, which is extensively employed in the United States, a device known as a repeating coil is used, and the battery is bridged across the circuit at the central station. The repeating coil consists of a transformer or induction coil formed by two coils of wire of equal length and size, it being customary to wind the four coils required for two repeating coils on the same core. There are two sets of windings in each circuit and the current of the battery divides and passes through a single coil before reaching the line or main circuit wires. In other words, the negative pole of the battery connects with the two sets of windings of one repeating coil, one of which joins the wires leading to each station, while the positive pole is similarly connected on the other side. Any variation in the current caused by the action of the sound waves on the transmitter of one circuit will produce similar effects in the other circuit by inductive action. Such is the case when the line is arranged for talking. To signal the central station the subscriber removes his receiver from the hook, thus closing a circuit which acts upon a relay and causes a small incandescent lamp to glow. This gives the signal to the central operator, who immediately completes the talking circuit first with her own transmitter and receiver, and then with that of the desired subscriber. The attention of the latter has been attracted by a call bell energized by an alternating current. This bell is in series with a condenser which has been bridged across the main circuit. Another central energy system is that of Stone, where impedance coils, or wire windings of considerable self-induction, are placed in the circuit instead of the repeating coils of the Hayes system. The effect of these coils is to prevent the rapidly alternating current in the telephone circuit flowing through the battery and to have it travel along the line to the other station where the impulses are reproduced. In the Dean-Carty System an impedance coil is employed bridged across the main circuit at the plugs and to the centre of it is connected one pole of a battery whose other terminal is grounded. There is also an impedance coil at each station connected with both sides of the circuit and its centre point is connected with the transmitter and the primary of the induction coil which are connected with the ground. All of the various systems for central energy in actual practice are necessarily exceedingly complex and are subject to important modification and improvement, but the foregoing are the more important. There are also methods where storage cells are used at the subscriber's station and where a thermopile is employed in connection with an ordinary lighting circuit.

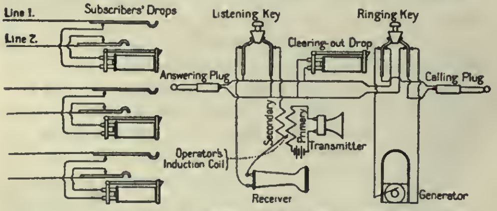


DIAGRAM OF SIMPLE METALLIC CIRCUIT SWITCHBOARD.

When a call is received the current coming in on the line wires causes the drop to fall, thus announcing the number of the subscriber. The central operator then inserts the answering plug in the jack, and, pressing the listening key, puts her instrument in circuit. She then inserts the calling plug in the jack belonging to the line of the desired subscriber, and by pressing the ringing key sends a signal to the latter's instrument.

Long-distance telephony was first made possible in 1885, when the American Bell Telephone Company organized the American Telephone and Telegraph Company. For several years previously experimental lines with metallic circuits of hard drawn copper were operated between New York and Boston. In 1885 a regular line between New York and Philadelphia was constructed, and so great was its success that within two years long-distance lines were established between New York and Boston, Albany and Buffalo, Chicago and Milwaukee, Boston and Providence, and New York and New Haven. The New York and Chicago circuit, 950 miles distance, 1900 miles of wire, was opened October 18, 1892, and long-distance telephoning between New York and Milwaukee and Saint Louis is also carried on. The American Bell Telephone Company in 1900 acquired the rights of patents of M. I. Pupin, by which the limits of long-distance telephony are greatly increased and conversation over circuits where there are submarine conductors of considerable length is possible. This is accomplished by inserting coils of self-induction at regularly recurring intervals along the line obtained by calculation.

The American Bell Telephone Company practically controls the telephone business of the United States, though a number of strong independent companies have been organized, whose business is increasing.

Statistics of the American Bell Telephone Company from 1894 (January 1st) to 1900

	1894	1895	1896	1897	1898	1899	1900	1901
Exchanges	838	867	927	967	1,025	1,126	1,239	1,348
Branch offices	571	572	686	832	937	1,008	1,187	1,427
Miles of wire on poles	214,676	232,008	260,324	286,632	327,315	396,503	509,036	627,897
Miles of wire on buildings	16,492	14,525	12,861	12,594	13,776	15,329	15,067	16,833
Miles of wire underground	120,675	148,285	184,515	234,801	282,634	358,184	489,250	705,269
Miles of wire submarine	1,637	1,856	2,028	2,818	2,675	2,973	3,404	4,203
Total miles of exchange service wire	353,480	396,674	459,728	536,845	626,400	772,989	1,016,777	1,354,202
Total circuits	205,891	212,074	237,837	264,645	295,904	338,293	422,620	508,262
Total employees	10,321	11,094	11,930	12,425	16,682	19,668	25,741	32,837
Total subscribers	237,186	243,432	281,695	325,244	384,230	415,180	432,946	800,880

Public Ownership of Telephones. In Europe public ownership of telephones exists to a certain extent and there has been agitation in this direction in the United States. For the most part, such public ownership of telephones is national, rather than municipal, and is chiefly confined to countries where private ownership of franchises is far less common than public ownership. Actual statistics are not readily available, and are constantly changing. but an admirable summary of the ownership of telephones in various countries, made by U. N. Bethell, general manager of the New York and New Jersey Telephone Company (see Bibliography below), is as follows:

"All over Europe, with a few exceptions, the industry at present [early in 1903] is controlled and owned by States or municipalities. In Belgium, France, Switzerland, Germany, Austria, and Hungary the central Government operates the industry. In Holland the State operates the trunk lines; in the two principal cities, Amsterdam and Rotterdam, the municipalities operate the local systems; and at The Hague a private company operates. In Denmark and Norway private enterprise under Government control operates the industry, while in Sweden the State operates it, except that in Stockholm and vicinity a private company since 1890 has been in active competition with the State. In Great Britain, in most places, private enterprise operates the local systems under license from the State; in a few places municipalities operate or are preparing to operate local systems; the State operates the trunk lines. In the United States private enterprise, under Government control, operates both the local systems and the trunk lines."

Among the municipal telephone systems in use or under construction in Great Britain early in 1893 were those at Glasgow, Portsmouth, Swansea, Brighton, and Hull. The general movement for municipal telephones in Great Britain followed a Parliamentary act of 1899, authorizing municipal construction. Tunbridge Wells and Glasgow, in 1901, were the first to install and operate systems under the act, but after an active campaign against public ownership in Tunbridge Wells the municipal plant was sold to its private competitor, in the latter part of 1902. There were conflicting reports as to the financial success of the plant, but apparently the advice of the engineer was not followed during construction, while subsequently the plant suffered from poor management. It is said that the municipal plant resulted in a marked reduction of rates and that when sold it yielded a profit. It should be added that in 1911 all telephone licenses granted to private companies in Great Britain will expire, and that all such companies pay 10 per cent. of their gross receipts to the Post-Office Department, which has had a monopoly of the telegraph business since 1869. The policy of the Post-Office Department is to monopolize the telephone as well.

The general question of municipal ownership has been discussed at length under that head. The public interests demand that the business shall be conducted as a monopoly, under public control. The latter does not exist in the United States to the extent that might be inferred from the closing sentence of the above quotation, but that is largely the fault of the legislative and executive departments of the several States, and to some extent of the municipalities also. Finally, the long-distance lines would be a troublesome factor in municipal ownership in America, unless they, as in some countries abroad, were owned by the general Government.

Bibliography. The following list contains some of the more important works on the telephone to which the reader is referred for further information: Miller, *American Telephone Practice* (New York, 1899); Alsopp, *Telephones, Their Construction and Fitting* (London, 1900); Houston and Kenelly, *The Electric Telephone* (New York, 1896); Webb, *Telephone Hand-book* (Chicago, 1894; new ed. 1901); Hopkins, *Telephone Lines and Their Properties* (New York, 1898); Prescott, *Bell's Electric Speaking Telephone* (New York, 1884; 2d ed. 1890); Thompson, *Philipp Reis, Inventor of the Telephone* (London, 1883). For discussion of the public ownership of telephones consult some of the references under Municipal Ownership; also papers by Bethell (against), Parsons (for) and Bennett (as to Great Britain) in "Proceedings of National Convention upon Municipal Operation and Public Franchises," published in *Municipal Affairs* (New York, vol. vi., No. 4, 1902-3; also Hemenway on Municipal Telephones," *Proceedings Seventh Annual Convention League of American Municipalities* (Des Moines, Iowa, November, 1903).

TEL'EPHUS (Lat., from Gk. Τήλεφος). In Greek legend, a king of Teuthrania, in Southern Mysia. Auge, the daughter of King Aleos of Tegea, was loved by Hercules and bore him a son, Telephus. In anger her father inclosed mother and child in a chest and cast them into the sea. The chest floated across the Ægean to the mouth of the Caëus, where Teuthras married Auge and brought up Telephus, who succeeded him on the throne. This early version was modified by the tragedians. Auge became priestess of Athena, and the child was born, or at any rate exposed, on Mount Parthenion, where it was suckled by a doe, and (in one version) found by Hercules. Auge meanwhile was cast into the sea and brought to Mysia, where she was adopted by Teuthras. Later, Telephus came to Mysia on account of an oracle, helped Teuthras against powerful enemies, and was rewarded by the hand of Auge. On the marriage night mother and son recognized each other. When the Greeks were on their way to Troy, they landed by mistake in the territory of Telephus and harried the country. Telephus defeated the invaders, but was himself wounded by Achilles. As an oracle informed him that only he who had wounded him could cure, he went to Greece, and as the Greeks needed his guidance to reach Troy, they yielded and Achilles healed the wound with rust from his spear. Telephus then guided the Greeks to Troy, but refused to take part in the war, since his wife, Astyoche, was a daughter (or sister) of Priam. The whole story of Telephus was represented on the smaller frieze of the Great Altar of Pergamon, and his battle with Achilles in the west pediment of the Temple of Athena Alea at Tegea. Consult: Pilling, *Quomodo Telephi fabulam et scriptores et artifices veteres tractaverint* (Halle, 1886); Jahn, *Telephus und Troïlos* (Kiel, 1841); id., *Telephus und Troïlos und kein Ende* (ib., 1859).

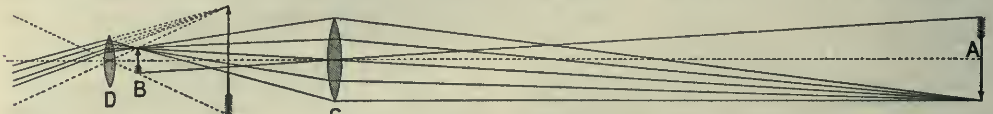


DIAGRAM OF ASTRONOMICAL TELESCOPE.

TELESCOPE (from Gk. τηλεσκόπος, *tēleskopos*, far-seeing, from τῆλε, *tēle*, afar + σκοπεῖν, *skopein*, to look). Essentially a lens or mirror to form an image of a distant object and a miscroscope to enable the observer to examine this image in detail. The invention of the telescope was doubtless accomplished in Holland, but there is no little confusion and controversy to be encountered in attempting to determine the original inventor. Tradition has it that about the beginning of the seventeenth century one Jansen, a spectacle-maker of Middleburg, Holland, constructed a telescope about 16 inches in length which he exhibited to Prince Maurice and the Archduke Albert, who, appreciating the importance of the discovery, paid him a sum of money to keep it concealed. Another spectacle-maker, Lippershey, made application (1608) to the States General for a patent for a telescope, as also did Metius, a professor of mathematics, but in the former instance, at least, it was refused, as the apparatus was already known. It seems certain that the instrument was known more or less about Europe, but the honor of its invention is usually given to Galileo, who was the first to describe the instrument and exhibit it in a complete form (May, 1609). Galileo having heard that a device to magnify distant objects had been constructed in France or Holland, immediately set to work to produce such an instrument. His telescope, similar in form to the modern opera glass (q.v.) and composed of a convex object glass and a concave eyepiece, as first constructed had a magnifying power of 3 times, but this was subsequently increased to 30 times, and Galileo was able to discover the satellites of Jupiter, the mountains of the moon, and other celestial objects. To Kepler we owe the discovery of the principle of the astronomical telescope with two convex lenses, and the description of such an instrument is contained in his *Catoptrics* (1611). This idea was actually employed in a telescope constructed by Father Scheiner (*Rosa Ursina*, 1630), and such telescopes were used in increasing numbers until the middle of the seventeenth century, when they were practically universal, and improved construction made possible Huygens's discovery of Titan, the brightest satellite of Saturn.

In order to appreciate the development of the telescope it may be worth while to consider some of the fundamental principles on which its action is based. A convex lens will give an image of a distant object which can be received on a screen, as in the camera obscura (q.v.). If instead of the screen we use a simple microscope or lens to observe this image which is formed in the air, we have an astronomical telescope. This will appear from the accompanying diagram.

C represents a convex lens, the object glass of a telescope; A is a distant object and B is a real and inverted image formed by the lens. The size of this image depends upon the ratio of the two conjugate foci or distances from the lens to the image and the object. As the distance of the lens from the object is necessarily fixed, depending of course on the positions of the object and the observer, in order to obtain as large an image as possible, it is necessary to increase the focal length of the lens. From the discussion of lenses in the article on Light (q.v.) it will appear that in order to obtain a large focal length for a telescope an object glass with large radii of curvature is essential. This, however, is not feasible in actual practice, as was found by the early astronomers after experiences with telescopes having focal lengths as great as 600 feet; and lenses of shorter focal length but of improved construction were adopted. The next question involved is the size of the object glass, or, as it is technically expressed, its aperture. The larger the lens the greater will be the amount of light transmitted. The pupil of the eye through which the light producing an image passes normally is about 1-5 of an inch in diameter, consequently as much more light will pass through the telescope as the square of the diameter of the object glass is times greater than the square of the diameter of the pupil. But if the image formed is too large, then the light will be distributed and the image will lack brilliancy and not be plainly visible. Taking these facts into consideration, it would appear that the greater the focal length of the lens and the greater its surface, the more satisfactory would be the image produced. This would be the case were it not for the fact that both spherical and chromatic aberration (q.v.) increase with the aperture of a lens, and that the larger the piece of glass, the greater the difficulty of securing homogeneity and freedom from imperfections. Increasing the focal length increases the difficulties involved in mounting the telescope as well as in the manufacture of the objective itself. To observe the image formed by the objective an eyepiece is used, whose action is simply to magnify the image.

The image furnished by the object glass is inverted and is merely magnified by the eyepiece. In what is known as the terrestrial telescope there is an additional lense or lenses added to erect or invert the image so that it will appear to the eye in its natural position. This lens merely forms a new image which is then viewed by the eyepiece as in the case of the astronomical telescope, the action being shown in the accompanying diagram, the erecting lens and the eyepiece being in reality a compound microscope to view the image furnished by the objective.

In the diagram C is the object glass, B is the inverted image formed by the rays coming from a distant object in the direction A, E and G serve merely to invert the image B and form it anew and erect at H where it is observed by the eyepiece D.

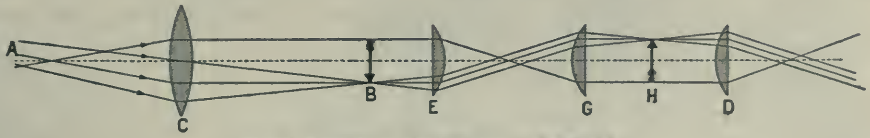


DIAGRAM SHOWING TERRESTRIAL TELESCOPE.

Other arrangements of the terrestrial eyepiece could be mentioned, but the one described is one of the earliest and simplest.

While the greatest care must be expended on calculating and constructing the object glass, the eyepiece is by no means unimportant. As the magnifying power of the telescope (the ratio of the angles formed by lines drawn to the extremities of the image and the object) is equal to the quotient obtained by dividing the focal length of the objective by that of the ocular, it would be of advantage to use a lens of comparatively large curvature, but here again chromatic and spherical aberration must be considered, for sharpness and distinctness are as essential as high magnification. In practice eyepieces vary considerably, depending on the use to which they are to be put. Generally they consist of two achromatic lenses, one convex, known as the field lens, which brings together the outer rays of the beam, while the lens nearest to the eye may be either positive (convex) or negative (concave). In case a micrometer is used to measure the image a positive lens is employed and the combination, which is known as a Ramsden eyepiece, though not quite achromatic, has a flat field. For mere observation the Huygenian eyepiece, with a negative lens of one-third of the focal length of the field lens, is preferable. The addition of lenses to the eyepiece acts to cut off the supply of light and to destroy the brightness of the image. Accordingly in the terrestrial telescope, while we have the erecting lens which inverts the image to its proper position, yet the image is not as bright as in the case of the opera glass, where there is far less magnifying power.

The difficulties due to spherical aberration were early experienced by opticians and astronomers, and in an attempt to obviate them astronomical telescopes were constructed of considerable focal length and power. From observations made with such instruments by Huygens, who was the pioneer in this line, he was able to present the first explanation of Saturn's rings (1659). He constructed a telescope 300 feet in length which magnified 600 times, while the telescope used by Cassini to discover the fifth satellite of Saturn (Rhea) was built by Campani of Rome and magnified about 150 times. The diameter of Venus was determined in 1722 by Bradley with a telescope of 212 feet focal length. These telescopes of extreme length were known as aërial telescopes, and naturally their mounting and manipulation presented many difficulties. In spite of these awkward conditions, valuable observations were made and ingenious appliances introduced to facilitate the operations. The invention of the achromatic object glass by Dollond in 1757-58 and the improvement of optical flint glass, which commenced in 1754, soon made possible the construction of improved telescopes, but these were all of modest dimensions, and until well into the nineteenth century few if any object glasses were constructed greater than twelve inches in diameter. The discovery of methods of making large disks of flint glass was made by Guinand, a Swiss mechanic, who then became associated with Fraunhofer (q.v.), and telescopes as large as 10 inches aperture were readily made. His successors made instruments with object glasses 15 inches across. The next successful manufacturer of telescope lenses was Alvan Clark of Cambridgeport, Mass., who from the time when an object glass manufactured in his shop was purchased by the Rev. W. R. Dawes of England, gradually achieved the highest rank as a maker of telescope lenses. At the Cambridgeport works have been constructed the lenses not only for the leading American observatories, but also for the Imperial Russian Observatory at Pulkova, and other European institutions. The manufacture of telescope lenses is to be regarded as a fine art, and the ability to work the disks of glass with the requisite precision and delicacy is possessed by but few.

The formation of an image by a concave mirror has been made use of in the reflecting telescope, of which numerous varieties have been devised and with which many of the most important astronomical discoveries have been made. The principle of this instrument will be apparent from the following diagram and explanation:

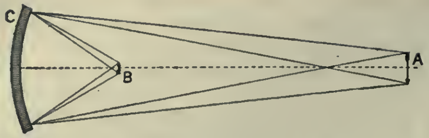
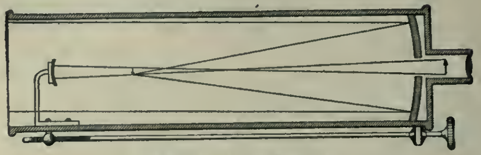


DIAGRAM SHOWING FORMATION OF AN IMAGE BY A CONCAVE MIRROR.

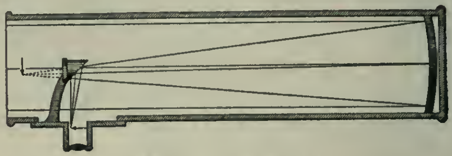
C is a concave mirror on which rays from a point of a distant object, A, fall. Following the law of reflection, these rays will be reflected and will be united at B, the focus for rays from the given point. The object A is made up of a number of such points; consequently at B there will be a number of points where the rays from A are collected and an image of the original object will be formed. If the rays come from an object infinitely distant, or in other words are parallel, they will converge at the principal focus, which is one-half of the radius of curvature. This will be the case in a mirror of large radius and for rays that are incident, not far from the axis; but if the mirror is large, then the rays near its circumference will not be brought to a focus at the point B, but nearer to the mirror, and consequently a blurred image will be produced. This is known as spherical aberration and is discussed under that head. Theoretically this could be remedied by the construction of a mirror of parabolic section, as the configuration of such a mirror is such that all parallel rays are brought to a focus in the same point. In practice, however, this is extremely difficult of attainment, as to secure a properly shaped mirror the most minute amounts of material must be removed from a spherical surface in order to make it parabolic. When an image is formed in this way it can be viewed either by being received on a screen or it can be observed with an eyepiece or a simple microscope. This is done in several ways in the reflecting telescope, and the chief points of difference in the various instruments are mainly in this respect. A concave mirror, according to tradition, was used by Ptolemy Euergetes on a lighthouse at Alexandria to discover distant ships. The Romans were acquainted with the power of collecting or concentrating rays of light possessed by such a mirror, but there does not seem to be any well-authenticated record of the application of the idea to the purposes of a telescope.

Father Zucchi, an Italian Jesuit, was the first to use an eye lens to view the image produced by a concave mirror (1616-1652), but to Gregory is due the first description of a telescope with a reflecting mirror, and the instrument has since been known by his name. Gregory, along with others, realized the shortcomings of a telescope with lenses and believed that the manufacture of concave mirrors would be attended with far less difficulty. An actual working instrument based on this principle was devised and constructed by Isaac Newton. With a telescope formed by a mirror of 6½ inches focal length, which magnified 38 times, he was enabled to make important observations. In these telescopes the great difficulty was viewing the image, as the eyepiece and the head of the observer would cut off a large portion of the incident rays. In the Gregorian telescope this was obviated by the interposition of a second concave mirror, which reflected the rays to the eyepiece, as is shown in the following diagram:



GREGORIAN TELESCOPE.

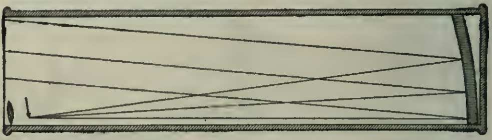
Newton used a plane mirror placed at an angle of 45° to the axis, which reflected the rays into an eyepiece arranged as in the following diagram:



NEWTONIAN TELESCOPE.

Draper used a total reflection prism instead of the plane mirror with considerable success, being one of the few astronomers in the United States to construct a reflecting mirror. Cassegrain employed a convex mirror instead of a concave one.

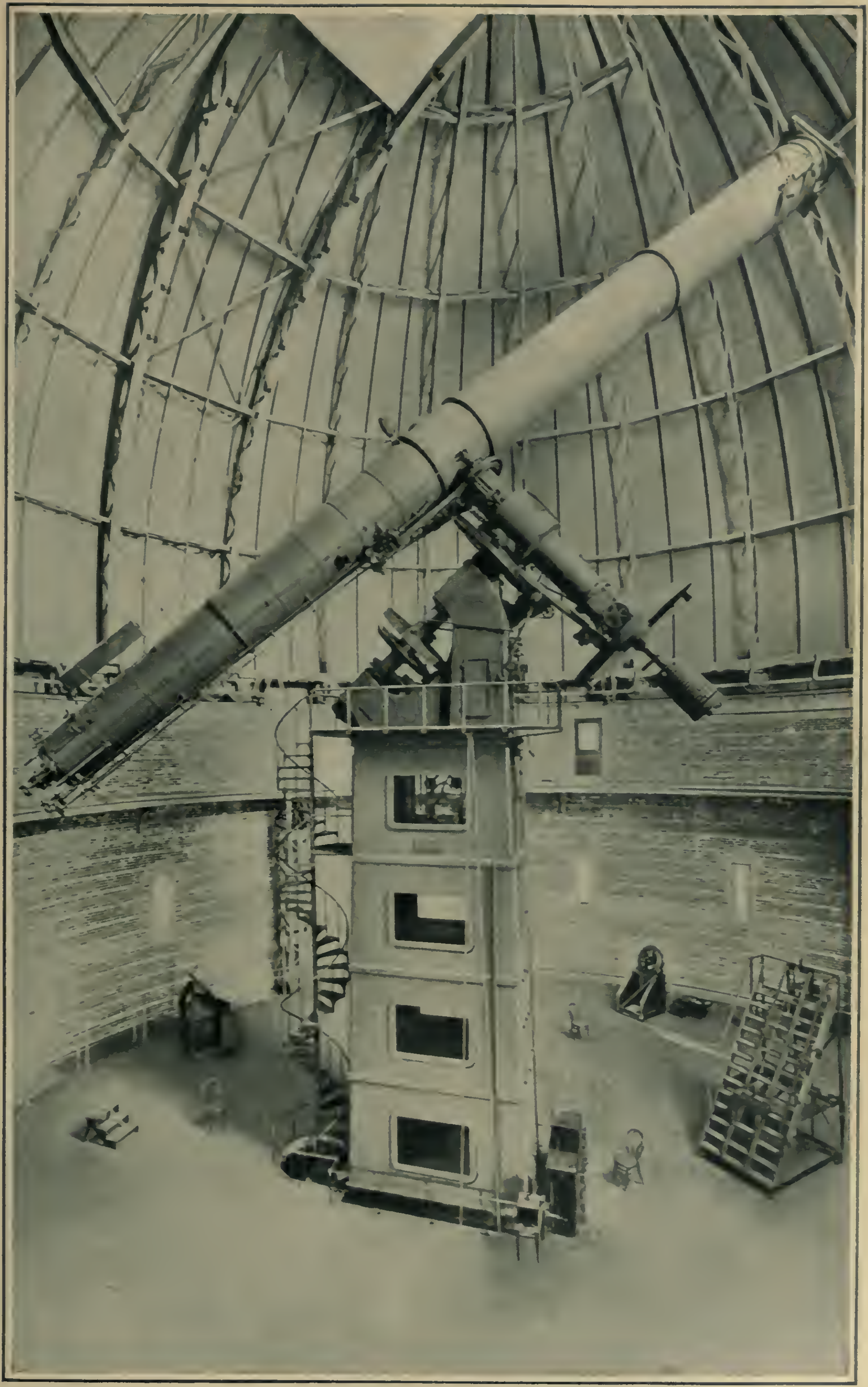
Herschel obtained satisfactory results by tilting his mirror and placing the eyepiece below the axis of the instrument, so that it was not in the way of the incident rays. Herschel's mirrors were as large as four feet in diameter, with a tube forty feet in length.



HERSCHEL'S TELESCOPE.

The reflecting telescope was extensively used because there was no chromatic aberration caused by refraction. Spherical aberration was, however, present and was a serious drawback. According to geometrical calculations, as has been said, there would be no spherical aberration if a parabolic mirror was used, as all the rays from a distant object would come to a focus at one point. The grinding of a parabolic mirror, however, was attended by many difficulties and was practically impossible except to a few opticians.

Perhaps the most celebrated reflecting telescope was that of Lord Rosse, whose mirror was six feet across. This was completed in 1842 and erected at Parsontown in Ireland. While famous for its size, this telescope has never been used in making discoveries of prime importance, and has not been used during recent years, being so mounted as not to be available for photographic work. Second to this, as will be seen from the table at the end of this article, is the reflector of Dr. A. A. Common at Ealing, England. Using the largest glass disk that could be obtained, five feet in diameter, Dr. Common produced a perfect mirror, which is mounted equatorially. This telescope is of the Newtonian type and has been particularly useful in celestial photography. The mirrors for reflecting telescopes were usually made of speculum metal,



THE FORTY-INCH YERKES TELESCOPE OF THE UNIVERSITY OF CHICAGO.

which is composed of a mixture of copper and tin, until Leibig discovered the method of depositing a film of silver on a glass surface.

The use of silvered glass for mirrors was suggested by Steinheil and later by Foucault, and has met with general adoption, as it not only facilitates the construction of the mirror, but makes possible its resilvering at any time without the destruction of its configuration. The reflecting telescope is available for photographic or spectroscopic work, as well as for visual observation, but the chief defects are the difficulty of grinding the metal or glass to true parabolic shape and the deformation of the mirror in its mounting owing to its great mass. In recent years the most important use made of a reflecting telescope has been to photograph the Nebulæ with the Crossley reflector of the Lick Observatory (q.v.), which is the largest telescope of this description in the United States. It was made by Dr. A. A. Common and was presented to Lick Observatory by Edward Crossley. Professor James T. Keeler, the director, remounted this instrument and in 1899 made a remarkable series of photographs.

The mounting of telescopes has also kept pace with the improvement of lenses and mirrors. Newton used a ball and socket joint to mount his small reflector, and then various arrangements of framework were employed for the aërial telescopes and later for the large reflectors. The first equatorial (q.v.) mounting is ascribed to Lassel. In England telescopes were mounted by having the polar axis supported at each end, but the German system, where the mounting is in the centre and the weight of the telescope is balanced by counterpoises, is now generally used for large refractors. The modern telescope is not merely an instrument for visual observation, but in connection with photography and the use of the spectroscope its field has been widely increased. Fraunhofer, who first used the spectroscope instead of the visual eyepiece, was able to record the spectra of Venus and Sirius, and since that time the combination of telescope and spectroscope has made possible some of the most important advances in astronomy. One of the earliest applications of photography was to the heavens, and the object glass of the telescope was used with the eyepiece removed, the image being formed directly on the plate. In the early stages of this work both reflecting and refracting telescopes were used, but with the latter it was found that special lenses were necessary in which the correction for chromatic aberration was arranged with regard for the actinic rather than the visual rays. The green, yellow, and red rays, which affect the human eye the most, do not produce the chemical effects on the photographic plate, which must be placed at the focus of the violet rays, and consequently a photographic objective is constructed so as to bring the blue and violet rays to a single focus. One of the first telescopes constructed for this purpose was by Lewis M. Rutherfurd (q.v.), with which many fine pictures of the moon were made. At the Lick Observatory photographic work with the large telescope has been accomplished most successfully by using an extra lens at the objective, which brings the photographic rays to a focus instead of the visual rays. At the Yerkes Observatory of the University of Chicago this difficulty has been overcome by the use of color screens, and photographs made in 1900 indicate the general usefulness of the method. The color screen is mounted in the plate-holder and is of a greenish yellow tint, which cuts off the blue rays. Orthochromatic plates are used and are affected by the rays in the middle part of the spectrum. So important is the photographic use of the telescope that in 1900 there were 18 photographic telescopes in various parts of the world engaged in making photographs for an International Star Chart to cover the entire heavens.

Of the modern telescopes of interest the instrument known as the *equatorial coudé* of the Paris Observatory is worthy of mention. In this instrument the observer is comfortably situated in an ordinary building, while mirrors are so arranged as to reflect the light into the telescope and then to the eyepiece. The tube of the telescope is in the form of an elbow, whence its name, with one arm forming the polar axis. At the point of intersection of the two arms there is placed a plane mirror, while in front of the object glass is a second plane mirror which is movable and enables light from any portion of the sky to be reflected into the tube. Very successful photographs of the moon have been made with this instrument, which has both visual and photographic object glasses 23½ inches in diameter. The great telescope of the Yerkes Observatory of the University of Chicago at Williams Bay, Lake Geneva, Wisconsin, is the largest telescope with an equatorial mounting, and until the construction of the Paris Exposition telescope was the largest refractor in existence. This instrument was mounted in a special observatory (for illustration, see OBSERVATORY) and both lenses and mounting represented the best work of modern opticians and mechanicians. The objective, which is 40 inches in diameter and has a focal length of nearly 62 feet, weighs when mounted in its cell about 1000 pounds. The crown-glass lens, which is 2½ inches thick at the centre and 3¼ inches at the circumference, weighs 200 pounds, and is separated from the flint-glass concave lens by 8⅜ inches. The latter weighs over 300 pounds and is about 1½ inches thick at the centre and 2 inches thick at the edges. The lenses are mounted upon aluminum bearings in a cast-iron cell. The telescope itself is mounted on a cast-iron column of four sections bolted together and resting on a cast-iron foot, which in turn rests on a concrete foundation. The clock room is located in the upper part of the cast-iron column and contains the mechanism for driving the telescope. The instrument is in perfect balance, a mechanical feat of no little difficulty when it is remembered that there is a weight of 1000 pounds at the object-glass end. The observatory is provided with a rising floor for the convenience of the observer, who is thus able to use the telescope in comfort, irrespective of its elevation. The most recent as well as the largest telescope is that built for the Paris Exposition of 1900 by M. Gautier, which differs materially from the large telescopes previously constructed. The object glasses of this great instrument are 49 inches in diameter and the tube 197 feet in length. Instead of being mounted equatorially, as are the large telescopes at the Lick and Yerkes Observatories, the Exposition telescope is fixed in a horizontal position, its axis being due north and south. Light is reflected into the tube by a siderostat on which the direct rays from the heavens fall. The siderostat, which was invented by Foucault, is a movable mirror with a plane surface mounted on such a mechanism that the light falling on the mirror from a given portion of the heavens will always be reflected to the object glass of the telescope. In other words, instead of the telescope being moved about its polar axis, as would happen with an equatorial, the mirror is given such a motion that it neutralizes the movement of the earth. This idea is said to have been suggested by Robert Hooke at a time when the long-focus lenses of Huygens were being used and the difficulties attending their mounting were under consideration. On the occasion of the transit of Venus in 1882 Lord Lindsay employed a heliostat in connection with his 40-foot telescope, while for taking photographs the American observers used the same method most successfully. When it was proposed to erect at the Paris Exposition a telescope larger than any previously attempted, it was realized that an equatorial of greater size than those of the great observatories in the United States was practically impossible, and accordingly the fixed form was adopted. Both visual and photographic objectives are provided, and with the latter the largest photographs of the moon yet produced have been taken. Each lens weighs half a ton and they were constructed by M. Gautier, who also made those for the University of Chicago telescope. Although in this form of telescope there is no elaborate mounting with mechanical devices, yet as much care must be expended on the siderostat as on the object glasses. The mirror forming the essential part of this instrument is 78½ inches in diameter, is 11 inches in thickness, and weighs 3600 kilograms (nearly 8000 pounds).

It is believed by astronomers that for direct visual observations the refractor is the better instrument, while for the study of stellar, planetary, and nebular spectra and the photography of these bodies the reflector is the more useful. Also the latter instrument can be used to advantage in photometric and radiometric investigations of the moon and the planets. The reflector is free from chromatic aberration, and there is not the absorption of light which occurs when lenses of large apertures are employed. Larger angular and linear apertures can be used and the mounting is far more simple than for a refractor of corresponding size. The development of the fixed refracting telescope is at present being awaited by astronomers, as it will obviate many difficulties of construction, mounting, and expense.

List of Large Telescopes in Existence in 1900

REFRACTORS 15 INCHES AND UPWARD

	Inches
Paris (Exhibition)	50
Yerkes	40
Lick	36
Pulkova (Russia)	30
Nice	29.9
Paris	28.9
Greenwich	28
McCormick Observatory, Virginia	26
Washington, United States	26
Newall's, Cambridge, England	25
Cape of Good Hope	24
Harvard	24
Princeton, N. J.	23
Mount Etna	21.8
Strassburg	19.1
Milan	19.1
Dearborn, Chicago	18.5
Warner Observatory, Rochester, United States	16
Washburn Observatory, Madison, Wis.	15.5
Edinburgh	15.1
Brussels	15.1
Madrid	15
Rio de Janeiro	15
Paris	15
Sir William Huggins	15

REFLECTORS 2 FEET 6 INCHES AND UPWARD

	ft.	ins.
Lord Rosse	6	
Dr. Common	5	
Melbourne	4	
Paris	4	
Meudon	3	3
South Kensington	3	
Crossley (Lick Observatory)	3	
Greenwich	2	6
South Kensington	2	6

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TEL'ESIL'LA OF AR'GOS (Lat., from Gk. Τελέσιλλα) c.510 B.C.). A Greek poet. She was born at Argos and is said to have served in the Argive army against Sparta. Even if these deeds are mythical, her name became a symbol for patriotic enthusiasm and her statue was placed in the Temple of Aphrodite. Her lyrics are lost except for two lines found in Bergk's *Poetæ Lyrici Græci* (vol. iii., 4th edition).

TELETS LAKE. A lake of Siberia. See ALTIN.

TEL'FORD, THOMAS (1757-1834). An eminent Scottish engineer, born in Eskdale, Dumfriesshire. At the age of fourteen he adopted the trade of a stone-mason. In 1780 he removed to Edinburgh, and in 1783 he repaired to London, where he was appointed in 1784 to superintend the erection of the resident commissioner's house at Portsmouth dockyard. In 1787 he was appointed surveyor of public works for Shropshire; and his two bridges over the Severn at Montford and Buildwas and other works gained for him the planning and superintendence of the projected Ellesmere Canal, to connect the navigation of the Severn, Dee, and Mersey—a work which occupied ten years (1795-1805). In 1801 he received a commission from the Government to report on the state of Scotland, and on the desirable public works for that country. As a consequence, the plan of a canal from Inverness to Fort William was revived, and its planning and construction intrusted to Telford. (See CALEDONIAN CANAL.) In the same capacity he constructed more than 1000 miles of road in the Highlands, Lanarkshire, and Dumfriesshire and about 1200 bridges, besides churches, manses, harbors, etc. In 1808, and again in 1813, he was invited to Sweden, to report on the projected scheme for connecting Lake Vener with the Baltic, and superintended the construction of the Göta Canal, by which this was effected. His next great work was the construction of the road from London to Holyhead, including the erection of numerous bridges—among others, of the Menai suspension bridge. For the last few years of his life he retired from the active duties of his profession, employed himself in collecting and arranging materials for a complete history of his various works, and had the greater portion of the MSS.

ready when he died suddenly at Abingdon street, Westminster. His life, entitled *The Life of Thomas Telford, Civil Engineer, written by himself*, was published in 1838. In America Telford is now chiefly known as a famous road-builder, and particularly for introducing the system of road improvement that bears his name. See Roads.

TELL, William. The hero of a Swiss legend, which in its main features is common to all Aryan peoples. It is found in the Icelandic Thidreksaga, in Saxo Grammaticus, in old English ballads, in Persian poetry, and elsewhere. These all tell of a master marksman and of a tyrant who compels him to pit faith in his skill against his natural instinct as a father. The Swiss legend, narrated with much circumstance, is that a mythical Austrian bailiff, Gessler, demanded homage to the cap of Austria in the market place at Altorf. Tell refused this homage, was condemned to death, but permitted to ransom himself by shooting an apple from the head of his son. On signifying his intent to have killed Gessler if he had killed his son Tell was fettered and carried to the bailiff's boat. A storm arose and Tell was released that he might save the boat. This he did, then leaped ashore, and killed Gessler. The story then speaks of a revolt in which Tell takes part and by which the Forest Cantons gain independence. The date is 1307. The oldest chroniclers know nothing of the tale. It appears timidly, late in the fifteenth century, in *Das weisse Buch*, and more boldly in Tschudi's *Chronicon* (c.1550). The numerous Tell monuments are all relatively modern. The most famous version of the story is Schiller's drama *Wilhelm Tell* (1804). The Swiss had many folk-plays on the subject. Consult Rothe, *Die aramatischen Quellen des Schillerschen Tell*, in *Forschung zur deutschen Philologie* (1894); and for historical criticism of the saga, consult Rochholz, *Tell und Gessler* (Heilbronn, 1877).

TEL′LER, Henry Moore (1830—). An American politician and Cabinet officer, born at Granger, N. Y. He was educated at Alfred University, was admitted to the bar in 1856, and began practice at Binghamton, N. Y., but in 1858 removed to Illinois, and in 1861 to Colorado. He was a Republican member of the United States Senate from 1876 until April 17, 1882, when he entered the Cabinet of President Arthur as Secretary of the Interior. At the close of Arthur's administration, he again entered the Senate and was reëlected in 1891 as a Republican, but, being a strong advocate of free silver, left the Republican national convention in 1896 after it had adopted a gold standard plank and supported W. J. Bryan for the Presidency. In the same year he was returned to the Senate as an independent Silver Republican, and in 1903 was reelected as the regular Democratic nominee.

TELLEZ, tĕl′yâth, Gabriel (c.1571-1648). A Spanish dramatist. It is probable that he early became a member of the Order of La Merced at Toledo. He was well known as a comic playwright before 1610, and had become the superior of a monastery of his Order at Trujillo by 1619. At his death he was prior of the monastery at Soria. The most important compositions of Tellez are the dramas which he produced under the pseudonym of Tirso de Molina. His best tales are contained in the collection entitled *Cigarrales de Toledo*. A second collection is the *Deleitar aprovechando* (1635), which in addition to some pious stories has a few religious dramas or *autos*. About eighty plays are known to be extant. The *Burlador de Sevilla*, the first work of great merit to bring Don Juan on the boards, has long been attributed to Tellez, yet some competent critics contest his authorship of it. Tellez was one of the best dramatists of the period of the greatest glory of the Spanish theatre; he is surpassed only by Lope and Calderon. Consult his *Teatro escogido*, ed. by Hartzenbusch (12 vols., 1839-42); his *Comedias escogidas*, also ed. by Hartzenbusch, in the *Biblioteca de autores españoles*, vol. v. (3d ed., 1885).

TEL′LICHER′RI, or **TEL′LICHER′RY.** A seaport in the District of Malabar, Madras, India, 90 miles south by east of Mangalore, on the Arabian Sea (Map: India, C 6). Population, in 1901, 27,883.

TELLURITE. A mineral tellurium dioxide crystallized in the orthorhombic system. It has a sub-adamantine lustre, and is of a yellowish-white or yellow color. It occurs as an incrustation with native tellurium in Transylvania and at various localities in Boulder County, Colo.

TELLURIUM (Neo-Lat., from Lat. *tellus*, earth). A non-metallic element discovered by Reichenstein in 1782. This element is found native in small quantities at various localities in Hungary, Transylvania, Virgina, and California. It is also found as tellurium dioxide or *tellurite*, as silver and gold telluride or *sylvanite*, as bismuth telluride or *tetradymite*, and in the form of other minerals, of more complex composition. It may be prepared by cautiously heating tetradymite with potassium carbonate and charcoal in a covered crucible, extracting the resulting potassium telluride (K_2Te) with water free from air, and then passing a current of air through the solution, the metal being thus deposited in the form of a powder.

Tellurium (symbol, Te; atomic weight, 127.49) is a white, shining, crystalline, brittle solid that has a specific gravity of 6.24, and melts at about 452° C. (about 846° F.). Like selenium, which it greatly resembles, it exists in amorphous and crystalline modifications, the conversion of the former into the latter being accompanied by the absorption of heat. There is also an increase of electric conductivity under the influence of light, though not so marked an increase as in the case of selenium. Tellurim combines with oxygen to form a monoxide (TeO), a dioxide (TeO_2), and a trioxide (TeO_3), the last two of which combine with water to form tellurous and telluric acids (H_2TeO_3 and H_2TeO_4 respectively), which in turn yield series of salts called respectively *tellurites* and *tellurates*. See Periodic Law.

TEL′LUS (Lat., earth), more commonly Tellus Mater. The Roman goddess of the field. She was invoked to protect and develop the seed. Her chief festival was the *Fordicidia*, celebrated on April 15th, when pregnant cows were sacrificed to her. On other occasions connected with seed-time and harvest she was worshiped jointly with Ceres. In later times the goddess is more commonly called *Terra Mater*. See also Gæa.

TEL′MANN, Konrad. The pseudonym of the German poet and novelist Ernst Otto Konrad Zitelmann (q.v.).

TELPHERAGE (from *telpher*, from Gk. τῆλε, *tēle*, afar + φέρειν, *pherein*, to bear). The automatic transportation of materials by electricity. Usually it is aerial transportation, and is employed for a car or truck operated by one or more electric motors which travels by means of grooved wheels on a tightly drawn wire cable. This truck receives its operating current by means of a short trolley pole and wheel from a wire conductor suspended over the track cable. The movement of the truck or telpher, as it is usually termed, may be controlled by an operator manipulating switches located at points along the line, or they may take place automatically. See Cableways for other methods of aerial transportation.

TEL′UGUS. The northeastern division of the Dravidian family, numbering more than 20,000,000. They present the typical aspect of the race—medium statured, mesocephalic to dolichocephalic in head-form. The Yanadis of Nellore, considered by some authorities to be the primitive Telugus, both with respect to physical characteristics and general culture status, are markedly dolichocephalic, broad-nosed, short-statured, and dark-skinned. The castes of the Telugus, adopted through Hindu influence, run down from the Brahmans to the despised Madigas, who are leather-workers. Other divisions are the Palayyakkarans and Tottlyans (cultivators), the latter of whom practice cousin-marriage; the Komatis (traders), who have their sacred book, the Kanyakapuran; the Boyas (hunters); the Bestas (hunters and fishers). Hinduism has largely, even among such primitive tribes as the Yanadis, superseded the old 'animistic' religion of the Telugus, though ancestor-worship and other relics of more ancient faiths appear here and there. About the middle of the sixth century some of the Telugus made their way into Ceylon, forming part of the advance-guard of the large Dravidian element in the island.

The Telugu language is second in importance of the Dravidian dialects, the first being Tamil (q.v.). In its linguistic structure Telugu coincides in the main with Tamil, although it differs widely from its older cognate in phonology and vocabulary. The alphabet is derived from one of the old forms of the Sanskrit devanagari script. (See Dēvānagarī.) The vocabulary is strongly influenced by Sanskrit, from which about one-third of the literary Telugu words are borrowed. While Telugu is less primitive than Tamil, it far exceeds it in euphony, and is sometimes called the Italian of the East. The literature, which is outlined under the title Dravidians, is abundant and of much stylistic merit. Consult: Caldwell, *Comparative Grammar of the Dravidian, or South Indian Family of Languages* (2d ed., London, 1875); Arden, *Progressive Grammar of the Telugu Language* (Madras, 1873); Morris, *Simplified Grammar of Telugu* (London, 1890); Brown, *Telugu-English and English-Telugu Dictionary* (ib., 1852-54); Sankaranarayana, *English-Telugu and Telugu-English Dictionary* (ib., 1900); Carr, *Collection of Telugu Proverbs* (ib., 1868); Burnell, *Elements of South Indian Palæography* (2d ed., ib., 1878).

TEM′BULAND. A dependency of Cape Colony (q.v.), situated south of Griqualand East. Area, 4122 square miles. In 1891 it had a population of 180,415, including about 5200 Europeans.

TÉMÉRAIRE, tå′må′râr′, The. A French battleship captured by the English in the battle of the Nile in 1798. In 1805 she took part in the battle of Trafalgar and was destroyed in 1838. The "Fighting *Téméraire*," a painting by Turner, exhibited in 1839, hangs in the National Gallery, London.

TEMESVÁR, tĕm′ĕsh-vär. A royal free city and capital of the County of Temes, Hungary, on the Béga Canal, 62 miles southeast of Szegedin (Map: Hungary, G 4). It consists of an outer and an interesting inner town or 'fortress.' There are a Catholic cathedral built by Marie Theresa, a Greek cathedral, immense barracks, and an arsenal (the castle built by Hunyady in 1442), the commander's palace, the Greek Catholic Bishop's palace, and a Gothic column (40 feet high), by Max, erected to the memory of the town's defenders of 1849, are among the noteworthy structures. . There is a museum of art, natural history, and antiquities. The town has a royal tobacco factory and manufactures cloth, paper, and leather. Temesvár became a town in the thirteenth century. It was destroyed by the Tatars in 1242. From 1552 to 1716 it was held by the Turks, from whom it was taken by Prince Eugene. In 1849 it successfully resisted the attack of the Hungarian insurgents under Vecsey. On August 9, 1849, the Hungarians under Bem and Dembinski were defeated near Temesvár by the Austrians under Haynau. Population, in 1890, 43,483; in 1900, 53,033, mostly German Catholics.

TEMME, tĕm′me, Jodocus Donatus Hubertus (1798-1881). A German criminalist, politician, and novelist, born at Lette, Westphalia. He studied law at Münster and Göttingen, entered upon his judicial career in 1817 at Paderborn, and after holding various judicial offices became vice-president of the Provincial Court of Appeals at Münster in 1848. His attitude as a leader of the Extreme Left in the Prussian as well as the German National Assembly involved him in a trial for high treason, and, although he was aquitted by the jury, caused his dismissal from Government service, in 1851. In the following year he accepted the professorship of criminal law at Zurich. Whatever success attended his legal publications was outstripped by his reputation as the author of more than 150 novels and stories dealing with criminal plots, among which may be mentioned *Deutsche Kriminalnovellen* (1858-59), *Kriminalnovellen*, 10 vols. (1860-63), *Dunkle Wege* (1862), *Schwarzort* (1863), *Die Heimat* (1868), and *Die Generalin* (1877).

TEM′PE (Lat., from Gk. Τέμπη). A narrow mountain defile, about four and a half miles long, in the northeastern part of Thessaly, between the precipitous sides of Mount Olympus (q.v.) and Ossa (q.v.), through which flows the River Peneus. At places the rocky walls retire, leaving room for little glades and openings. Tempe was celebrated as one of the favorite haunts of Apollo. It was from the earliest times noted for its beauty and picturesqueness and was constantly praised in song. The name finally came to be applied to any beautiful and sequestered vale.

TEMPELTEY, tĕm′pel-tī, EDUARD (1832—). A German dramatist, born in Berlin. He studied at the University of Berlin, and subsequently took up journalism. In 1862 he entered the service of the Duke of Coburg. Among his other duties was the superintendence of the Court theatre. He was the author of several popular dramas, among them *Clytemnestra* (1857) and *Cromwell* (1883).

TEMPERA (It., from Lat. *temperare*, to proportion, modify), or DISTEMPER. In its original sense tempera signifies any fluid medium with which pigments may be mixed; but the term is usually restricted to a glutinous medium such as egg, size, or gums, as distinguished from oil; and especially to that in which the yolk of eggs is the chief ingredient. In Italy the egg was diluted with the milky juice of young sprouts of the fig tree; in Germany and the North with vinegar and honey. Tempera differs from fresco in that the pigments are not applied to the fresh plaster, but to the dry surface; they may be applied to any kind of surface. When tempera paintings have been coated with an oil varnish for purposes of preservation, it is difficult to distinguish them from oils. They are usually clear and brilliant in color, precise in form and outline; the rapid drying of the color preventing any blending of color or outline.

Tempera is probably the most venerable kind of painting, having been used in ancient Egypt, Babylon, and Nineveh, and by the Greeks for interior decoration. It was the favorite medium throughout the Middle Age, even for wall decoration. During the fourteenth and fifteenth centuries the increased technical skill led to the more frequent use of fresco, which had to be executed with great rapidity (see FRESCO); but tempera was used for the finishing touches, even by such a consummate master of fresco as Michelangelo. It continued to prevail for panel paintings until the perfection of the new oil medium by the Van Eycks (q.v.) displaced it in the North. In Italy its use lingered until about 1500, nearly all of the greatest paintings of the early Renaissance which are not frescoes being executed in this medium. Tempera painting has been lately revived, with some success, by Baron von Pereira at Stuttgart. A form of tempera in which the colors are mixed with glue is employed in scene painting and house decoration. Consult Hamerton, *Graphic Arts* (London, 1882); Pereira, *Leitfaden für de Tempera malerei* (Stuttgart, 1893).

TEMPERAMENT (Lat. *temperamentum*, due proportion, from *temperare*, to proportion, modify, from *tempus*, time, season; connected with Icel. *amb*, an out-stretching, Lith. *tempiù*, I extend). Emotional constitution, i.e. disposition toward a given type of emotional reaction. An individual's temperament is said, e.g. to be 'impulsive' if the individual responds, as a rule, quickly and with feeling to situations; the temperament of the oposite type is said to be 'cold and sluggish.' The usual classification of temperaments is that formulated by Galen: choleric (energetic, 'objective'), sanguine (warm, impressionable, changeable), melancholic (sentimental and 'subjective'), and phlegmatic (quiet, slow, and persistent). The manner in which these differ both in strength and in the rapidity of alteration in the affective reaction may be expressed as follows:

	Strong	*Weak*
Quick..........	Choleric.............	Sanguine
Slow..........	Melancholic.........	Phlegmatic

The word temperament is also used more widely to cover any general mental characteristic or aptitude; e.g. 'nervous' or 'musical' or 'artistic temperament.'

BIBLIOGRAPHY. Sully, *Human Mind* (New York, 1892); Lotze, *Microcosmus* (Eng. trans., 4th ed., New York, 1890); Wundt, *Physiologische Psychologie* (Leipzig, 1893); Külpe, *Outlines of Psychology* (New York, 1895); Galton, *Natural Inheritance* (ib., 1889). See TENDENCY; MENTAL CONSTITUTION; DISPOSITION.

TEMPERAMENT. In music, a system of compromise in keyed instruments for the avoidance of the necessity presupposed by the strict relation of musical intervals of having a separate row of keys corresponding to each tonic. Taking C as keynote, the ratios of the notes of the diatonic scale, as derived from the number of vibrations in a given time of a string sounding that note, are:

C	D	E	F	Q	A	B	C
24	27	30	32	36	40	45	48

The intervals between these notes are by no means equal, and may be thus expressed in numbers by logarithms:

$$\begin{array}{ccccccccccccccc} C & & D & & E & & F & & G & & A & & B & & C \\ & \underbrace{\qquad}_{51} & & \underbrace{\qquad}_{46} & & \underbrace{\qquad}_{28} & & \underbrace{\qquad}_{51} & & \underbrace{\qquad}_{46} & & \underbrace{\qquad}_{51} & & \underbrace{\qquad}_{28} & \end{array}$$

We have here three species of intervals, of which those represented by 51 are called major tones; those by 46, minor tones; and the smaller intervals represented by 28, semitones. These intervals will evidently only serve with C as keynote. If, for example, we start from D instead of C, we find E a tolerable, though not quite correct, second to D; but the third and seventh of the scale are entirely wrong. Were the major and minor tones equal, and each semitone exactly half a tone, the insertion of a note in the middle of each tone dividing the seven intervals would make it immaterial where the scale began, any one of the twelve notes becoming alike available as a keynote; and though such equality is contrary to the immutable principles of harmony, an arrangement based on it is found practically to give but little offense to the ear. In what is called the *equal temperament*, the twelve intervals are all of the same length, and no advantage is given to one key over the rest. This is, in theory at least, the temperament adopted in the pianoforte. By means of this equal temperament it is possible to start from any tone of the scale and, going always by the interval of a fifth, arrive at the same tone six octaves above or below the starting-tone. Acoustically, c^5 is 74·73 higher than the sixth octave of C. Instead, therefore, of using the acoustic fifth the tempered fifth is used, which makes b No. 4 identical with c^5. Hence the possibility of free modulation through all keys, which in recent times has led to the recognition of tonality (q.v.). As soon as the principle of equal temperament was understood the modern system of major and minor modes displaced the old Church modes. Two of the most active champions of equal temperature were Rameau and J. S. Bach. The former was chiefly the theorist, the latter the practical composer. Bach's immortal *Wohltemperiertes Klavier* was written with the special purpose of introducing the new system of equal temperament.

TEMPERANCE (Lat. *temperantia*, moderation, sobriety, self-control, from *temperare*, to proportion, modify). Primarily, a moderate use and enjoyment of all good things. In modern days the word is often used to designate great moderation in the use of alcoholic beverages, or even total abstinence from them.

Among uncivilized races, ancient and modern, intoxication has been associated with religious ideas and has been encouraged as an incident of religious festivity. As a common vice of appetite it has always been condemned, and in almost all communities in one way or another punished. The earliest attempt at temperance reform is claimed by the Chinese, who affirm that in the eleventh century B.C. one of their emperors ordered all the vines in the kingdom to be uprooted. Early reforms are attributed also to the priests of India and of Persia. The Carthaginians forbade wine in their camps, and to magistrates holding public office. Among the Hebrews there were various sects and orders which abstained from the use of intoxicants. The Buddhists taught total abstinence. The Christian Church made some attempt to bring about a more moderate use of the wine-cup. Saint Gildas dealt out severe punishment to any churchman guilty of drunkenness. Dunstan is said to have labored in the cause of temperance in England to the end that King Edgar at his instance restricted the number of taverns and the quantity of intoxicants that might be sold. By a law of 1285 taverns in London were required to close at curfew. From 1603 legislation against ale-houses and drunkenness increased. In 1736 Parliament attempted to restrict the use of gin by means of a prohibitory tax, which, however, only brought about an illicit trade.

UNITED STATES. In April, 1808, a society was formed at Moreau, Saratoga County, New York, consisting of 43 members, and providing in their Constitution that "no member should drink rum, gin, whisky, wine, or distilled spirits, ... except by advice of a physician or in case of actual disease (also excepting at public dinners), under penalty of twenty-five cents; . . . . provided that this article shall not infringe on any religious rites." This society existed for fourteen years, but accomplished little. The American Temperance Society was founded in Boston, February, 1826, and the New York State Temperance Society in 1829. By 1830 the latter society numbered 100,000 members. In 1833 prominent members of Congress organized the Congressional Temperance Society. Before the Civil War a number of secret societies were established for the promotion of temperance. They required a pledge of total abstinence, advocated prohibition, and tried to educate public sentiment in favor of reform. They also provided the usual beneficiary features and opportunities for self-culture. The Sons of Temperance, founded in 1842, grew rapidly in membership and influence. (See TEMPERANCE, SONS OF.) The Independent Order of Good Templars was started in New York in 1851. It spread over the whole world. (See GOOD TEMPLARS, INDEPENDENT ORDER OF.) The Templars of Honor and Temperance (1845) were strong in the South. Later benefit but non-secret societies are the Royal Templars of Temperance (Buffalo, 1869), and the Templars of Temperance, an order strong in England and the Scandinavian countries. After the Civil War the consolidation of societies began. In 1865 the National Temperance Society and Publication House was organized at Saratoga, as a non-partisan and non-sectarian society, advocating total abstinence. This society published and distributed pamphlets, text-books, and papers, held public meetings, and called national and international conferences. The Women's Crusade led to the organization in 1874 of the Woman's Christian Temperance Union (q.v.). In 1868 a prohibition party was organized in Illinois and a temperance political party in Michigan. The call for a convention came from the Grand Lodge of Good Templars. The National Prohibition Party was organized in Chicago in September, 1869. (See PROHIBITION.) Law and Order Leagues were established to see that existing legislation is properly enforced (Chicago, 1872; New York, 1877; Philadelphia, 1880; Massachusetts, 1882). In 1883 the general society—the Citizens' Law and Order League of the United States—was formed.

GREAT BRITAIN. In August, 1829, a temperance society was started at New Ross, County of Wexford, Ireland, whose members pledged themselves to abstain from liquors, except as medicine. At the same time a similar movement began in the north of Ireland. Within twelve months there were sixty societies, with 3500 members. The Glasgow and West of Scotland Temperance Society was founded in November. Up to this time the moderate use of liquor was permitted, but John Dairé and others of the Society of Dunfermline pledged themselves to total abstinence and began to form total abstinence societies. The first societies in England were established at Bradford, Warrington, and Manchester in 1830. The British and Foreign Temperance Society, founded in London (June, 1831), through the influence of William Collins of Glasgow, was for some years the leading temperance society in England. It was the first to start a crusade against beer. The movement for total abstinence had its beginning at Preston in Lancashire. After the formation of the Youth's Temperance Society at Preston in 1834, and its extension to other forms, a conference was held at Manchester, resulting in the organization of the British Association for the Promotion of Temperance, on the Principle of Total Abstinence from all Intoxicating Liquors. Thereupon the total abstinence element struggled for recognition in the British and Foreign Temperance Society. In August, 1836, the teetotal society was merged into the New British and Foreign Society for the Suppression of Intemperance. The later periods of temperance work in Great Britain may be designated by: (1) the Father Mathew crusade in 1838, during which in two years 1,800,000 people took pledges in Ireland; (2) the beginning of work among children through the formation of Bands of Hope, in 1847; (3) the John B. Gough (q.v.) mission in 1858;

(4) the introduction of Good Templarism, in 1868; and (5) the organization of Blue Ribbon Army in February 10, 1878, now the Blue Ribbon Gospel Temperance Movement with branch organizations, the Help Myself Societies for men and the Help One Another Societies for women. The United Kingdom Alliance (1853) urges prohibition upon Parliament.

The temperance movement in America and Great Britain has been characterized by the emotionalism of religious revivals. Prayer and conversion were offered as aids to reform. Many religious organizations as such have interested themselves in temperance work. The Methodist Church from the days of the Wesleys has advocated total abstinence. The Friends were opposed to drinking, and among the Dunkards abstinence was a test of fellowship. Since the beginning of the nineteenth century, Baptists, Congregationalists, and Presbyterians have been opposed to drinking. In the United States church members are more often connected with non-sectarian organizations. Among the general church organizations are: The Congregational Total Abstinence Association (1874); The Baptist Total Abstinence Association (1874); the Total Abstinence Society of the Presbyterian Church of England (1892); a number among various Methodist sects; Church of England Temperance Society (1862, reorganized 1873), formed to promote temperance, to study the causes of the abuse of alcohol, and to do rescue work. The Roman Catholic Church advises moderation, but where this is impossible, total abstinence. In 1902 the Catholic Total Abstinence Union of America (q.v.) contained about 80,000 members. In Great Britain the League of the Cross was inaugurated by Cardinal Manning in 1873.

Medical men have formed societies such as the British Medical Temperance Association (1872) advocating total abstinence and making investigations, and the American Medical Temperance Association (1891). Some labor unions, especially the Knights of Labor, have discouraged the use of intoxicants. Farmers' associations, such as the National Farmers' Alliance and the National Grange, have put themselves on record as opposed to the liquor traffic. Among the many children's societies that have been organized are: the Cold-Water Army (1828); juvenile branches or cadets of secret societies; Bands of Hope; and the Loyal Temperance Legions of the W. C. T. U. In opposition to temperance reformers, liquor manufacturers and dealers have organized to prevent hostile legislation. In 1862 the United States Brewers' Association was formed to oppose the internal revenue taxes and prohibition. In Illinois the brewers organized, purchased saloon sites in Chicago, and established cheap saloons conducted by agents. The Liquor Dealers' and Manufacturers' State Protection Association of Illinois is another association of liquor men.

In August, 1846, a World's Temperance Congress was held in London, at which 302 delegates were present. Since then there have been other international conventions, notably the World's Temperance Congress of 1893 at Chicago. At this meeting the economic aspects of the problem, especially the cost to the workingman, were emphasized. There was a general feeling in favor of total abstinence among English and Americans, while the Europeans advocated moderation and the drinking of wine. In Canada and Australia the movement has progressed along the same line as in England and America.

Scandinavian Countries. Drunkenness has been a serious vice in Sweden and Norway. Various temperance societies have been organized, and the efforts to solve the question by means of the Bergen system of monopoly in Norway and the Gothenberg system (q.v.) in Sweden have received much comment.

Germany. The German Temperance Society was organized in 1837, but the national custom of beer-drinking lessens the importance of the liquor problem in that country.

Austria. Only recently has a temperance movement been organized. The Society for Checking Inebriety was started in 1884.

Belgium has several temperance societies, among them the Association Against the Abuse of Alcohol (1878).

Switzerland has a total abstinence movement, superseding societies advocating moderation. The Blue Cross Federation was founded in 1877.

Latin Countries. Spain, up to 1860, was a sober country. Since then a slight increase in drunkenness has been due to the adulteration of wines, which has caused the people to use spirits. There is no active temperance movement, however. Since the destruction of the vines has led the poor of France to drink adulterated spirits, drunkenness has increased, and there is a decided temperance movement in favor of moderation rather than total abstinence.

Russia. Drunkenness has been a great vice in Russia. The peasant drink vodka is particularly intoxicating. Various temperance societies exist. Since January, 1895, the Government has acted as middleman, not maintaining a monopoly, but regulating and limiting the sale of liquor, and analyzing it to ascertain its purity. A large revenue is obtained in the provinces where this system has been established, and the system is being extended to other provinces.

General Considerations. (1) *Economic Aspects.*—A large amount of capital is invested in the liquor business—vast manufacturing plants (breweries and distilleries) and the property, fittings, and money paid for bonds and licenses necessary for the retail trade. For example, in June, 1896, there were 6187 distilleries in the United States, producing 89,992,555 gallons, and 1866 breweries, producing 1,111,636,750 gallons. The capital invested by 1924 firms was $269,270,249, and 41,425 people were employed. National, State, county, and municipal governments often have an interest in the traffic, through the levying of taxes upon it. In 1896 liquor taxes amounted to $164,016,401.68. These taxes are important as revenues, especially to small localities. The cost of liquor-drinking to the consumer is great, since the money spent on liquor is diverted from more useful expenditures. Chicago's drink bill in 1894 was $70,000,000. In 1896 the consumption per capita in the United States was 16.42 gallons. An important economic consideration for the community is the cost of maintaining criminals and paupers made so by the abuse of intoxicants.

(2) *Relation to Poverty.*—Drunkenness makes greater ravages among artisans than among paupers. Warner's tables show that it was

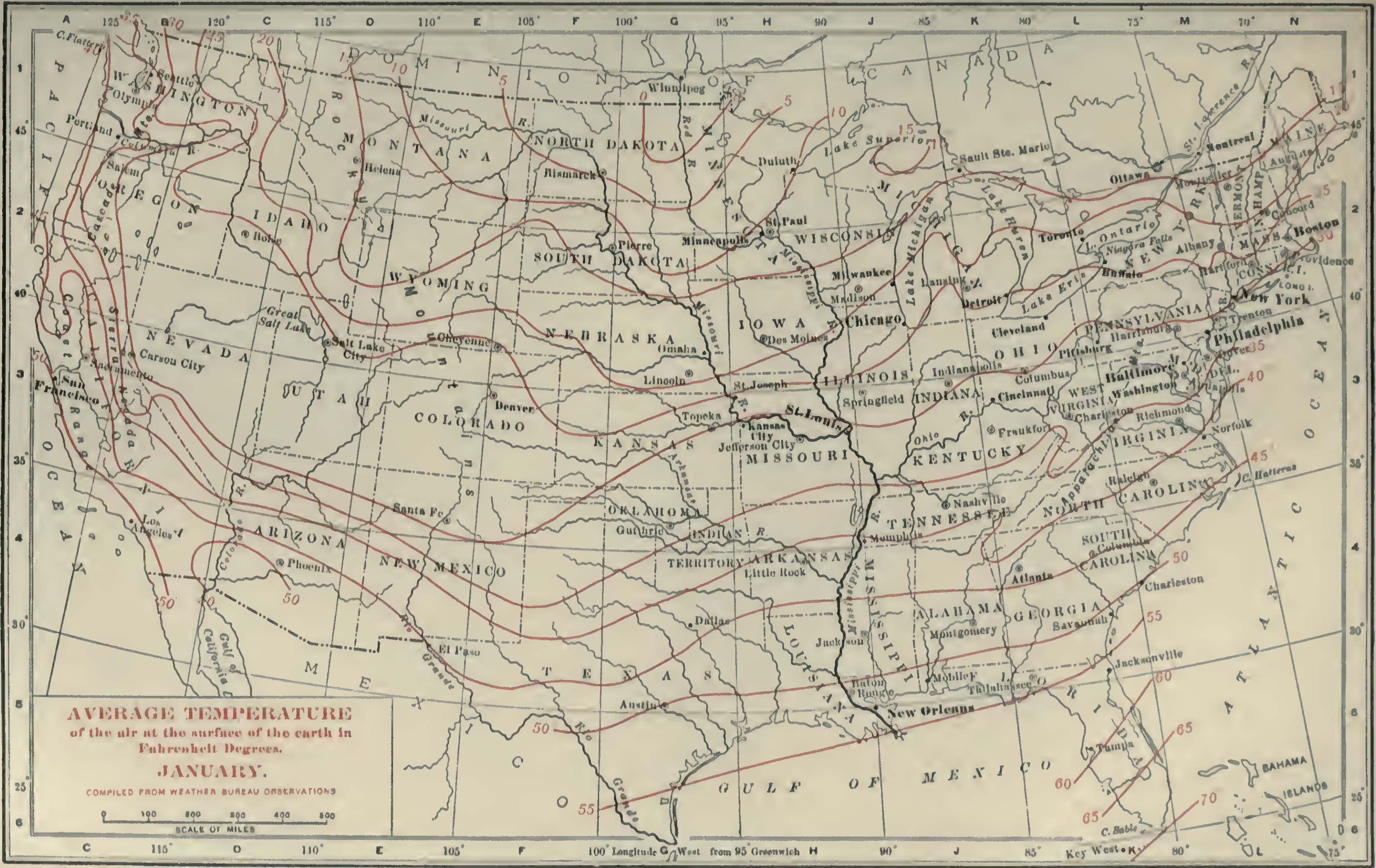
the direct cause of distress only in 15.28 per cent. of the cases investigated. Drinking to excess is rather a symptom and source of degeneration, and develops in a people of natural strength exhausted by vice, overwork, and conditions of life that undermine health. The children of drunkards are frequently idiots or insane.

(3) *Legislative Aspects.*—Various attempts have been made to control the liquor traffic by legislation, while certain regulations have always been considered necessary. The national Government, since 1789, has placed internal revenue taxes and some customs duties upon liquors. Congress also has passed laws regulating the sale of liquor to Indians and soldiers and the sale in the District of Columbia, and requiring the scientific study of temperance in the schools of the District of Columbia, military, Indian, and Territorial schools. In the States the methods used to control the liquor traffic are: (1) licenses; (2) local option; (3) prohibition; (4) dispensary system. It has been customary from the earliest times to license the sale of liquor. The modern issue has been that of high license ($500.00 or more), which its advocates claim lessens the number of saloons and improves their character. High licenses prevail in large cities. The laws of Massachusetts and Pennsylvania are considered the most successful. Local option has the advantage of the support of public opinion. The earliest laws were those of Connecticut (1839) and New York (1845). Prohibition exists in Maine (1846; in Constitution 1884), and Kansas (in Constitution 1880), Iowa, and North and South Dakota. Kansas, however, has practically local option. There is no attempt at concealment, and since the hard times of 1890 the fines for breaking the law have been regularly counted upon as revenue by some cities. Vermont and New Hampshire, after a long experience with prohibition, have adopted local option. Where prohibition exists the question of compensation for those engaged in the liquor traffic has come up for judicial decision. As a result the National Anti-Nuisance League was organized in 1888 to push cases. South Carolina alone has the dispensary system, or State monopoly of the liquor traffic. The law was passed December 24, 1892. The advantages claimed for this system are: that personal profit is eliminated; purity and an honest measure are guaranteed; treating is impossible; sales are made in the daytime and for cash, and the concomitant temptations are removed. Other laws relating to the liquor traffic regulate the hours of closing and the sale on Sunday, the sale to minors and drunkards, the situation of saloons and their accompaniments in the way of pool, games, theatres, or other attractions.

REMEDIES. The arguments advanced against the use of alcoholic drinks have been: (1) Scriptural, based on a supposed distinction in the Bible between fermented and unfermented wine, as shown by the use of the Hebrew words *yayin* (Prov. xxi.) and *tirosh;* (2) physiological, which claims alcohol to be a poison and which shows that temperance conduces to health; (3) social, viewing alcohol as a cause of crime, vice, and poverty; and (4) economic, in that the manufacture and consumption of alcohol are nonproductive and a great waste of material. The remedies offered by the early temperance movement were reformatory and preventive. Moral suasion was used, and drinkers were urged to sign the pledge and to strengthen themselves by the aid of prayer and religion. Total abstinence was demanded of the strong to help the weak. Prohibition was urged in order to remove temptation. Homes and asylums were established, as the Washingtonian House in Chicago and the Franklin Home, Philadelphia. The prevention work was largely educational through the distribution of literature, lectures, the formation of societies, and the preparation of text-books for use in the public schools. Business considerations now exert an important influence. In positions of responsibility or where accidents are likely (such as engineers, foremen, watchmen) drinking is prohibited. The habits of applicants for employment are carefully scrutinized, especially in the business of transportation. Even where moderation is overlooked, excess is never tolerated. Saloon property pays a higher insurance rate. Some life insurance companies refuse to insure men engaged in the liquor business.

BIBLIOGRAPHY. Important contributions to the study of the liquor problem have been made by the Committee of Fifty formed in 1893 and comprising representative men in the fields of education, religion, and sociology. The committee had its origin in a group of men who, beginning in 1889, had associated themselves for the purpose of pursuing the study of practical problems in sociology. Papers written by various members and criticised by all were published in the *Century Magazine* and the *Forum*. Meetings of the committee take place twice a year in New York. Four sub-committees deal with the different aspects of the liquor problem, physiological, legislative, economic, and ethical. The publications of the committee comprise: (1) Wines and Koren, *The Liquor Problem in Its Legislative Aspects* (Boston and New York, 1897); (2) Koren, *Economic Aspects of the Liquor Problem* (ib., 1899); (3) Calkins, *Social Substitutes for the Saloon* (ib., 1901); (4) Billings, *Physiological Aspects of the Liquor Problem* (ib., 1903); *Twelfth Annual Report of United States Commissioner of Labor* (1897); "Economic Aspects of Liquor Problem," *Cyclopedia of Temperance and Prohibition* (New York, 1891); *Temperance of All Nations*, edited by Sterns (Papers of World's Temperance Congress, 1893, New York, 1893); Tracts, Publications, and files of papers of W. C. T. U. and temperance societies; Samuelson, *The History of Drink* (London, 1880).

TEMPERANCE, SONS OF. An order founded in New York in 1842 with the object of making the great temperance movement of that period permanent. It has life insurance, sick and funeral benefit features. There are male and female members and there is a cadet branch for boys of sixteen years, who are known as the Cadets of Temperance, and who subscribe to a pledge which binds them to avoid all connection with the use, sale, or manufacture of spirituous liquors. There are four grand divisions of the order, one in England, where it was introduced in 1846, two in Australia, and one in North America. About one-half of the members are in the United States and it is estimated that 3,000,-



AVERAGE TEMPERATURE
of the air at the surface of the earth in
Fahrenheit Degrees.
JANUARY.
COMPILED FROM WEATHER BUREAU OBSERVATIONS

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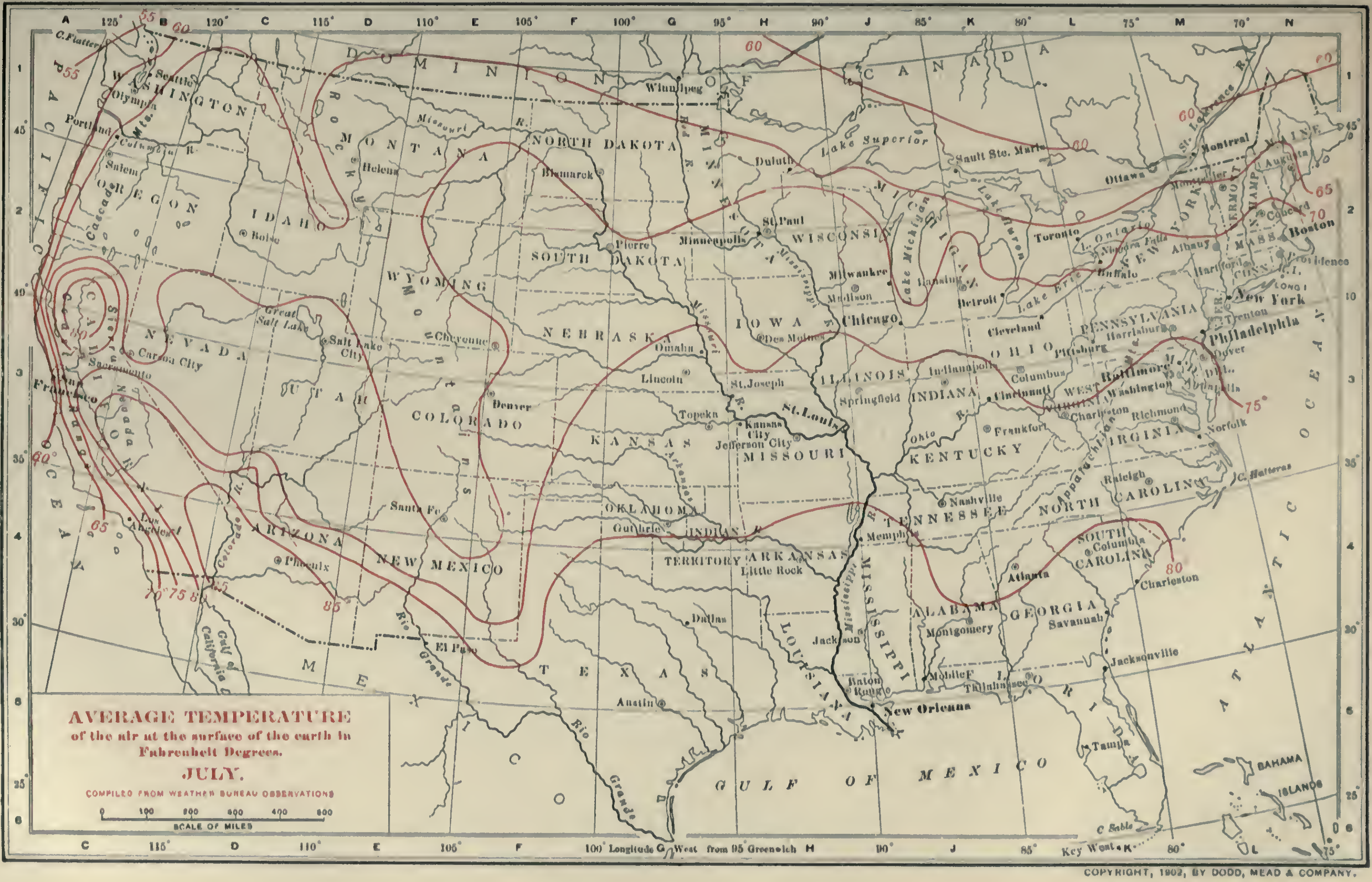

AVERAGE TEMPERATURE
of the air at the surface of the earth in
Fahrenheit Degrees.

JULY.

COMPILED FROM WEATHER BUREAU OBSERVATIONS

0 100 200 300 400 500
SCALE OF MILES

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000 members have been on the rolls since the organization of the order. The ritual is very impressive. The order is now established in Great Britain, Ireland, the Bahamas, Liberia, New Zealand, Australia, Scotland and Wales.

TEMPERATURE. See Heat.

TEMPERATURE, Terrestrial. The distribution of heat in the atmosphere depends to some extent on its direct absorption of solar radiations, and especially the absorption at the upper surface of the clouds, but is principally governed by the angular altitude of the sun and the contact of the air with the ground and the ocean. The numerous irregularities give rise to the great currents of air as well as to the local winds, and the latter carry the heat and the temperature rapidly from one part of the globe to the other, so that ultimately the atmospheric temperature is almost equally controlled by the winds on the one hand and the oceans, continents, rain, snow, and cloud on the other. The typical continental climates experience great diurnal and annual ranges of temperature, and the typical oceanic climates show a small range.

The distribution of temperature on any level surface at any depth below or height above sea level is shown by means of isotherms which are drawn through all places that have the same temperature at any moment, or the same monthly or annual mean temperature. Charts showing these isotherms have been published by various meteorological services for the air and the land, and by various hydrographic offices for the oceans. The highest mean annual temperatures occur within the tropics and especially over the land areas of Northern Africa and Southern Asia, with corresponding small regions in Central America and the northern portion of South America. The lowest mean annual temperatures are found in Northern Siberia and the northern portions of British America, which represent the southern extension of a large Arctic area of low temperature. See Climate.

TEMPERATURE OF THE BODY. The temperature in the healthy human adult averages from 98.4° to 98.6° F., but 97.5° and 99° F. are within normal limits. In the new-born child the temperature is slightly above the average, as it is in old age. Race has but a slight influence, a difference of .29° F. being observed between the nations of Southern Europe and those of the northern part. The temperature rises slightly after a meal and during exercise. During the day the body heat varies about half a degree, being highest between 5 and 8 P.M. and lowest between 2 and 6 A.M. In childhood the temperature is easily and rapidly influenced, slight ailments causing marked febrile reaction. The temperature is registered by means of the clinical thermometer (q.v.), which is self-registering, placed in the mouth, axilla, fold of the groin, rectum, or vagina. The surface of the body is slightly cooler than the interior. A temperature below 93° or above 108° F. is almost always fatal. The usual range in fevers is between 99.5° and 105° or 106° F. As a rule there is a constant relation between the amount of fever and the rapidity of the pulse (q.v.) in many people. A pulse of 80 indicates a temperature of 100° F.; a pulse of 90, a temperature of 101° F., etc. A rise of temperature between 99° and 102° F. is termed slight or moderate pyrexia; from 101° to 105° severe pyrexia; and above this point hyperpyrexia. Many chronic and a few acute diseases are characterized by a subnormal temperature. This is observed in hemorrhage, starvation, and wasting from chronic diseases. In the melancholia of certain mental troubles there may be great depression both of the general and surface heat. An elevation of temperature attends by far the greater number of diseases. In the great class of the acute general infections (see Nosology) an elevation of the body heat is the most important symptom and is proportional to the severity of the disease. Very marked elevation of temperature (hyperpyrexia) is seen in tetanus, acute rheumatism, pernicious malarial fever, and after injuries to the spinal cord. In tetanus the thermometer may register as high as 112.5° F. In sunstroke or heat-stroke, an equally high point has been reached. Lastly, the temperature may rise just before death, and after it, in *rigor mortis*. See Animal Heat; Fevers; etc.

TEMPERATURE VARIETIES. Varieties, races, or sub-species are largely differentiated by variation resulting from being subjected to different influences, principally in the nature of temperature and comparative moisture. It is a matter of universal observation that widespread species present a great range of variability in size, proportion of parts, color and other characteristics, so that it is often a matter of doubt whether a variant ought to be classed as a geographical sub-species, or as a distinct species. When it appears that the same kind of variation affects all or nearly all of the animals of a certain class in a region, coincidently with the character of the local climate, it is fair to assume that the change from the normal noted is due to local climatic influence. Temperature seems to act most directly in producing the common form of seasonal dimorphism, which affects most of the higher animals that dwell in the temperate zones, and are called upon to endure the cold of winter as well as the heat of summer. This causes a semi-annual change in mammals and birds from a comparatively thin and short coat of hair or feathers in the warm half of the year to a thicker and longer covering more suitable to the cold season. In addition to this there is always a greater or less change of color, the bright dress of summer, assumed after the spring molt, falling out in the autumn and being gradually succeeded by a plainer, less conspicuous suit for the winter months. The difference is often very great; and in the arctic regions amounts to a change from decided colors in summer to pure white in winter.

The comparative degree of average moisture in the air of two regions will be reflected in the colors and other features of the same species of animals inhabiting them; those of the moist region will have darker colors, and a tendency to larger size and proportionality longer external parts, as bills, legs, and tails, than the dry land species, which will be more pale in color and compact in form. Dr. J. A. Allen has shown this very conclusively in his investigations upon North American birds. Let one of these districts be severed for a considerable period from the others and the results accredited to isolation (q.v.) would follow; but the species so formed might well be called 'temperature species' in reference to their origin. Geographical races may therefore be regarded as incipient species.

That changes from heat to cold, wetness to dryness, or the reverse, in the climates of regions of the world in the course of its history since animal life appeared upon it, have been efficient factors in species-making, may well be believed.

See EVOLUTION; MELANISM; ISOLATION; and consult authorities there mentioned.

TEMPERING STEEL. A peculiar effect is produced upon steel by heating it to redness, and then suddenly cooling it. By this means, extreme hardness is obtained. Steel is so susceptible to this process, called tempering, that almost any degree of hardness and brittleness can be obtained. If, for instance, we make a piece of steel red hot, and then plunge it into cold water, it becomes hard and brittle when cold, and is actually, though slightly, increased in bulk. But if we reheat the metal, and allow it to cool slowly, it again becomes soft and malleable as before. Moreover, if we again reheat it, but not to redness, and cool it suddenly, it is still further softened. If, before reheating, the surface has been polished, a beautiful shade of color is produced by the heat, which is varied according to the temperature employed; and so exactly is this the case, that the experienced manipulator is guided by the color produced, instead of by nice regulations of the heat applied. For ordinary operations, the metal is cooled by plunging it in cold water; but oil, mercury, and saline solutions are used for special purposes. An exact series of experiments has proved that the following colors are produced at the temperatures given: very pale yellowish, by 430° F.; pale straw, 450°; yellow, 470°; brown, 490°; mottled brown, 510°; purple, 530°; bright blue, 550°; blue, 560° dark blue, 600°. See ANNEALING; IRON AND STEEL.

TEMPEST, THE. A play by Shakespeare first acted in 1610, though Fleay suggests that its present form was abridged perhaps by Beaumont about 1613 for a Court performance, the wedding of the Princess Elizabeth. Sidney Lee also doubts that it was originally written for this occasion. It was first printed in the Folio of 1623. The sources are principally books of travel: Eden's *History of the Travaile* (1577), Raleigh's *Discovery of Guiana* (1596), and S. Jourdan's *Discovery of the Bermudas* (1690), telling of Sir George Somers's fleet at Bermuda in 1609.

TEMPESTA. See MULIER.

TEMPLARS, KNIGHTS. A religious and military order of the Middle Ages, the great rival of the Knights of Saint John of Jerusalem. In 1119 Hugues de Payens and Geoffrey de Saint-Adémar (Saint-Omer), with seven companions, formed a military band to protect pilgrims in Palestine. They adopted the rule of Saint Augustine, and took the name Knights of Christ. But as quarters were assigned to them in the palace at Jerusalem, known as Solomon's Temple, they soon were called Knights of the Temple, or Knights Templars (*milites templi*). In 1128 at the Council of Troyes a rule, inspired by Saint Bernard, and closely following the Cistercian, was given them.

The order grew rapidly. At the end of the thirteenth century it had about fifteen thousand members, and in the middle of the same century it is said to have owned nine thousand castles and manors. It was free from all taxes and was under the jurisdiction of the Pope alone. As the order had to make regular transfers of supplies and money from Europe to Palestine, they developed an effective banking system. Their strong and well-manned 'temples' were the safest places for depositing treasure and documents and for a time the Templars were the bankers of Europe. There were three ranks in the order, knights, chaplains, and servants. The knights, few in number, were the real Templars. They directed the affairs of the order, and they alone could wear the white mantle with its red cross. At the head of the order was the grand master. The capital of the order was at Jerusalem till 1187, and then successively at Antioch, Acre, and Cæsarea, and after the extinction of the Christian power in Syria (1291), in Cyprus. The standard of the order, called *Beauséant*, was half black, half white, with the motto *Non nobis Domine.* The Templars' wealth, pride, and power brought them into conflict with Church and State. With the decay of the crusading spirit their activity was more feared, and in the latter half of the thirteenth century opposition grew rapidly. They had made enemies in other military orders and among the monastic orders. Their adoption of Oriental customs and the secrecy of their rites impressed popular imagination. They were charged with many evil and sacrilegious practices. The direct attack on them came in France. Philip IV., under the influence of Guillaume de Nogaret, saw his chance to be rid of an insubordinate order, and to increase his wealth. He got Pope Clement V. to aid him. On October 13, 1307, the grand master, Jacques de Molay (q.v.), with all the Templars, was arrested without warning. Their trial was in charge of the Inquisitor for France. Most of them under torture confessed to some or all of the charges against the order. Many of them afterwards retracted, including Molay. A large number were burned at the stake, Molay himself being spared for a number of years. In 1311 Clement called the General Council of Vienne, chiefly for the purpose of suppressing the order. When the council persisted in demanding that the question should be tried strictly as a judicial question without any regard for policy, Clement held a secret consistory, March 22, 1312, at which the suppression was decreed. On April 3d the bull *Vox in excelso* was published declaring the reasons for the Papal condemnation. On May 2d the bull *Ad providam* was issued decreeing the final abolition of the order. Its property went to the Hospitalers; but the seizures of Philip were confirmed to him. Jacques de Molay was burned in 1314.

Consult: Curzon, *La règle du Temple* (Paris, 1886); Gmelin, *Schuld oder Unschuld des Tempelordens* (Stuttgart, 1893); Lea, *History of the Inquisition*, vol. iii. (New York, 1888).

TEMPLE. A building consecrated to religious worship, especially among pagan peoples. The term is also applied to the chief sanctuary of the Jews (see TEMPLE OF JERUSALEM), to Christian churches belonging to the Knights Templars, and in France to Protestant places of worship. A temple was usually dedicated to some deity, whose image it contained; the interior was accessible to priests, but not to the general body of worshipers. Among most ancient peoples the temple was the principal architectural feature, as in Greece, where the history of temple construction is practically the history of architecture. The subject is therefore best treated under the subdivision ARCHITECTURE, in such articles as ASSYRIAN, BABYLONIAN, EGYPTIAN, GREEK, ROMAN, INDIAN, CHINESE, and JAPANESE ART; also under ARCHITECTURE, ANCIENT AMERICAN.

TEMPLE. A city in Bell County, Tex., 35 miles south by west of Waco; on the Gulf, Colorado and Santa Fe and the Missouri, Kansas and Texas railroads (Map: Texas, F 4). It has a public library, King's Daughters' Hospital, and the Gulf, Colorado and Santa Fe Railroad Hospital. Temple is the shipping centre for the cotton, corn, oats, and live stock of the surrounding country. Cottonseed-oil mills, cotton gins and compresses, foundries and machine shops, bottling works, a large cold storage plant, flouring mill, and a candy factory are among the leading industrial establishments. The Gulf, Colorado and Santa Fe Railroad maintains shops here. The government is vested in a mayor, chosen biennially, and a unicameral council. Temple was settled in 1881. Population, in 1890, 4047; in 1900, 7065.

TEMPLE, THE. (1) A former stronghold of the Templars in Paris, built in 1212. When the order was suppressed in 1312 it was used as a royal treasury and subsequently as a prison. During 1792 and 1793 Louis XVI. and his family were confined in it. The last remains of the building were removed in 1871 and its site is now occupied by the Marché du Temple. (2) A former lodge of the Templars in London, dating from the end of the twelfth century, and now represented by the Temple Church and the Inns of Court, known as the Inner and Middle Temple, which stand on the site of the ancient building, the former within the precincts of the city. The Temple became Crown property when the order was dissolved, was presented to the Earl of Pembroke, and then passed to the Knights of Saint John, who leased it to law students.

TEMPLE, FREDERICK (1821-1902). Archbishop of Canterbury. He was born at Leukas, in the Ionian Islands, and was educated at Balliol College, Oxford. He was principal of Kneller Hall, and then inspector of church training-colleges, until he was elected head-master of Rugby, where his administration was very successful. In 1860 his name was prominent as one of the authors of *Essays and Reviews*, a book supposed to have a rationalizing tendency, though Temple's own essay on "Education and the World" contained little that would be considered dangerous nowadays. The suspicion of heterodoxy, however, clung about him and found expression when Gladstone, in 1869, nominated him as Bishop of Exeter, in a formal protest against his confirmation. This distrust died away afterwards and he acquired a great reputation for absolute justice and impartiality, while in many respects his later career associated him rather with the High Church party than with the Broad. In 1885 he was translated to the see of London, and in 1896 he was made Archbishop of Canterbury, and a year afterwards, with his brother primate of York, stood out as a champion of the Church of England in a learned and dignified reply to the Papal decision declaring the invalidity of Anglican ordination. He died in London soon after officiating at the coronation of Edward VII. His most important published work is *The Relation Between Science and Religion* (1884), being the Bampton Lectures for that year. Consult biographies by Aitken (London, 1901) and Dant (ib., 1903).

TEMPLE, HENRY JOHN, third Viscount Palmerston. A British statesman. See PALMERSTON.

TEMPLE, Sir RICHARD (1826-1902). An English politician and author, born at Kempsey, near Worcester. Having entered the Indian service in 1848, he rose quickly, becoming Finance Minister of India (1868), Lieutenant-Governor of Bengal (1874), and Governor of Bombay (1877-80). On his return to England in 1880 he became financial member of the London School Board (1886-94), and president of the Social Science Congress. From 1885 to 1895 he sat in Parliament as a Conservative. For his services he was made a baronet in 1876. His publications comprise: *India in 1880* (1881); *Men and Events of My Time in India* (1882); *Oriental Experience* (1883); *Cosmopolitan Essays* (1886); *Palestine Illustrated* (1888); *Memoir of John Lawrence* (1889); *Life in Parliament* (1893); *Story of My Life* (1896); *A Bird's-Eye View of Picturesque India* (1898); and *The House of Commons* (1899).

TEMPLE, RICHARD TEMPLE GRENVILLE, Earl (1711-79). An English statesman. He was the eldest son of Richard Grenville of Wotton Hall, Buckinghamshire, and was educated at Eton and privately. In 1734 he was returned to Parliament for Buckingham. On the death of Viscount Cobham in 1749 his mother was created Countess of Temple and at her death in 1752 Grenville succeeded to the Temple earldom. He was a political associate of William Pitt, who married Grenville's sister Hester, and he held the position of First Lord of the Admiralty, 1756-57, and Lord Privy Seal, 1757-61. He was afterwards in frequent opposition to the King, Pitt, and his brother George Grenville, supported Wilkes, and was one of the many to whom the authorship of the *Letters of Junius* was attributed. Consult the *Grenville Papers* (1852-53), which consist of the correspondence between Pitt and George and Richard Temple and throw much light on the political and Court life of the period.

TEMPLE, Sir WILLIAM (1628-99). An English statesman and essayist, born in London. He was reared by an uncle, Dr. Henry Hammond, rector of Penshurst, in Kent. He entered Emmanuel College, Cambridge, in 1644; but he left four years later without a degree, and set out for France. On this journey he met Dorothy Osborne (1627-95), the daughter of a stanch royalist, whom he married in 1655. Dorothy's letters during the last years of the courtship possess great charm. In 1665 Temple was sent to Westphalia on a secret mission to the Bishop of Münster. On his return (1666) he was created a baronet, and appointed resident at the Court of Brussels. His most important diplomatic success was the famous treaty of 1668, known as the Triple Alliance, by which England, Holland, and Sweden bound themselves to unite in curbing the ambition of France. Temple was long Ambassador at The Hague and helped to bring about the marriage of the Prince of Orange with the Princess Mary (1677). In 1679 Charles II. urged him to become his Secretary of State. Though Temple refused this post, he attempted to reform the government by establishing a privy council of thirty members, by whom the King promised to be guided in all public affairs, but this council proved an utter failure. Temple soon abandoned politics and retired, first to Sheen, and then to Moor Park in Surrey, where for the last ten years of his life he devoted himself to landscape gardening and to literature. During this period he received into his household as amanuensis, and afterwards as secretary, Jonathan Swift (q.v.), who ultimately became his literary executor.

As a writer Temple is now known chiefly by his historical *Memoirs* (unauthorized ed. 1691; 1709) and his *Miscellanea* (1680; 1692). In the series of 1692 first appeared the famous essay on Ancient and Modern Learning, which deals with the comparative merits of ancient and modern literature. The outcome of the spirited controversy in England was Swift's *Battle of the Books* (1704). Temple has been considered one of the reformers of English style. According to Dr. Johnson he was "the first writer to give cadence to English prose." Temple's English was particularly pleasing to Charles Lamb, who comments upon it in his *Essay on the Genteel Style.* Consult his *Works* (London, 1814); the *Life, Works, and Correspondence by T. P. Courtenay* (ib., 1836); and Macaulay's article on this biography in the *Edinburgh Review* for October, 1838 (reprinted in *Essays*); the *Letters* of Dorothy Osborne, ed. by Parry (London, 1888); and *Battle of the Books.* For the controversy on ancient and modern learning, see also the articles RICHARD BENTLEY, ROGER BOYLE, JONATHAN SWIFT, WILLIAM WOTTON, and BATTLE OF THE BOOKS.

TEMPLE AT JERUSALEM. The central shrine of Judaism after the establishment of the Davidic monarchy, situated on Mount Moriah in Jerusalem. The first 'house of God' was the Tabernacle or Tent of Meeting, described in Exodus xxv.-xxvii.; but this was replaced during Solomon's reign (c.977-937 B.C.) by a permanent structure of great magnificence. This is described in great detail in II. Chronicles iii.-iv. (more briefly in I. Kings vi.); but, although certain features of the design are clearly set forth, others are wholly passed over, so that efforts to restore it from these descriptions have produced an extraordinary variety of results. It is, however, evident from the descriptions that the Temple followed the general plan of the Tabernacle with its inclosures, but on double the scale. The arrangement of the Tabernacle, with its outer court, inner court, sanctuary or Holy Place, and Holy of Holies, resembled in its general scheme that of the Egyptian temples (see EGYPTIAN ART); but the Tent itself was of modest dimensions, the Holy of Holies forming a cube of 10 cubits or about 15 feet, and the sanctuary a double cube 10 by 10 by 20 cubits. The Temple proper of Solomon measured 60 cubits in length, the outer sanctuary or Holy Place being 20 by 40 cubits in size and the Holy of Holies 20 by 20 cubits; both were 20 cubits high. Within the latter was the Ark of Testimony under two cherubim with outspread wings; in the Holy Place were the altar of incense, the show-bread table, the seven branched candlesticks, and ten smaller tables and candlesticks. Both chambers were wainscoted with cedar and wholly covered with gilding; they were separated by a 'veil' or fixed curtain fitted with an olive wood doorway and doors. It was this veil that was 'rent in twain' at the crucifixion (Matt. xxviii. 51; Mark xv. 38; Luke xxiii. 44). The golden candlestick carried by Titus to Rome in A.D. 70 is figured in a relief on the Arch of Titus.

In front of the Temple porch were two columns of bronze, 'Jachin' and 'Boaz,' 23 cubits high; and against its side and end walls were three stories of small chambers for the priests. The court immediately surrounding the Temple was reserved for the priests, and contained the brazen altar of burnt offering and the great bronze 'Sea,' or tank, borne on twelve bronze oxen; these, with the cherubim in the Holy of Holies, being the only examples of free sculpture in Jewish art. A second court was the place of general assembly for all Jewish worshipers; it preceded or surrounded the first; but whether built by Solomon or encircled at a later date is not certain. Solomon's palace and the 'House of the Cedars of Lebanon' adjoined the Temple court. Dependencies and outbuildings were added at various times to the main group. Of the architectural style of the Temple there is little hint in Scripture; but we know that its builders were chiefly Phœnicians, and the combination of an Egyptian type of plan with such Assyrian decorative details as palms, cherubim, and 'knops and flowers' is quite in harmony with the mixed style of Phœnician work in general.

Solomon's Temple was destroyed by Nebuchadnezzar B.C. 586. Upon the return of the Jews from the Babylonian captivity by permission of Cyrus a new edifice was erected under the direction of Zerubbabel and finished B.C. 516. The vision of this second temple given by Ezekiel (chapters xl.-xliii) is generally recognized as something more than a mere creation of fancy. Though vague in many points, it is consistent and detailed in others, representing a far more elaborate system of courts, inclosures, gates, and porticoes than the first temple possessed. The temple proper was a reproduction of the original edifice, but far inferior to it in splendor of ornament and gilding. Both the first and second edifices were, however, surpassed in architectural splendor by the third temple, erected by Herod, B.C. 18. The area of the temple terrace was greatly enlarged by new substructures built with masonry of colossal magnitude, a section of which forms the present 'place of wailing' of the Jews. Marble was profusely used for colonnades, gates, and walls, and the magnificence of Roman carved decoration and architectural detail was blended with the Oriental arrangement of the plan, which reproduced essentially the disposition of the two preceding structures, but with an additional exterior 'Court of the Gentiles.' A new *stoa basilica* or three-aisled portico of vast dimensions occupied the south side of the inclosure; 'Solomon's porch' was reerected in the form of a colonnade along the east front, in which was perhaps the 'Gate Beautiful' (Acts iii. 2). This temple was the one from which Christ expelled the money-changers and merchants. It was destroyed during the pillage of the city by Titus, A.D. 70, but contrary to his orders. Under Constantine an effort on the part of the Jews to rebuild it was severely punished, and a contemporary writer states that a later attempt by the Emperor Julian to rebuild it was frustrated by "flames which burst from the foundations." On the temple area, called by the Arabs *Haram-esh Sheri*, one of the early caliphs (probably Abd-el-Melek, who reigned from 685 to 705) erected a splendid mosque, the *Kubbet-es-Sakhrah*, commonly known as the 'Mosque of Omar,' and the place has ever since remained in the possession of the Moslems.

All three temples must have presented an aspect of mixed architectural styles, due to the general lack of skill in the plastic arts among the Jews, and their consequent dependence on the arts of neighboring nations. Solomon's achievement was, under these circumstances, amazing in the grandeur of its general conception and the splendor of its gilding, decoration, and furniture. But it was far surpassed in scale and in magnificence of external architecture by Herod's temple.

THE TEMPLE SERVICE. The Solomonic temple was primarily intended to be a Yahweh-sanctuary, as is evident from I. Kings viii. 13. But during the period of the Davidic dynasty many other divinities were worshiped in it. (See e.g. Ezek. viii., II. Kings xviii., xx.) The temple of Zerubbabel appears to have been devoted solely to Yahweh. In B.C. 168 the sanctuary was dedicated to Zeus Olympius and remained a Zeus temple for three years (I. Macc. i. 54; iv. 52). The magnificent temple of Herod was until the fall of Jerusalem the great centre of the Jewish sacrificial cult, having no rival except Onias's Temple (q.v.) at Leontopolis, and was devoted exclusively to the imageless worship of Yahweh.

In the regal period the King was the chief priest officiating in the temple. Whether there was a ceremony corresponding to the 'seizing of the hands of Bel' by the Babylonian kings, cannot be determined. But the annual entrance into the Holy of Holies by the high priest of the Persian period may have developed out of such a custom. David set the example of appointing his own sons as priests (II. Sam. xviii. 8). There was no distinction yet between priests and Levites. Even in the Deuteronomic code, introduced about B.C. 620, the Levites are priests whose function it is to offer sacrifices. In the Persian period a high priest was at the head of the hierarchy; and only families claiming descent from Aaron were permitted to offer sacrifices. The Levites were a class by themselves and were not allowed to present the sacrifices, while musicians and doorkeepers formed a still lower class. The Levites as well as the priests were divided into twenty-four 'courses.' Next to the high priest ranked the *Segan*, or captain of the temple police, then came the heads of the twenty-four courses, and a large number of other officials. While in earlier times even the common people seem to have had access to the inner court, in later times the Levites and lower ministers were forbidden to enter it. Non-Israelites were not permitted to enter any part of the temple, but representatives of the people of Israel were required to attend in turn the daily offerings in the outer court.

The Tamid, or the daily offering, presented every morning and evening, was the most important of the many sacrifices of a public character. The number of sacrifices was increased on Sabbaths and festivals. The ceremony was preceded by lustrations and solemn choice of officiating priests. It consisted of the slaughter of the victim, the sprinkling of the blood on the altar, the removing of the blood from the altar of incense in the Holy Place, the trimming of the lamps on the candlesticks, the carrying of the different parts of the victim to the foot of the altar, the presentation of the flour-offering, the baked meal, and the libations of wine. During the celebration of this sacrificial service, the Shema Israel (Deut. vi. 4-9; xi. 13-21; and Num. xv. 37-41), the Ten Commandments, and three blessings were pronounced by the priests. The offering of incense was accompanied with prayer. Then the Levitic choir, to the accompaniment of stringed instruments, sang the psalm of the day, divided into three sections. At the end of each, priests blew three blasts on the silver trumpets, and the people prostrated themselves. This ritual goes back at least to Maccabean times, and the music and singing no doubt formed a part of the daily service long before sections of the present Psalter were in use. After the public sacrifice, private sacrifices began.

BIBLIOGRAPHY. The literature of the Temple is considerable. Among attempts to restore it one of the earliest is that of Villalpandus in Pradi's *In Ezechielum Explicationes* (1596). Of recent discussions and restorations we may mention Meyer, *Der Tempel Salomos* (Berlin, 1830); Canina, *Ricerche sull' architettura degli antichi Giudei* (Rome, 1845); De Vogüé, *Le temple de Jérusalem* (Paris, 1866); Edersheim, *The Temple, Its Ministry and Services in the Time of Christ* (London, 1874); Fergusson, *Temples of the Jews and Other Buildings on the Haram Area* (ib., 1874); Robins, article in *British Architect* (January, 1886); and the elaborate and superbly illustrated discussion of the first and second temples in Perrot and Chipiez, *Histoire de l'art en Judée*, etc. (Paris, 1889). The restoration of Zerubbabel's temple, by Chipiez, in this work, is a remarkable example of constructive archæology. See also Friedrich, *Tempel und Palast Salomos* (Innsbruck, 1887); Schmidt, *Solomon's Temple in the Light of Other Oriental Temples* (Chicago, 1902).

TEMPLE BAR. A noted gateway between Fleet Street and the Strand, London, built in 1670 by Wren, and marking the boundary of the City. Here the sovereign, on entering the City, was obliged to ask from the Lord Mayor permission to pass. The structure was removed in 1878 to make a way for the enormous traffic and its place was supplied by the memorial bearing statues of Queen Victoria and of Edward VII., then Prince of Wales.

TEMPLE CHURCH. The church connected with the former house of the Knights Templars in London, and the only portion of the original group of buildings remaining. It consists of a Norman Round church, 58 feet in diameter, dating from 1185, with a choir added in 1240. It has a richly painted ceiling and interesting tiled flooring, and contains nine monuments of Templars.

TEMPO (It., time). The degree of rapidity with which a piece of music is to be executed. The rhythmical proportions of notes, as indicated by their form, give them only a relative value, and have no reference to the absolute speed at which the entire composition is to be played. The varying rates of speed at which different compositions, or portions of compositions, are to be played is usually indicated by certain terms called *tempo marks.* These terms are not, however, always used with exact precision, and sometimes apply more to the character than to the absolute speed of performance. The following table gives the most usual tempo marks with their approximate significances:

SLOW	MODERATE	FAST
Largo	Andante	Animato
Grave	Moderato	Allegro
Lento molto	Allegretto	Vivace
Lento	Adagietto	Vivo
Larghetto	Allegro moderato	Allegro molto
Adagissimo	Sostenuto	Allegro vivo
Adagio	Commodo	Presto
Andantino	Non troppo allegro	Prestissimo
	Maestoso	
Indicating retard		Indicating acceleration
Rallentamento		Accelerando
Rallentando		Stringendo
Ritardando		Affrettando
Largando		Veloce
Ritenuto		Ravvivando il Tempo
Tardando		Doppio movimento
Lentando		Sempre accelerando
Meno mosso		Più mosso

The tempo is indicated with far greater exactness by references to the beats of the metronome (q.v.). It is not, however, uncommon for composers to express the tempo by reference to some well-known musical form which has a characteristic movement, as 'tempo di marcia,' 'tempo di valse,' 'tempo di minuetto,' etc. Schumann and Wagner discarded the Italian nomenclature and indicated the tempo by means of German terms. In this they have been followed by a few other composers, but the German terms are not well enough known to be free from a certain vagueness. The Italian terms came into use at the beginning of the seventeenth century. Before that time the means of expressing the general speed at which a composition was to be played were very limited. In mensurable music (q.v.) each note had a certain average time value (integer valor); but in the course of years the unit of measure changed so frequently that great confusion ensued. In transcribing works of the sixteenth century in modern notation all notes must, as a rule, be reduced to about half their face values; while in still older works the reduction should be to a quarter or an eighth of the original value. *Tempo rubato* (stolen time) is the name given to a mode of performance to which a restless character is imparted by protracting one note beyond its proper duration, and curtailing another so that the aggregate duration of each measure remains unchanged. *Modification of tempo* is a term first used by Richard Wagner, in his article "Ueber das Dirigieren," to indicate that a composition cannot be played throughout in strict metronome time. This is especially true in dramatic music, and throws the responsibility for the interpretation of the music upon the conductor (q.v.).

TEMPORAL POWER (Lat. *temporalis,* relating to time, from *tempus,* time, season; connected with Icel. *þamb,* an out-stretching, Lith. *tempiù,* I extend) OF THE POPE. The sovereign power which the Pope possessed as ruler of the Papal States (q.v.), which, although modified in its exercise by his spiritual character, was in substance the same as that of any arbitrary sovereign. The question as to the necessity or utility of such a power vested in the hands of a spiritual ruler, and even of its lawfulness and its compatibility with his spiritual duties, has been very warmly debated. Many of the mediæval sectaries put forward the principle of the incompatibility of the spiritual with the temporal power in the same person, not only in relation to the Pope, but also as to the other ecclesiastics who were feudal lords. Such were the doctrines of the Vaudois, of Pierre de Bruys, and above all of Arnold of Brescia (qq.v.). Through the centuries which followed, the anti-Papal controversies turned so entirely upon doctrine that there was little room for the discussion of this question, and it is a mistake to suppose, as has not unfrequently been done, that it entered in any way into the conflict of Gallican and Ultramontane principles. Even the great Gallican champion Bossuet (q.v.) not only admitted the lawfulness of the Pope's temporal sovereignty, but contended that it was in some sense necessary to the free exercise of his spiritual power, and to the independence of his ecclesiastical government. It was not until the aggression of the French Republic upon Rome, and the annexation of the Papal provinces called the Legations to the Cisalpine Republic, and afterwards to the Kingdom of Italy, by Bonaparte, that the controversy assumed any practical interest. For a few years all of the Papal territories were in the hands of Napoleon. More recently, upon the incorporation of the whole of the Papal States in the Kingdom of Italy, the question once more agitated the entire Catholic world, and is still, a generation later, a practical one. Most Roman Catholics, while admitting that the possession of temporal sovereignty is no essential part of the privileges of the successor of Saint Peter, regard the possession of a sovereignty independent of any particular sovereign as the means providentially established for the protection of the spiritual independence of the Pope, and of the free exercise of his functions as spiritual ruler of the Church.

TEMRYUK, tyĕm-ryōōk′. A seaport in the Territory of Kuban, Ciscaucasia, Russia, situated on an inlet of the Sea of Azov, 90 miles west of Ekaterinodar (Map: Russia, E 5). It has an extensive export trade in grain and flour. Population, in 1897, 14,476.

TEMUCO, tȧ-mo͞ok′kô. The capital town of the province of Cautin, Chile, 140 miles southeast of the port of Concepcion, with which it has railway communication, on the north bank of the river Cautin (Map: Chile, C 11). The town has tanneries and breweries and carries on an important trade with the Arucanians of the vicinity. Its population in 1895 was 7078.

TENAILLE, tê-nāl′. See FORTIFICATION.

TENANCY AT SUFFERANCE (OF. *tenance*, from ML. *tenantia*, a holding, retaining, from Lat. *tenere*, to hold, retain; connected with Gk. *τείνειν*, *teinein*, Skt. *tan*, Goth, *uf-þanjan*, AS. *þenian*, OHG. *denen*, *dennen*, Ger. *dehnen*, to stretch out). A continued but wrongful occupation of land by a tenant whose original possession was with the consent of the owner, after his term has expired and without permission of the landlord. By the common law, the landlord may enter at any time and forcibly eject him, and he cannot maintain an action against the landlord for assault and battery, if the latter expels him from the premises without using unnecessary force or violence. He may be sued for use and occupation, but not for rent. See TENANCY AT WILL. Consult the authorities referred to under LANDLORD AND TENANT.

TENANCY AT WILL. An occupation of land by a person under a demise or agreement with the landlord that the tenancy shall not be for a fixed term, but shall be determinable at the will or caprice of either party. By the common law, a tenant at will could not assign or convey his estate, and was obliged to pay rent only for the time he remained in actual occupation. A tenant at will is entitled to notice to quit, and in the absence of statute this notice should generally be given for a time equal to the period between two rent days, in advance of the date set for removal. Where such a tenant receives notice to quit and has growing crops at the time, he is entitled to enter later and gather them, and he must always be given a reasonable time in which to remove. See TENANCY AT SUFFERANCE.

TENANCY IN COMMON. See COMMON, TENANCY IN; JOINT OWNERSHIP.

TENANT FOR LIFE. See LIFE ESTATE.

TENANT RIGHT. In English law a custom which is recognized in some districts in Ireland, under which a tenant is conceded the right to continue to occupy land, upon which he has made improvements, practically indefinitely without the payment of an increased rent. By the 'Land Act' of 1870 the custom was recognized. See LANDLORD AND TENANT.

TENAS′SERIM. The southernmost division of Lower Burma (see BURMA), bordering on Siam, and comprising the districts of Salwin, Amherst, Tavoy, Thaton, Toungu, and Mergui (Map: Burma, C 4). Tenasserim is a narrow strip of coast about 500 miles long, with a varying breadth of from 40 to 80 miles, extending from the Pakchan River northward to the Salwin. Area, 36,086 square miles. Population, in 1891, 912,051; in 1901, 1,137,776. The chief town is Maulmein.

TEN BRINK. See BRINK.

TENCH (OF. *tenche*, Fr. *tanche*, from ML. *tenca*, Lat. *tinca*, tench). A small European cyprinoid carp-like fish (*Tinca vulgaris*), an inhabitant of ponds and stagnant waters. It is deep yellowish brown and usually about a foot long. Its flesh is poor. See Plate of CARPS AND ALLIES.

TENCIN, täɴ′säɴ′, CLAUDINE ALEXANDRINE GUÉRIN DE (1681-1749). A French novelist, prominent in the literary society of the Regency. She was born at Grenoble, and was placed in the Convent of Montfleury as a novice, whence a sympathetic Lothario rescued her from seclusion. She next appeared at Paris as an unscrupulous friend of Cardinal Dubois (1714), gathering about her a crowd of admirers, among them Fonetnelle, Law, and the Regent. With the death of the Regent Orleans (1723) her influence waned. In 1726 she suffered a brief imprisonment in the Bastille because a desperate lover had killed himself in her house. Later her reputation revived; she became decorous and popular with the now also aging 'pets of the menagerie' of her youth, among them Duclos, Lamotte, Marivaux, Marmontel, Montesquieu. She wrote three novels, all mingling history with fiction: *Les mémoirs du comte de Comminges* (1735); *Le siège de Calais* (1739); and *Les malheurs de l'amour* (1747), the last a bit of psychic autobiography. The strength of all these tales lies in their scenes of dread and gloom, some of which were then unrivaled in French fiction. Her nearest literary analogue is Madame de Lafayette (q.v.). Tencin was mother, through one of her many illicit connections, of D'Alembert (q.v.) Her correspondence with her brother, Cardinal de Tencin (1680-1758) appeared in Paris in 1780, that with the Duke de Richelieu in 1806. Alleged *Mémoires secrets* were published by Barthélemy (*Grenoble*, 1790). Tencin's *Œuvres*, with those of Madame de Fontaines, were published by Garnier (Paris, 1864).

TEN COMMANDMENTS. See DECALOGUE.

TENDA, tĕn′dȧ, COL DI. A pass over the Maritime Alps in Italy near the French boundary, and 25 miles from the Mediterranean coast (Map: Italy, B 3). Its altitude is 6145 feet, and it carries the railroad from Cuneo to Ventimiglia. The carriage road from Cuneo to Nice passes here through a tunnel nearly two miles long and lighted by electricity.

TENDAI-SHU, tĕn-dī′sho͞o′ (Chin. *T'ien-tai Tsung*, name of a mountain in China where the founder of the sect studied). A sect of Japanese Buddhists, established toward the end of the eighth century by a Japanese priest named Dengyo Daishi. Like all Japanese sects, it is of the Northern School, and is based upon the *Saddharma Pundarika*, or 'Lotus of the Good Law.' Salvation lies in the perception of the original and absolute Buddha, of whom the historic Buddha is one manifestation. The means of salvation are meditation and wisdom. It has an exoteric teaching for the vulgar, while its esoteric doctrines are reserved for the monks, although the highest truths are recognized as transcending human comprehension. The sect is eclectic, and various Buddhas are worshiped in its temples. It completed the triumph of Buddhism in Japan by declaring that the Shinto deities are manifestations of Buddha. As it attempted in its teaching to reconcile contradictory doctrines, it gave rise to schism and became the mother of many sects. Its centre was on the mountain near Kyoto called Hiyei-zan. Its priests, though devoted by profession to meditation, became very warlike in the Middle Ages. Nobunaga (q.v.) in A.D. 1571 destroyed the monastery, and killed the inhabitants. The sect never regained its commanding position.

TENDENCY (from Lat. *tendens*, pres. part of *tendere*, to stretch, tend; connected with Gk. *τείνειν*, *teinein*, Skt. *tan*, to stretch, OHG. *dunni*, Ger. *Dünn*, AS. *þynne*, Eng. *thin*). A term in psycho-physics denoting the nervous disposition which underlies mental constitution. It may be termed 'psycho-physical tendency' if attention is to be directed to the trend of consciousness which is given by a peculiarity of organic structure, or 'mental tendency' if emphasis is to be laid on the fact that different minds are attracted by different sources of stimulation and persist in reacting differently to like stimuli.

Tendencies are either natural or acquired. (1) Natural tendencies are based on inheritance and are transmitted through the medium of the nervous system, which tends to discharge by preference in a certain direction. (2) Acquired tendencies are permanent impressions, 'sets' which are given the nervous system, especially while it is plastic. Such a tendency exists as a liability to discharge through certain channels which form lines of least resistance under stimulation. A habit started quite incidentally or even in the face of constitutional reluctance may become in time a distinctly 'ingrained' tendency toward a particular action or mode of thought. (See Mutual Constitution, Disposition, Memory, Temperament and Habit.) W. James speaks of 'feelings of tendency' when a meaning is adumbrated but not fully realized, in the state of expectant attention. See Fringe and Subconscious.

TENDER (from *tender*, OF., Fr. *tendre*, from Lat. *tendere*, to stretch, extend; connected with Gk. *τείνειν*, *teinein*, Skt. *tan*, Goth. *uf-þanjan*, AS. *þenian*, OHG. *denen*, *dennen*, Ger. *dehnen*, to stretch out). As a legal term, the formal offer to perform some legal obligation incumbent on the person tendering performance under such circumstances as to make no further act necessary from the party making the tender. The term is most frequently used with reference to the payment of money due, but it is not limited to that application. If the obligation is simply to pay money, all that the debtor is required to do is to plead that he duly tendered the money; and if he pay into court the sum formerly tendered, the other party must discontinue the action or proceed with it at his own risk. See Mortgage; Pledge.

In some States the rule that a tender must be made in lawful money has been relaxed and a tender made by a check or bill of exchange is good unless the debtor rejects the tender on the ground that negotiable paper is tendered instead of lawful money. The creditor may also dispense with the necessity of tender on the part of the debtor by preventing a tender. In many States there are statutory provisions permitting a debtor in case action is brought against him by the creditor, to pay the sum due into court, or to offer to permit the creditor to take judgment for the amount due, the effect being, as in case of tender, to stop the running of interest and to prevent the creditor from recovering further costs.

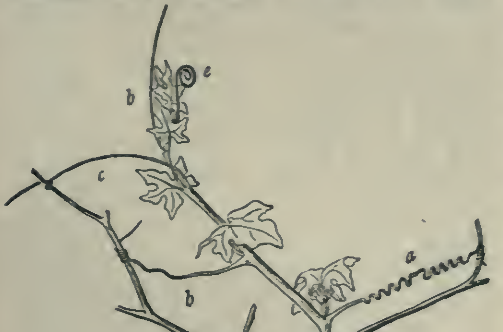
United States notes issued under act of Congress of 1862 are legal tender for all public and private dues except duties on imports and interest on the public debt. Those issued under act of July 14th, 1890, are legal tender in payment of public and private debts. Gold and silver certificates of the United States are legal tender under the same condition as gold and silver coinage respectively. Notes issued for circulation by national banks are legal tender in payment of all debts and dues, public or private, except duties due the United States on imports, and interest due on the public debt and in payment upon redemption of the national currency. They are generally not legal tender for any debt due any national banking association. See Legal Tender.

TENDON (from ML. *tendo*, tendon, from Lat. *tendere*, to stretch, extend). A term employed in anatomy to designate the structure of white fibrous tissue reaching from the end of a muscle to bone or some other structure which is to serve as a fixed attachment for it, or which it is intended to move. In accordance with their form, tendons have been divided into the three following varieties: (1) *Funicular*, or rope-like, as the long tendon of the biceps muscle of the arm; (2) *fascicular*, as the short tendon of that muscle, and as most tendons generally; and (3) *aponeurotic*, or tendinous expansions, sometimes of considerable extent, and serviceable in strengthening the walls of cavities, as, for example, the tendons of the abdominal muscles.

The tendons begin by separate fasciculi from the end of each muscular fibre, and they similarly terminate by separate fasciculi in distinct depressions in the bones besides being closely incorporated with the periosteum. Tendons, together with their sheaths, are subject to acute and chronic inflammations and to tumor formation. The ordinary acute form of inflammation known as *acute teno-synovitis* is usually brought along by injury such as a blow or by over-use. The chronic form of inflammation is usually tubercular, though a rheumatic diathesis sometimes occurs. The tumors usually observed in tendons are small fibres and cartilaginous enlargements. Such growths occasionally assume malignant character. When separation of a tendon occurs either by rupture or incision, if the ends of the divided tendon are not too widely separated, repair takes place by the deposition of new fibrous tissue, closely resembling true tendon tissue. This repair is usually complete at the end of three weeks.

TENDRIL (Fr. *tendrille*, from *tendre*, tender, from Lat. *tener*, delicate; connected with *tenuis*, Gk. *ταναός*, *tanaos*, Skt. *tanu*, OHG. *dunni*, Ger. *dünn*, AS. *þynne*, Eng. *thin*). A slender, usually cylindrical organ of higher plants used for climbing. As to their origin, tendrils may occupy the position of leaflets, or of leaves, normally subtended by branches, or of branches usually subtended by leaves. The last two sorts, however, are not always easily distinguished. Some tendrils are coiled when young, unrolling as they mature; others are merely bent, or straight, or variously folded. At maturity they are usually slightly hooked near the apex.

Structurally, tendrils contain vascular bundles, surrounded by a cortex of thin walled and somewhat elongated parenchyma cells, covered by a delicate epidermis. (See HISTOLOGY.) Physiologically, they are sensitive to friction, often remarkably. Sensitiveness is ordinarily greatest on the concave side of the curved tip, though some tendrils are more sensitive on the flanks and others equally sensitive on all sides. Tendrils of Cyclanthera under favorable conditions will respond to a stimulus in less than ten seconds, those of Passiflora in about 30 seconds, while those of some other plants may only respond after 30 to 90 minutes. The response consists in a curvature of the tip. This is first due to the shortening of cells on the concave side and the lengthening of those on the convex side. This temporary curvature is maintained by the accelerated growth of the convex side, so that the part of the tip beyond the object with which it has come into contact is coiled around the support, provided this be of sufficiently small diameter. If large and rough the tip may be appressed to the surface, growing closely into the irregularities, and so adhere more or less firmly in that way. The petioles of some leaves, e.g. Clematis, show a similar but less acute sensitiveness to friction, making one turn about a support. Uncaria has short conical hooks which are stimulated by contact and friction to grow in such a way that they enlarge greatly and curve about a support. After a tendril has laid hold of an appropriate support the portion between the support and the axis of the plant is brought under strain, to which it responds by unequal growth on one side. By this means it is thrown into a spiral with one or more points of reversal (a mechanical necessity when a once straight cylindrical body elongates on one side and so coils up). The coils develop mechanical tissues, and the most perfect tendril thus becomes a strong, uniformly coiled, elastic spiral spring which supports the plant. See LIANAS.



TENDRILS OF BRYONY.

a, a tendril that has attached itself and is coiling, with reversal of coils in centre; *b*, a recently attached tendril, the unequal growth just beginning; *c*, one just attached; *d*, one just straightened out; *e*, one still coiled from the bud.

TENEBRÆ (Lat., darkness). A service in the Roman Catholic Church; the matins of Thursday, Friday, and Saturday in Holy Week, generally sung on the preceding evening. The name is taken from the opening of the Responsorium following the fifth lesson on Good Friday, *Tenebræ factæ sunt.* The service consists of sixteen Psalms and a Canticle from the Old Testament, sung with their proper Antiphons in fourteen divisions, nine Lessons, nine Responsories, the Canticle *Benedictus*, and the *Miserere.* Most of the service is in unisonous plain chant. At the conclusion of each Psalm and Antiphon one of the fifteen candles in the triangular candlestick used for this special service is extinguished with ceremony. During the singing of the *Benedictus* the six altar candles are put out one by one. The only light remaining is the candle at the apex of the candlestick. This is removed and carried behind the altar. After the singing of the Antiphon, *Christus factus est pro nobis ovediens usque ad mortem*, a silence follows, during which the *Paternoster* is whispered in secret; after the *Miserere*, a prayer is made and the candle is brought from behind the altar. Then, according to the rubric, "all rise and depart in silence."

TEN′EDOS. An island in the Ægean Sea, situated five miles from the northwestern coast of Asia Minor, near the entrance of the Dardanelles (Map: Greece, G 2). Area, 16 square miles. The only town which bears the name of the island is inclosed by walls and has an old castle and remains of the storehouses erected by Justinian. The surface of the island is uneven and rocky, but the soil is fairly fertile. Wine is the most important product, about 5,000,000 gallons being annually exported. Population, about 4000, one-third of whom are Mohammedans. Originally settled by Æolians, Tenedos was successively under the control of Persia, Athens, Rome, the Byzantine emperors, and Venice. Since 1322 it has been a Turkish possession, and is included in the Archipelago Vilayet.

TENEMENT (Lat. *tenementum*, a holding, fief, from *tenere*, to hold, retain). In the strict legal sense, anything of a permanent nature, corporeal or incorporeal, which may be held or be an object of tenure (q.v.). The term is now used in a very broad sense and denotes any estate or interest in lands. The word is also popularly used to denote a rented house, especially one which is occupied by several families. See REAL PROPERTY.

TENEMENT HOUSE PROBLEM. The problem of the making possible a healthful human existence under the conditions of dense population in our modern cities. With the growth of great cities, a double movement of population takes place. The well-to-do are driven from former residential districts by the encroachments of business, while working people crowd into their vacated houses. Rear tenements are built behind the old houses; new structures are put up solely for use as tenements; and the whole process is left in the hands of private builders and landlords, ill-regulated by the municipality, until its two most obvious evils, the danger from epidemics and the danger from fire, force themselves upon public attention.

The fundamental evil of the tenement is crowding under unsanitary conditions. Houses built for one family cannot be adapted to hold four or more, sanitary conveniences become increasingly inadequate, needed repairs are not made, the tenants deteriorate, and the slum is formed. A district built up fully with new tenements and more crowded than the slum may be less degraded, but is hardly more wholesome. A high death-rate, especially among infants, is a normal characteristic of tenement districts. In New York in 1894 the general death-rate for the city was 22.75, but it was as high as 33 in some crowded wards. Jewish quarters, densely populated as they are, are exceptional in usually having a death-rate below that for the whole city. In certain rear tenements in New York the death-rate for children under five years has been at times over 200 per 1000.

The personal and social evils of tenement life are more far-reaching than the physical. See Housing Problem.

A first step in reform is legislation compelling the destruction or renovation of existing dwellings that are unsanitary, but it is equally important to provide for rehousing the displaced population, and to see that new tenements are properly built. The British act of 1890 permits municipal condemnation of unsanitary areas, but requires that all persons displaced shall be rehoused on or near the same site. Ordinary laborers must live near their work, or in the central area of the city, and it is thought a mistake to build in such areas model tenements at a cost requiring rents that only the skilled artisan can pay. To house the artisan in the outer belts, the clerk and similarly paid workers in the suburbs, and to provide quick and cheap transportation, is the effective mode of attacking the housing problem. Such a process is necessarily slow. So long as old houses stand, and new ones are put up for private profit, a good sanitary and building code is essential, but with it should be provided, as has not usually been done in American cities, a proper force for inspection and enforcement. Private initiative has proved that model tenements can be commercially successful in housing either artisans or more poorly paid laborers. As the more obvious evils of over-crowding, malconstruction, and insanitation are corrected, the purely social aspects of the problem are attacked more and more directly, both by the municipality itself and by private philanthropy. In Great Britain housing improvements on a large scale have been undertaken by the municipalities. Private companies also have been active. The Housing of the Working Classes Act (1890), consolidating and improving a series of laws reaching back to 1851, permits cities to condemn and acquire economically areas adjudged unsanitary, and to erect and manage new dwellings on the premises. Under this act London spent $1,400,000 in clearing 15 acres of one of its worst slums in Bethnal Green, laid out the area attractively, and rehoused upon the same site practically all the 5700 people displaced. The County Council later undertook other schemes involving the housing of 25,000 persons, and in accordance with the amendment of 1900 began to build workmen's cottages outside the county limits. Several large private foundations, such as the Peabody Fund, have built and successfully run model tenements on a large scale.

In Continental Europe construction of tenements by the city is less common than in England, but general sanitary reform has been very marked. In Berlin, where over 99 per cent. of the population live in apartments or tenements, the chief activity centres in efficient sanitary measures and the removal of congestion through rapid transit and supervision of the suburbs. In many German towns, and in Belgium, Holland, Scandinavia, and France, municipal effort has gone along similar lines, while many model tenements have been built by private societies. In Paris sanitary conditions are carefully supervised, and questionable tenements are in the hands of a special commission.

Conditions differ widely in the large cities of the United States. Most have slum districts; not many, as yet, have developed a serious tenement house problem. Chicago's rapid and ill-regulated growth has given her several deplorable areas, with a great number of old, neglected and unsanitary houses. Jersey City has some of the worst tenement districts in the country. In Boston conditions are similar to those of New York, where the tenement problem has long been pressing, and, owing to the confined land space of Manhattan Island, is unique in difficulty. The Board of Health was roused to criticise housing conditions as early as 1834, and after 1843, when the Association for Improving the Condition of the Poor was founded, the matter was frequently brought to public notice. A legislative inquiry in 1856 and an investigation by the Council of Hygiene in 1864 led to the first tenement-house ordinance in 1867. New York has long had a model sanitary code, but provision for enforcement has been wholly insufficient for this, as with its tenement laws. Up to 1879, the date of the next revival of public interest, tenement dwellings in New York were modified private houses or rear tenements built behind such, or buildings put up solely for tenement purposes, covering 75 to 90 per cent. of the lot's area. In 1879 appeared the typical New York tenement, the 'double-decker' or 'dumb-bell.' Built five stories high on a lot 25 feet wide, it covers from 86 to 90 per cent. of the lot's depth, and 75 per cent. of its area, with 14 rooms, for four families, on each floor. Its typical feature is the laterally indented air shaft, usually 28 inches wide in the widest part, or 56 inches when two similar houses are together. All rooms except the four outside ones open upon this shaft, which gives little daylight and no ventilation below the fourth story, is the source of greatest danger during fires, and has been described, hygienically, as a 'culture tube on a large scale.' Under such conditions perhaps a million New Yorkers live.

The commissions of 1884 and 1894 improved the tenement laws in various points, but little progress was made in enforcement. Model tenements, beginning with the 'Riverside' dwellings in Brooklyn, erected by Alfred T. White in 1876, have been built in many places in New York City, notably by the City and Suburban Homes Company (founded 1896). These undertakings have been commercially successful, paying dividends of 4 to 7 per cent. No American city has followed the English policy of building tenements on its own account, but the plan of condemning property for small parks has found favor. New York spends at least $1,000,000 yearly in this way. It thus abolished its worst slum, at Mulberry Bend, and—one example among several—

in 1903 it opened 2½ acres between Hester and Division streets, with playgrounds and public conveniences in the heart of one of the most crowded areas in the world. The results of the work done by the Tenement House Commission of 1900 have been substantial. Under the new law, new tenements may not cover more than 70 per cent. of the lot's area, and discretionary power to mitigate this restriction has been taken from the Building Department. The old form of air shaft is no longer legal in new tenements, open courts being required instead. Encouragement is given to tenement building on wider units than the 25-foot lot; provisions for sanitation and for protection against fire are improved, and, above all, a special Tenement House Department has been created to enforce the law concerning old houses as well as new. New York's transit question is yet far from solved, but progress is making. Tremendous as the city's tenement problem is, the outlook for the near future is encouraging.

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TENERANI, tā′nā-rä′nē, Pietro (1789-1869). An Italian sculptor, born at Torano, near Carrara. He was a pupil of Canova and later of Thorwaldsen, to whom he became a favorite assistant. He resided almost altogether at Rome, was professor in the Academy of San Luca, and held the post of director of all the museums and galleries of that city. His works are fair and soft in form, and smooth in execution. His "Psyche and Pandora's Box," in the Palazzo Lenzoni, Florence; a large relief of the "Deposition from the Cross," in the Lateran; an "Angel of the Resurrection," in Santa Maria sopra Minerva; and the tomb of Pius VIII. in Saint Peter's are among the best of his sculptures. Other specimens are to be found in many Italian churches and cemeteries. He executed a statue of Bolivar for Colombia, South America.

TEN′ERIFFE′ (Sp. *Tenerife*). The largest of the Canary Islands (q.v.), situated a little west of the centre of the group, between the islands of Palma and Gran Canaria (Map: Spain, F 5). Area, 782 square miles. It consists of a nearly circular main portion from which a peninsula projects toward the northeast. The latter consists of ancient, much eroded, and forest-covered mountains, while the main portion rises into the magnificent Peak of Teneriffe or Pico de Teyde, a dormant volcano 12,192 feet high. The base of this enormous cone consists of pasture land interspersed with forests of chestnut and oak, but the upper slopes, which are steep and difficult of ascent, are covered with volcanic scoriæ, while the summit is capped with snow in winter. The last serious eruption of the volcano occurred in 1704. The climate is mild and healthful, and dates, cocoanuts, and other tropical and northern fruits are cultivated, as well as grain, cotton, sugar, and grapes. Population, in 1887, 109,417; in 1900, 137,302. The capital of the island, as well as of the whole archipelago, is Santa Cruz de Tenerife (q.v.).

TENES′MUS (Neo-Lat., from Lat. *tenesmos*, from Gk. *τεινεσμός*, *teinesmos*, a straining at stool, from *τείνειν*, *teinein*, to stretch, strain). Pain referred to the rectum or bladder, due to the spasmodic contraction of the sphincter ani or sphincter vesicæ, and associated with an unsuccessful desire to evacuate the bowels or bladder. Rectal tenesmus is a constant symptom of dysentery (q.v.), and may accompany hemorrhoids, fissure, fistula, or malignant disease of the lower part of the rectum. Causes of vesical tenesmus are chiefly cystitis (q.v.) and pressure on the bladder. Treatment will depend on the disease of which tenesmus is a symptom, but cold or hot applications, enemas containing laudanum, or suppositories of opium, cocaine, belladonna, or hyoscyamus will relieve the pain.

TENIERS, te-nērz′ *Fr. pron.* te-nyä′, David, the Elder (1582-1649). A Flemish genre and landscape painter, born at Antwerp, pupil of his brother Julian (1572-1615). He studied under Rubens and in Rome was influenced by Elsheimer, in whose manner he painted landscapes with mythological figures, eight of which are preserved in the Vienna Museum. Afterwards he turned to fantastic subjects and rustic genre scenes in the prevailing taste of the times, such as the "Temptation of Saint Anthony" (Berlin Museum), "Peasants Carousing in Front of a Tavern" (Darmstadt Gallery), and "A Dutch Kitchen" (Metropolitan Museum, New York).

TENIERS, David, the Younger (1610-90). The principal genre painter of the Flemish school, born at Antwerp, son and pupil of the preceding. Before he was twenty his work bore the stamp of maturity, and in 1633 he entered the guild as master. His early manner and choice of subjects is represented by such examples as "The Prodigal Son" (Pinakothek, Munich), "The Five Senses" (Brussels Museum), "A Merry Repast" (Berlin Museum), and "The Misers" (1634, National Gallery, London). The delineations from peasant life, which henceforth constituted the keynote of his productions, showed the influence of Adrian Brouwer. Of more than 100 such pictures which Teniers painted, some of the most characteristic are: the "Interior of Village Inn," "Flemish Tap-Room" (1643); "Peasants' Dance" (1645); "The Smokers" (1650, all in the Pinakothek, Munich); "Hour of Rest" (Amsterdam), "Smoking Club" (Dresden), and "Backgammon Players" (1641, Berlin). Brouwer's spirit also prevails in subjects like "The Dentist" and "The Barber Shop" (both in Cassel), "The Village Doctor" (Brussels), and "The Bagpipe-Player" (Buckingham Palace, London); also in various treatments of "The Alchemist" (The Hague and Dresden), and of the "Temptation of Saint Anthony" (Brussels, Dresden, and—dated 1647—Berlin).

In 1637 Teniers married Anna Breughel, the daughter of Jan Breughel and ward of Rubens, who was one of the marriage witnesses. Soon after the death of Brouwer in 1638 the influence of Rubens became apparent in Teniers's coloring, which changed from a general brownish tint to a warm golden tone with rich and luminous local colors, and in the dramatic life animating his large compositions, extremely rich in figures. This phase is well exemplified by a "Peasants' Dance" (1640, Berlin), and the "Flemish Kirmess" (1641, Dresden, Vienna, Madrid, 1652, Brussels and Amsterdam). Especially remarkable for the number of figures is "The Great Fair in Florence" (Munich), and interesting portrait groups are represented in "The Artist and His Family" (c.1645, Berlin), and "Teniers in Front of His Castle Near Perck" (National Gallery, London). In 1642 he was commissioned to paint for Saint George's Guild an "Archers' Festival" (now in the Hermitage, Saint Petersburg), containing 45 characteristic portrait figures. A few scenes from military life are depicted in the splendid "Guard Room" (1641, Amsterdam), "Robbers Plundering a Village" (1648, Vienna), and "Relief of Valenciennes by the Spaniards" (Antwerp). Among several biblical episodes, the most attractive is "Abraham's Sacrifice" (1653, Vienna).

After Teniers had, about 1643, become lord of the manor of Dry Toren (Three Towers), near Brussels, he seems to have been more than ever absorbed in rural life and work; witness such productions of his brush as "The Sausage-Maker," "Cow-Stable," and "Goat-House" (all in Vienna), the last two especially noteworthy for their fine chiaroscuro. In 1650 the artist was appointed Court painter to Archduke Leopold William, and removed to Brussels, where he superintended that art-loving Prince's picture gallery and depicted notable events in his life and that of his consort, Isabella. The most interesting of these pictures is "The Shooting Match at Brussels, 1652" (Vienna), containing more than 470 figures. As director of the gallery he painted a series of interiors, faithfully representing its contents to the minutest detail. Of these there are four in Munich, and one each in Vienna (1656), Madrid, and Brussels (1657), the last being characteristic of the delicate silvery tone which prevailed in the painter's coloring for about a decade from 1650 on. Among the works of his later period are rural scenes and landscapes, besides his inimitable parodistic monkey-pictures, notably "Monkeys in a Tavern Smoking," "Repast in the Kitchen," and "Monkey Concert," all in the Pinakothek, Munich. Unique among his works is the "Sacrament of the Miracle of Saint Gudule" (Berlin), painted on white marble, the grain of which is visible through the colors. The Metropolitan Museum, New York, possesses a "Marriage Festival" and a "Temptation of Saint Anthony."

Teniers left about 800 paintings, which in searching observation of nature, wondrous harmony of color, and their whole artistic combination entitle their author to undisputed supremacy in his sphere. Consult: Rosenberg, *Teniers der Jüngere* (Leipzig, 1895); Wurzbach, in Dohme, *Kunst und Künstler*, i. (ib., 1877).

TENIM′BER. A group of islands in the Malay Archipelago. See TIMORLAUT.

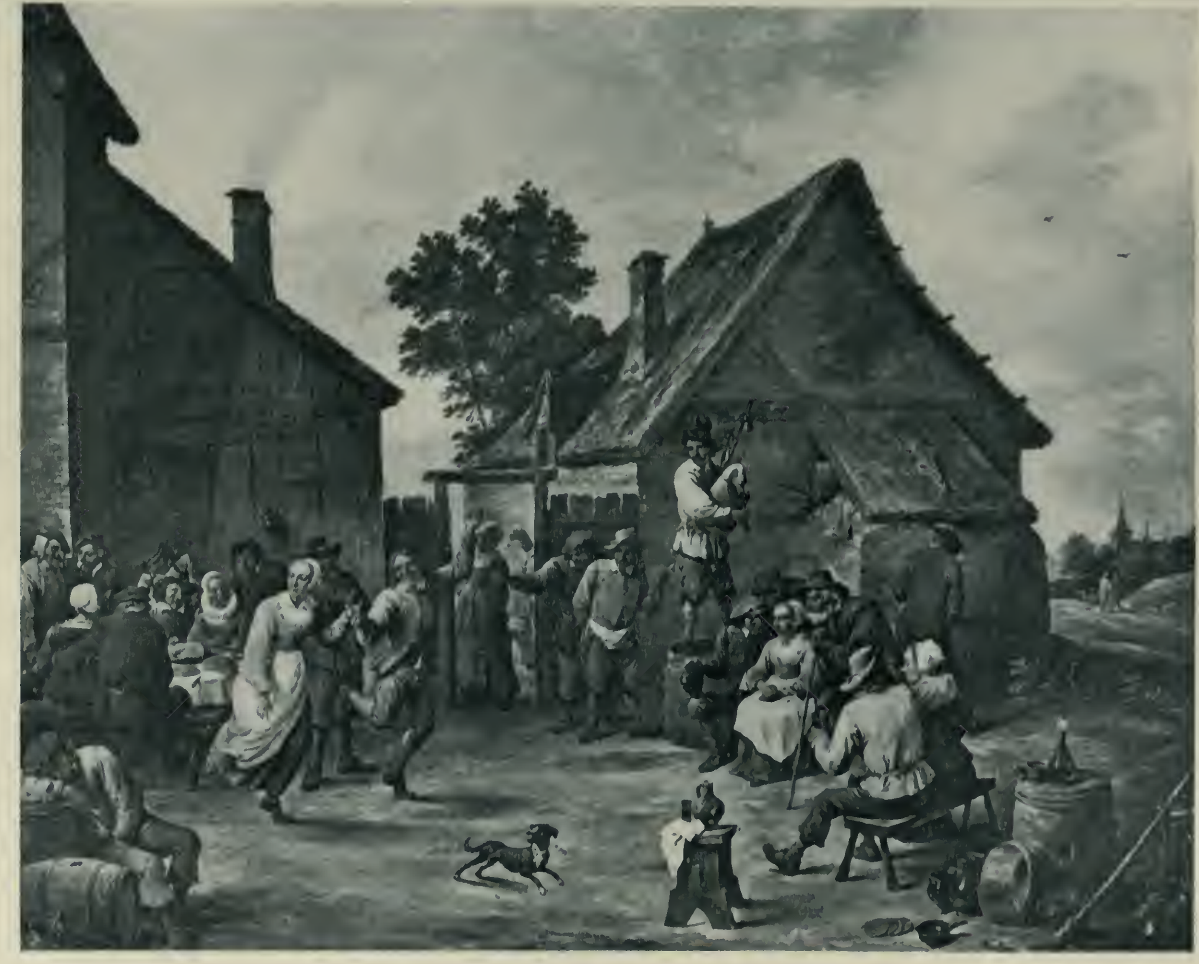
TENINO, tȧ-nē′nō. A tribe of Shahaptian stock (q.v.) formerly claiming most of the Deschutes River country of northern Oregon, and now gathered with other tribes upon Warmspring reservation in the same region. They originally lived farther to the northeast, upon the Columbia. In 1855 they made their first treaty with the Government, and agreed to come upon their present reservation. Their language is also that of several smaller tribes formerly occupying both banks of the Columbia.

TEN KATE. See KATE.

TEN′NANT, WILLIAM (1784-1848). A Scottish poet. He was born at Anstruther, Fifeshire, Scotland. A cripple almost from his birth, he naturally turned to study. In 1799 he entered the University of Saint Andrews, which he left after two years to become clerk to his brother, a corn-agent. The business proving unsuccessful, he was glad to accept in 1813 the situation of parish schoolmaster at Dunino, a small village about four miles from Saint Andrews, with a salary of £40 a year. In 1812 he had published his *Anster Fair*, a poem of much sprightliness and humor. The piece gradually made its way, aided by a highly laudatory notice in the *Edinburgh Review*, from the pen of the then omnipotent Jeffrey. In 1816 Tennant became teacher of a school at Lasswade, near Edinburgh, whence three years afterwards he was transferred to the Dollar Academy in Clackmannanshire. His attainments as a linguist were by this time extraordinary. In 1834 he was appointed professor of Oriental languages in the University of Saint Andrews. In connection with his new duties, he published a *Syriac and Chaldee Grammar* (1840). He died at Devon Grove, October 14, 1848. Besides other miscellanies in verse, Tennant published: *The Thane of Fife, a Poem* (1822); *Cardinal Beaton, a Tragedy* (1823); and *John Baliol, a Drama* (1825). None of these later productions increased the literary reputation which his first work had won for him. Consult Conolly, *Life of William Tennant* (Edinburgh, 1861).

TEN′NENT, GILBERT (1703-64). A Presbyterian minister. He was born in County Armagh, Ireland; came to America with his father, William Tennent, in 1718, and aided him as a teacher in the 'Long College.' He studied medicine and theology; was ordained pastor of a Presbyterian church in New Brunswick, N. J., in 1726, continuing the connection until 1743, though traveling and preaching with Whitefield in New England for several months; founded and became pastor of a church in Philadelphia, with which he remained connected until his death. In 1753 he visited England with President Davies to obtain aid for the College of New Jersey and raised £1500. He published many sermons.

TENNENT, Sir JAMES EMERSON (1804-69). A British traveler, politician, and author, born at Belfast, Ireland. He traveled through the Levant and Greece in 1824-25, and was a member of Parliament from 1832 to 1845. In 1842 he secured the passage of the bill granting copyrights to designers. He was secretary to the India Board (1841-43); civil secretary to the Ceylon colonial Government (1845-50); and



DAVID TENIERS—THE RUSTIC WEDDING

FROM THE PAINTING IN THE PINAKOTHEK, MUNICH

shortly after his return to England, again entered Parliament (1852). There he was successively secretary for the Poor Law Board (1852), and a joint secretary of the Board of Trade (1852-67). After resigning the latter post, he was made a baronet. Under his original name of Emerson, to which he had added his wife's name, Tennent, Sir James published a number of books, including: *A Picture of Greece in 1825* (1826); *Christianity in Ceylon* (1850); *Ceylon: An Account of the Island* (2 vols., 1859); *Sketches of the Natural History of Ceylon* (1861); and *The Story of the Guns* (1865).

TENNESSEE′. A South Central State of the United States, popularly called 'The Volunteer State.' It lies between latitudes 35° and 36° 36′ N., and between longitudes 81° 37′ and 90° 28′ W., and is bounded on the north by Kentucky and Virginia, on the east by North Carolina, on the south by Georgia, Alabama, and Mississippi, and on the west by Arkansas and Missouri. The western boundary is formed by the Mississippi River, the eastern by the crest of the Unaka Mountains, while the southern boundary is a straight line. Tennessee has an extreme length from east to west of 432 miles, and an extreme breadth of 109 miles. Its area is 42,050 square miles, giving it the thirty-first rank in size among the States.

TOPOGRAPHY. The surface features fall into eight natural and well-marked topographical regions. The easternmost is the Unaka or Great Smoky Mountains, forming a belt of bold ridges. The average elevation of the main ridge is nearly 5000 feet, but a number of peaks within the State rise above 6000 feet, and Mount Guyot has an altitude of 6636 feet. Along the western base of the mountains stretches the Eastern Valley of the Tennessee, forming a succession of almost unbroken parallel minor ridges and valleys with an average elevation of 1000 feet. The valley is bounded on the west by the abrupt and rugged escarpment of the Cumberland Plateau. This is a nearly level table-land, rising about 1000 feet above the East Tennessee Valley, and falling on the western edge in a somewhat less rugged slope to a lower plateau known as the Highland Rim. This occupies the central portion of the State as far west as the north course of the Tennessee River, with an altitude of nearly 1000 feet. As its name implies, it forms a rim encircling the Central Basin, a large oval depression lying several hundred feet below the surrounding highland. The Highland Rim, though generally level, is cut by deep river valleys, and it is separated by the narrow Western Valley of the Tennessee from the Western Plateau Slope. The latter slopes gradually toward the Mississippi River, near which it ends abruptly in a line of bluffs bounding the Mississippi Flood Plain, a low and almost unreclaimed region covered by large lagoons and heavily forested cypress swamps.

HYDROGRAPHY. Tennessee belongs wholly to the Mississippi Valley, and its western quarter is drained directly into the Mississippi through a number of streams, the largest of which are the Obion and the Big Hatchie. The remainder of the State is drained by the two great tributaries of the Ohio, the Cumberland and the Tennessee. Both enter the State across the northern boundary in the east, and both leave it over the northern boundary in the west after making a large semicircular curve in which the Tennessee passes beyond the southern State limits. Both of them are large, navigable waterways, and the Tennessee has, besides, a number of navigable headstreams within the State, such as the Clinch, the French Broad, the Holston, and the Hiawassee. There are no lakes except the lagoons and cut-offs in the Mississippi bottomland. The largest of the lagoons is Reelfoot Lake, 25 miles long and 5 miles broad.

CLIMATE. The climate is in general mild, equable, and, except in the western lowlands, remarkably healthful and pleasant. The mean temperature varies but slightly in the different sections of the State, being scarcely two degrees lower in the east than in the west, excepting, of course, on the high mountains in the extreme east. For July the mean temperature is 77°, and for January 38°. The maximum may reach 104°, but the minimum is seldom lower than 10°, though it occasionally falls below zero in the mountains. The rainfall is also nearly equally distributed both as to seasons and localities, being somewhat heavier in the spring than in the autumn and heavier in the middle section than in the east and west. The normal average for the eastern section is 47 inches, for the middle section 52 inches, and for the west 50 inches, while the highest and lowest normals are respectively 61 and 42 inches.

SOIL. There is great diversity in the soils of the State, depending on the character of the rock formations, whose outcrops are coincident with the topographical regions. The alluvium of the Mississippi bottoms is the richest soil. It is followed beyond the bluffs by a brown loam becoming sandy and barren toward the Tennessee River. The Highland Rim has a siliceous soil of indifferent quality, but the Central Basin has a very fertile calcareous soil. The Cumberland Plateau is sandy and unproductive, but good magnesian limestone soil again occurs in the East Tennessee Valley.

FLORA. Numerous species of oak, as well as beech, hickory, walnut, locust, the tulip tree (*Liriodendron tulipifera*), and persimmon are common throughout the State. On the mountains the pine, hemlock, sugar maple, and ash are abundant, though pine also grows in the sandy belt of the western plateau. Red cedar is especially common in the Central Basin, and in the swampy lowlands of the west are found the cypress, larch, swamp cedar, and papaw. Tennessee still has a very large forest area, chiefly distributed over the extreme eastern and western sections and in the southwestern and northeastern parts of the middle section.

For FAUNA see under the UNITED STATES.

GEOLOGY AND MINERALS. The outcrops of the geological formations of Tennessee correspond with the topographical regions described above. In the western three-fourths of the State the strata lie nearly horizontal and undisturbed, and the Central Basin and Cumberland Plateau are formed by the wearing away in the one case of the overlying, and in the second case of the surrounding portions of the strata. East of the Cumberland Plateau the strata are upturned so that their exposed edges form the ridges of the East Tennessee Valley and the mountain ranges. The great eastern Archæan area comes but slightly within the State limits in the extreme east. The Unaka Mountains are mostly of the Ocoee formation of the Cambrian system. The minor ridges and depressions of the East Tennessee Valley consist of successive outcrops of Potsdam sandstone of the Cambrian, and Trenton limestone, shales, and dolomite belonging to the Lower Silurian age. The Lower Silurian strata pass under the Cumberland Plateau and Highland Rim, and reappear as the surface rock of the Central Basin, and again in the bottom of the Western Tennessee Valley. The plateau strata are Carboniferous, the Highland Rim being Sub-Carboniferous, while the Cumberland Plateau belongs to the Upper Carboniferous system. West of the Western Tennessee the Paleozoic strata disappear, and on their edges the Cretaceous and Tertiary strata rest unconformably. The Cretaceous outcrop is narrow, the greater part of the Western Plateau Slope being Tertiary. Between the bluffs and the Mississippi River the surface is of recent alluvial formation.

There are two great iron belts in the State, one occupying the western part of the Highland Rim, and the other stretching along the western slope of the Unaka Mountains. The ore is chiefly limonite, with some magnetite in the northeast. Copper occurs in the metamorphic rocks in the extreme southeastern corner of the State, and zinc and lead are found in various parts of the East Tennessee Valley. The coal measures of the Cumberland Plateau contain several seams of bituminous coal of workable thickness. Other minerals of importance are hydraulic limestone and marble of a good quality, as well as other building stones derived chiefly from the Silurian strata.

Mining. Tennessee is beginning to acquire considerable importance as a mining State. Coal is excavated in the mountain counties west of the Upper Tennessee River. For several years prior to 1899 the annual value of the coal output was about $2,300,000; subsequently it rose until in 1901 it was valued at $4,067,381, the amount being 3,633,290 short tons. Over 9000 men are employed. There were 404,017 short tons of coke manufactured in that year. The iron ore mined in 1901, 789,494 long tons, was an increase over former years and made the State sixth in rank. Of the total amount, 474,545 tons was brown hematite. The mining of phosphate rock began in 1894 and the output of 1901 was worth $1,192,090, which was less than in the previous year. The marble quarried in the State each year is usually worth between $300,000 and $400,000; in 1901, however, the amount rose to $494,637. The value of limestone quarried for that year was $330,927, a sum larger than usual. Clays found in the State are extensively utilized in the manufacture of brick and tile.

Agriculture. The State has a great diversity of physical conditions with a corresponding variation of soil and crops. The river valleys are generally fertile. The region known as the Central Basin contains a limestone soil of great fertility. In 1900 20,342,058 acres were included in farms, a little over half of this area being improved. While the farm area was but little greater in 1850 than in 1900, the improved area had almost doubled. The average size of farms decreased meanwhile from 261 acres to 90.6 acres. In 1900 12.6 per cent. of the farms were rented for cash, and 27.9 per cent. share rent, the latter having made a large gain during the decade ending with that year. Over one-seventh of the farms are operated by negroes, but only 22.4 per cent. of the negro farmers own their farms.

By far the largest and most valuable crop is corn, the acreage of which increased very considerably in the decade 1890-1900. Wheat is also an important cereal and much more than regained in the decade 1890-1900 what it had lost in the preceding decade. The cultivation of oats, the only other important cereal, has decreased. Cotton is one of the leading crops in the southwest corner of the State, and it is of much importance also in some of the northern counties. The area in hay and forage has increased more than threefold since 1880. Dry peas and sorghum cane are noteworthy products, as are also Irish and sweet potatoes. Peanuts are grown in large quantities in the Tennessee Valley. The climate is favorable to fruit culture, and in 1900 there were over 11,700,000 fruit trees, of which 7,700,000 were apple trees. There was a large increase in the number of all varieties of fruit trees in the decade ending with 1900. Of the 12,944 acres reported in small fruits in 1899, 11,548 acres were in strawberries. Watermelons and various vegetables are extensively raised. The following table is self-explanatory:

CROP	1900, acres	1890, acres
Corn	3,374,574	2,791,324
Wheat	1,426,112	877,361
Oats	235,313	588,138
Rye	16,556	26.443
Hay and forage	645,617	571,553
Cotton	623,137	747,471
Tobacco	71,849	51.471
Peanuts	19,534	16,244
Dry peas	82,841	....
Potatoes	27,103	36,992
Sweet potatoes	23,174	23,746
Sorghum cane	31,364	40,303

Stock-Raising. The number of cattle increased between 1870 and 1890, but decreased in the following decade. Both horses and mules increased in each decade from 1870 to 1900. Sheep, on the contrary, fell off in numbers. In 1899 $1,510,183 was received from sales of dairy products. The following table gives the number of stock for two census years:

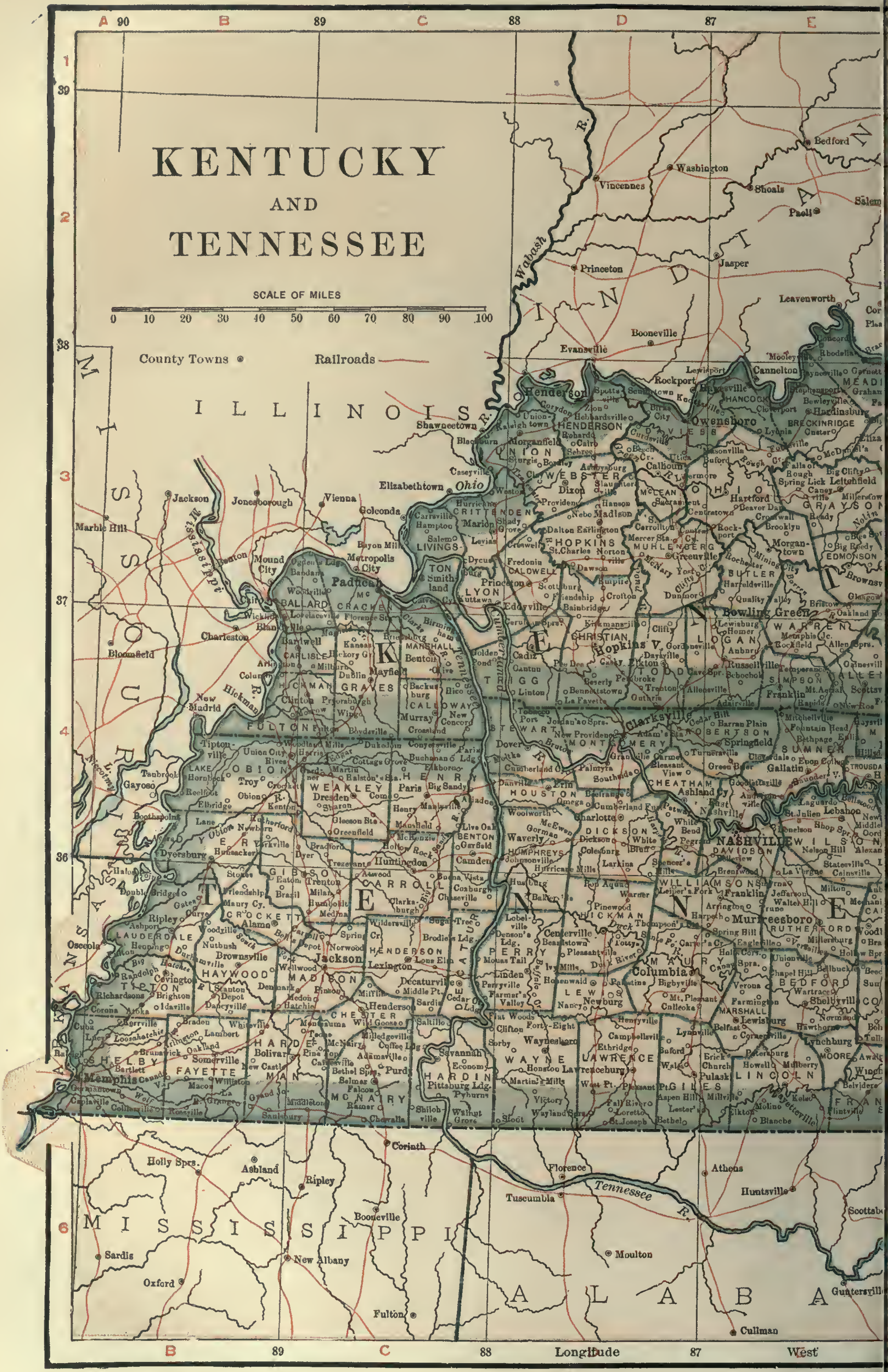
	1900	1890
Dairy cows	321,676	345.311
Other cattle	590,507	620,028
Horses	352,388	311,842
Mules and asses	262,509	203,639
Sheep	307,804	540,996
Swine	1,976,984	1,922,912

Forests and Forest Products. Tennessee stood first among Southern States in 1900 in the value of its lumber products. It is estimated that the State contains 27,300 square miles of wooded area. Increased activity in the lumber industry began after 1880. The value of products more than doubled between 1890 and 1900. The value of planing mill products decreased during the same period.

Manufactures. Since 1880 the manufacturing industry has grown rapidly, the value of products increasing 95.2 per cent. in 1880-90, and 48.5 per cent. in the subsequent decade, the value in 1900 being $107,437,879. There were in

AREA AND POPULATION OF TENNESSEE BY COUNTIES.

County.	Map Index.	County Seat.	Area in square miles.	Population.	
				1890.	1900.
Anderson	G 4	Clinton	350	15,128	17,634
Bedford	E 5	Shelbyville	489	24,739	23,845
Benton	C 4	Camden	430	11,230	11.888
Bledsoe	F 5	Pikeville	400	6,134	6,626
Blount	H 5	Maryville	552	17,589	19,206
Bradley	G 5	Cleveland	325	13,607	15.759
Campbell	G 4	Jacksboro	477	13,486	17,317
Cannon	E 5	Woodbury	325	12,197	12,121
Carroll	C 5	Huntingdon	624	23.630	24.250
Carter	J 4	Elizabethton	345	13,389	16,688
Cheatham	C 4	Ashland City	347	8,845	10.112
Chester	C 5	Henderson	300	9,069	9.896
Claiborne	H 4	Tazewell	464	15,103	20,696
Clay	F 4	Celina	260	7.260	8,421
Cocke	H 5	Newport	420	16,523	19,153
Coffee	E 5	Manchester	442	13,827	15,574
Crockett	B 5	Alamo	267	15,146	15.867
Cumberland	F 4	Crossville	548	5.376	8,311
Davidson	E 4	Nashville	520	108,174	122,815
Decatur	C 5	Decaturville	287	8,995	10,439
Dekalb	F 5	Smithville	322	15,650	16,460
Dickson	D 4	Charlotte	600	13,645	18,635
Dyer	B 5	Dyersburg	500	19.878	23.776
Fayette	B 5	Somerville	618	28,878	29.701
Fentress	F 4	Jamestown	445	5,226	6,106
Franklin	E 5	Winchester	610	18,929	20,392
Gibson	C 5	Trenton	625	35,859	39.408
Giles	D 5	Pulaski	605	34.957	33,035
Grainger	H 4	Rutledge	309	13.196	15,512
Greene	B 5	Greenville	615	26,614	30,596
Grundy	F 5	Altamont	375	6.345	7,802
Hamblen	H 4	Morristown	165	11,418	12,728
Hamilton	F 5	Chattanooga	427	53,482	61.695
Hancock	H 4	Sneedville	208	10,342	11.147
Hardeman	B 5	Bolivar	655	21,029	22,976
Hardin	C 5	Savannah	587	17.698	19,246
Hawkins	H 4	Rogersville	490	22,246	24.267
Haywood	B 5	Brownsville	520	23,558	25.189
Henderson	C 5	Lexington	515	16,336	18.117
Henry	C 4	Paris	625	21,070	24.208
Hickman	D 5	Centerville	655	14.499	16,367
Houston	D 4	Erin	200	5,390	6.476
Humphreys	C 4	Waverly	435	11,720	13,398
Jackson.	F 4	Gainesboro	325	13,325	15,039
James	F 5	Ooltewah	160	4,903	5.407
Jefferson	H 4	Dandridge	310	16,478	18,590
Johnson	J 4	Mountain City	290	8,858	10,589



KENTUCKY
AND
TENNESSEE

SCALE OF MILES

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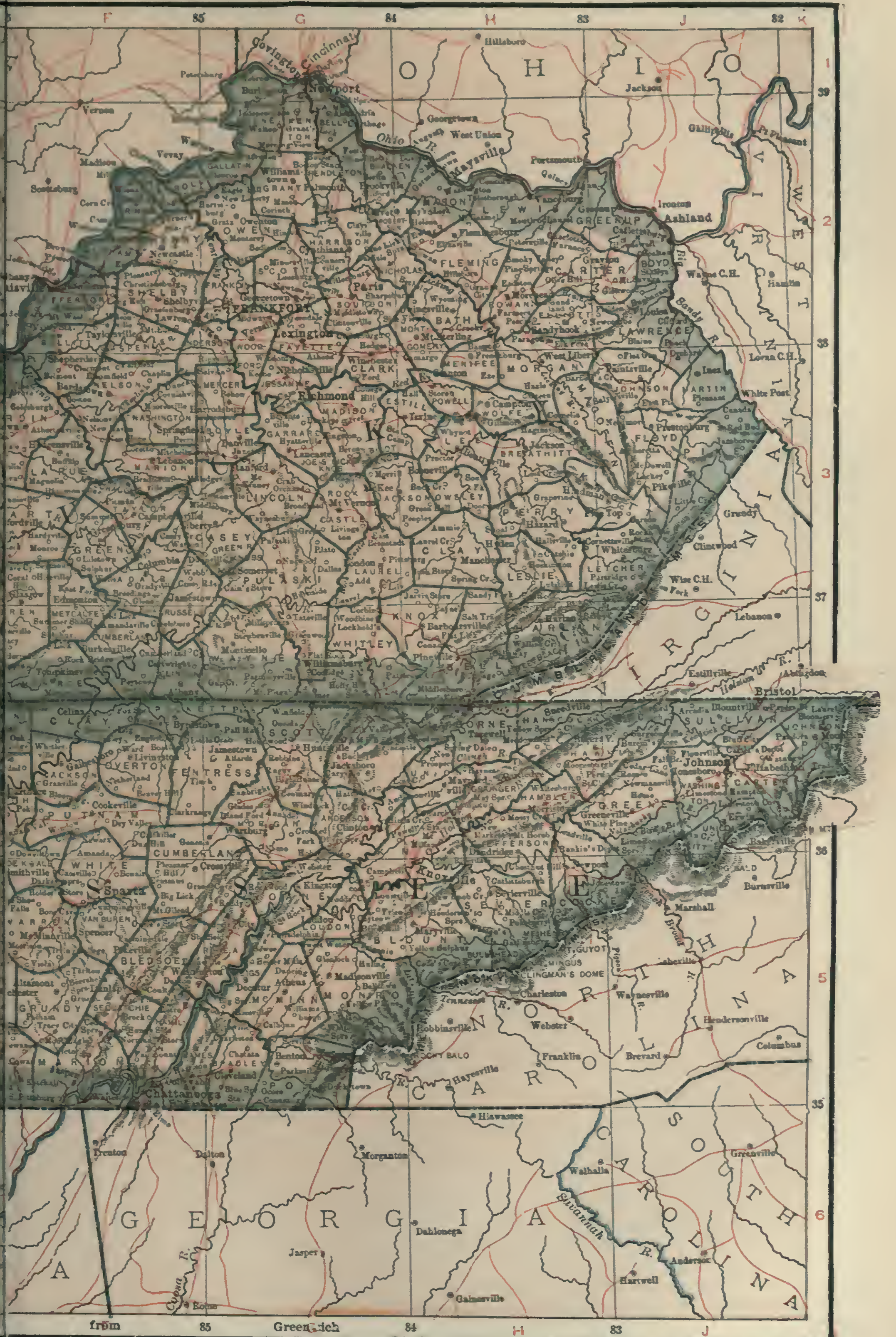
County Towns ◉ Railroads ——



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AREA AND POPULATION OF TENNESSEE BY COUNTIES.

(Continued.)

County.	Map Index.	County Seat.	Area in square miles.	Population.	
				1890.	1900.
Knox	H 4	Knoxville	520	59,557	74,302
Lake	B 4	Tiptonville	128	5,304	7,368
Lauderdale	B 5	Ripley	460	18,756	21,971
Lawrence	D 5	Lawrenceburg	590	12,286	15,402
Lewis	D 5	Hohenwald	295	2,555	4,455
Lincoln	E 5	Fayetteville	597	27,382	26,304
Loudon	G 5	Loudon	230	9,273	10,838
McMinn	G 5	Athens	437	17,890	19,163
McNairy	C 5	Selmer	570	15,510	17,760
Macon	F 4	Lafayette	280	10,878	12,881
Madison	C 5	Jackson	545	30,497	36,333
Marion	F 5	Jasper	504	15,411	17,281
Marshall	E 5	Lewisburg	315	18,906	18,763
Maury	D 5	Columbia	632	38,112	42,703
Meigs	G 5	Decatur	210	6,930	7,491
Monroe	G 5	Madisonville	668	15,329	18,585
Montgomery	D 4	Clarksville	548	29,697	36,017
Moore	E 5	Lynchburg	145	5,975	5,706
Morgan	G 4	Wartburg	540	7,639	9,587
Obion	B 4	Union City	505	27,273	28,286
Overton	F 4	Livingston	459	12,039	13,353
Perry	D 5	Linden	520	7,785	8,800
Pickett	F 4	Byrdstown	165	4,736	5,336
Polk	G 5	Benton	437	8,361	11,357
Putnam	F 4	Cookeville	430	13,683	16,890
Rhea	G 5	Dayton	365	12,647	14,318
Roane	G 5	Kingston	442	17,418	22,738
Robertson	D 4	Springfield	500	20,078	25,029
Rutherford	E 5	Murfreesboro	605	35,097	33,543
Scott	G 4	Huntsville	595	9,794	11,077
Sequatchie	F 5	Dunlap	263	3,027	3,326
Sevier	H 5	Sevierville	588	18,761	22,021
Shelby	B 5	Memphis	769	112,740	153,557
Smith	F 4	Carthage	334	18,404	19,026
Stewart	D 4	Dover	495	12,193	15,224
Sullivan	J 4	Blountville	430	20,879	24,935
Sumner	E 4	Gallatin	520	23,668	26,072
Tipton	B 5	Covington	430	24,271	29,273
Trousdale	E 4	Hartsville	107	5,850	6,004
Unicoi	J 4	Ervin	189	4,619	5,851
Union	H 4	Maynardville	237	11,459	12,894
Van Buren	F 5	Spencer	275	2,863	3,126
Warren	F 5	McMinnville	444	14,413	16,410
Washington	J 4	Jonesboro	325	20,354	22,604
Wayne	D 5	Waynesboro	757	11,471	12,936
Weakley	C 4	Dresden	565	28,955	32,546
White	F 5	Sparta	370	12,348	14,157
Williamson	D 5	Franklin	500	26,321	26,429
Wilson	E 4	Lebanon	552	27,148	27,078

the latter year 50,167 persons engaged as wage-earners in the industry. The recent growth is noteworthy in that textile manufacturing, the most prominent industry in a number of other Southern States, is not here important. The basis of the State's manufactures is its wealth of grain, timber, and minerals, together with its water power and advantages for river and railroad transportation. Flouring and grist mill products (whose value increased 74.8 per cent. between 1890 and 1900) and timber products each rank by far the first among the manufacturing interests. The abundance of coal and iron ore has given rise to a flourishing iron and steel industry, and to the manufacture of foundry and machine-shop products. The manufacture of cottonseed oil and cake is of greater importance than that of cotton textiles. The value of leather products in 1900 was more than twice that in 1890. There was a very large increase in the manufacture of tobacco products. The following table shows the relative importance of the leading branches for 1890 and 1900:

INDUSTRIES	Year	Number of establishments	Average nnmber wage-earners	Value of products, including custom work and repairing
Total for selected industries for State	1900	3,787	28,478	$67,168,395
	1890	2,102	21,596	43,628,010
Increase, 1890 to 1900	......	1,685	6,882	$23,540,385
Per cent. of increase	......	80.2	31.9	54.0
Per cent. of total of all industries in State	1900	47.3	56.8	62.5
	1890	46.1	57.6	60.3
Flouring and grist-mill products	1900	1,618	1,154	$21,798,929
	1890	918	1,417	12,474,284
Foundry and machine-shop products	1900	95	3,146	4,074,509
	1890	68	2,620	4,427,187
Iron and steel	1900	16	1,979	5,080,624
	1890	15	1,472	4,247,868
Textiles—total	1900	72	4,251	3,907,279
	1890	69	3,051	3,724,138
Cotton goods	1900	17	2,108	1,994,935
	1890	20	2,124	2,507,719
Hosiery and knit goods	1900	4	511	395,150
	1890	....	....	....
Woolen goods	1900	51	1,632	1,517,194
	1890	49	927	1,216,419
Oil, cottonseed and cake	1900	17	751	2,980,041
	1890	15	1,030	2,504,741
Tobacco—total	1900	92	1,237	3,010,602
	1890	54	700	853,529
Chewing, smoking, and snuff	1900	35	615	1,541,475
	1890	24	531	577,690
Cigars and cigarettes	1900	35	161	290,647
	1890	25	139	236,807
Stemming and rehandling	1900	22	461	1,178,480
	1890	5	30	39,032
Leather, tanned, curried, and finished	1900	44	803	2,802,117
	1890	60	612	1,266,556
Cars and general shop construction and repairs by steam railroad companies	1900	16	2,817	3,113,053
	1890	10	1,772	1,605,778
Lumber and timber products	1900	1,732	11,192	18,127,784
	1890	820	7,424	9,073,686
Lumber, planing mill products, including sash, doors, and blinds	1900	85	1,148	2,273,457
	1890	73	1,498	3,450,243

TRANSPORTATION. The State has the advantage of water transportation afforded by the Mississippi and Tennessee rivers. A number of trunk line railroads cross the State, most of them centring in the State's chief port, Memphis. Among the railroads are the Nashville, Chattanooga and Saint Louis, the Louisville and Nashville, the Illinois Central, and the Southern. The mileage increased from 1253 in 1860 to 1843 in 1880, 2767 in 1890, and 3184 miles in 1900.

BANKS. The first bank in the State was the Nashville Bank, established in 1807, with a capital of $200,000. In 1811 the Bank of the State of Tennessee followed, with the State as one of the stockholders. A second Bank of the State of Tennessee was in existence from 1820 to 1832. The State funds were transferred to the new Union Bank of Tennessee, with a capital of $3,000,000, of which $500,000 were subscribed by the State. The tendency to intrust the banking business to the State was still alive, and in 1838 the third venture was made by the organization of the Bank of Tennessee, with a capital of $5,000,000, all of which was to be supplied by the State, partly from funds on hand and partly by sale of bonds. It started with an actual capital of only $2,073,355, which was all the State could get together. The following twenty years were comparatively profitable for the banking business of the State, but the panic of 1857 forced many concerns into liquidation, and before they recovered from it the great political conflict came, almost destroying the banking institutions. In 1866, by order of the Legislature, the Bank of Tennessee was formally placed in liquidation, when its assets of $12,478,483 were found to consist mainly of Confederate bonds, certificates, treasury bonds, etc. In 1883 the State finally assumed the liability for the bank notes, and they were redeemed for special certificates of indebtedness. The depositors of the bank, including the State school fund, never realized anything. In 1869 there were 13 national banks and one State bank. The State banking system regained its ground after 1890. The present free banking law is lax. There is no system of bank examinations and no governmental control, and the liability of stockholders is strictly limited. The Constitution prohibits the State forming a bank or even holding stock in one. The condition of the various banks in 1902 is shown below:

	National banks	State banks
Number of banks	59	153
Capital	$7,140,000	$6,463,000
Surplus	1,845,000	1,554,000
Cash, etc	2,615,000	4,791.000
Deposits	26,780,000	24,714,000
Loans	26,339,000	19,949,000

Government. The present Constitution was adopted in February, 1870. Proposed amendments must receive a majority vote of the members elected to each House of two consecutive Legislatures, followed by a majority approval of all the citizens voting for Representatives. The Legislature cannot propose amendments oftener than once in six years. The Legislature can at any time submit to the people the question of a new constitutional convention, a majority of the votes cast being decisive. Voters must be United States citizens who have resided in the State twelve months, in the county six months, and have paid poll taxes.

There is a maximum limit of 99 to the number of Representatives and the Senators are limited to one-third the number of Representatives. Both are elected for a term of two years, elections being held on the first Tuesday after the first Monday in November of the even years, and the Legislature meeting on the first Monday in the following January. Members receive $4 per day and mileage, but the wage shall not exceed seventy-five days for a regular session, or twenty days for an extra session. Ministers and priests are ineligible to the Legislature, and atheists and duelists to any civil office.

The executive power is vested in a Governor who is chosen every two years; a Secretary of State, elected by the Legislature for four years; a Treasurer and Comptroller of the Treasury, elected in the same manner for two years; an Attorney-General, appointed by the Supreme Court judges, and who serves six years; and a State Superintendent of Schools, nominated by the Governor and confirmed by the Senate, serving two years. The Governor can call extra sessions, and has the pardoning and veto power. His veto, however, is overridden by a majority vote of the members elected to each House. There is a Supreme Court of five judges, elected for eight years. Judges of the circuit, chancery, and other inferior courts are elected by their respective districts for eight years. Nashville is the capital. The State has 10 Representatives in the Lower House of Congress.

Militia. In 1900 the State had 384,249 men of militia age. The organized militia in 1901 numbered 1304.

Finances. The history of the public debt constitutes the most important and interesting part of the financial history of the State. The first debt was created in 1832 and 1838 for the purpose of establishing State banks. Between 1840 and 1850 the State inaugurated the system of public improvements. Bonds were issued to turnpike and railroad companies for construction, and first mortgages were the usual guarantees. In 1861 the total amount of bonds outstanding was over $18,000,000, and a war loan of $3,000,000 was added. The four years of the Civil War destroyed the sources of State income, made payment of interest impossible, and swelled the total indebtedness considerably. In 1865 it rose to $25,277,406, out of which $5,169,740 was interest overdue. The current interest charges alone amounted to $1,185,048, while the revenue was far below it, taxation inadequate, and the amount actually collected considerably less than the sum assessed. Most of the companies to which the bonds were issued failed to pay the interest. The carpet-bag régime that followed the Civil War did not improve matters. New bonds to the amount of $3,408,000 were issued to 14 railroad companies in 1868, interest remained unpaid, and in 1869 the total debt reached $39,896,504. Measures of relief were then passed by the Legislature; sale of the delinquent roads was authorized, and the solvent railroads were permitted to pay their debts in State bonds which were below par. By these means the debt was rapidly reduced to $27,920,386 in 1874. Yet even then the State was unable to meet its obligations. Repudiating began to be talked of toward 1880, and, frightened by this agitation the bondholders began to offer various plans of settlement. A plan of refunding at 50 per cent. was agreed to by the bondholders and the Legislature in 1879, but was rejected by popular vote.

In that year the debt question was the main campaign issue, and the repudiation party lost. A final settlement was reached in 1883, when the State debt proper was scaled down 20-24 per cent. and the railroad guarantee bonds 50 per cent. The total debt was reduced by this operation from $28,000,000 to about $15,000,000. The conversion was completed in 1890. In 1900 the public debt was $17,023,600. The general tax is at present the main source of income (about 50 per cent.). Licenses give 25 per cent. and a tax on railroad and other corporations about 15 per cent. The net receipts in 1900 (omitting the operations of the loan accounts) were $2,069,624, the net disbursements $1,801,911.

Population. The population increased from 35,691 in 1790 to 422,823 in 1820, 1,002,717 in 1850, 1,109,801 in 1860, 1,258,520 in 1870, 1,542,359 in 1880, 1,767,518 in 1890, and 2,020,616 in 1900. From lowest in rank among the States it rose to fifth in 1850 and declined to fourteenth in 1900. The negro population in 1900 numbered 480,430, showing an increase of less than 200 over 1890. There were 17,746 foreign born. The population per square mile in 1900 was 48.4. In that year there were nine cities which had more than 4000 inhabitants each. In 1900 Memphis had a population of 102,320; Nashville, 80,865; Knoxville, 32,637; Chattanooga, 30,154; and Jackson, 14,511.

Religion. About two-fifths of the church membership is Methodist and about one-third Baptist. The Presbyterians and the Disciples of Christ also have strong followings.

Education. In 1900, 20.7 per cent. of the population over ten years of age were illiterate. This was a reduction from 38.7 in 1880. The per cent. for the native white population was 14.2 and for the colored 41.6. In 1900 there were 573,287 whites and 195,556 colored persons between the ages of 6 and 21. The school enrollment for that year was 485,354 and the average attendance 270,662 whites and 67,904 colored. Between 1875 and 1900 much progress was made, and the State is in advance of most Southern States. There is a State Superintendent of Public Schools nominated biennially by the Governor and confirmed by the Senate. For local supervision a superintendent for each county is chosen by the County Court biennially; and in each district there are three directors, elected by the people for three years, one going out each year. The law requires State and county superintendents to be persons of literary and scientific attainments and of skill and experience in the art of teaching. The county courts may elect boards of education in their respective counties, and these boards have authority to establish one or more high schools in their county. The text books used are uniform throughout the State. In the country districts the primary course covers six years, but two additional years may be taken in many districts in the so-called secondary school. In 1900 there were 4960 male and 4235 female teachers. The expenditure upon the country schools for the year was $1,751,047, of which $1,403.848 was for salaries of superintendents and teachers. There was an additional $597,006 expended for city schools. Normal school training is provided for by the Peabody College for Teachers (q.v.) at Nashville. A large number of students at this institution are aided by the grants of scholarships. The higher institutions of learning include some of national reputation. See TENNESSEE, UNIVERSITY OF; NASHVILLE, UNIVERSITY OF; VANDERBILT UNIVERSITY; FISK UNIVERSITY.

CHARITABLE AND PENAL INSTITUTIONS. There is an unsalaried Board of Charities appointed by the Governor which investigates the whole system of public charities and correctional institutions, and reports thereon to the Legislature. The plans for new buildings, modifications, etc., must be submitted to it for suggestions and criticism. The State maintains three hospitals for the insane, namely, the Western Hospital near Bolivar, the Central Hospital near Nashville, and the Eastern Hospital near Knoxville. There is a State school for the deaf at Knoxville, one for the blind at Nashville, and an industrial school at Nashville. The State also maintains a Confederate soldiers' home near Nashville. The main prison at Nashville had on December 1, 1902, 923 convicts, and the branch prison at Petros had 762 convicts on the same date. Over two-thirds of the total number are negroes. The prisoners at the branch prison are worked in coal mines, but are not leased to contractors. The revenue from convict labor is greater than the cost of maintaining the convicts.

HISTORY. Probably De Soto (q.v.) reached the Mississippi at the present site of Memphis in 1541. La Salle, about 1682, built a fort at this point, and called it Fort Prud'homme. The place was again occupied by the French in 1714. The grant by Charles II. to the Lords Proprietors of Carolina of the territory between latitudes 29° and 36° 30′ N. in 1665 included this territory. (See NORTH CAROLINA.) The first English settlement was Fort Loudon, built in 1756, at the suggestion of Governor Loudon of Virginia, and garrisoned by royal troops, but afterwards captured by the Cherokees. Before this, however, Dr. Thomas Walker with a party of Virginians had named the Cumberland River and Mountains, and Daniel Boone (q.v.) and others had entered the wilderness, which was regarded as a common hunting ground by the Cherokees, Creeks, Miamis, Choctaws, and Chickasaws. In 1768 the Iroquois, who claimed sovereignty by conquest, ceded their claim to the English, and in 1769 William Bean's cabin on the Watauga marked the beginning of real settlement. James Robertson (q.v.) and others came in 1770, another settlement was made near Rogersville in 1771, and soon after Jacob Brown opened a store on the Nollichucky. After the defeat of the Regulators (q.v.) in North Carolina, a great number of settlers came, supposing the territory to be Virginia soil. When the territory was found to be within North Carolina, the inhabitants of the first two settlements met in 1772 and formed the Watauga Association (q.v.), which served as a form of government for several years. In 1775 Col. Richard Henderson (q.v.) bought from the Indians the territory between the Cumberland and the Kentucky Rivers. More settlers came in 1778-79 and in 1780 a compact of government was drawn up at Nashborough, by Col. Henderson, who had been Chief Justice of North Carolina, and James Robertson, who had been one of the signers of the Watauga Association. These two compacts were much alike and served their purpose excellently.

The Watauga settlers in 1775 or 1776 gave the name Washington District to their colony, and in 1776 it was annexed to North Carolina, though some had dreamed of a separate State. The number of settlers increased rapidly and nearly 500 men under John Sevier (q.v.) and Isaac Shelby (q.v.) went across the mountains and took part in the attack on the British under Ferguson, at King's Mountain (q.v.), in 1780. All this time the settlers were harassed by severe Indian wars. In 1784 North Carolina ceded to the General Government all the territory of the present State on condition that the cession be accepted within two years, but retained until that time full sovereignty. The inhabitants, indignant at being transferred without their consent, and thinking that they had been abandoned, elected delegates from each military company, who met at Jonesboro, August 23, 1784, and formed the State of Franklin, or Frankland; John Sevier was chosen Governor. Congress ignored the request to be recognized as a State and North Carolina promptly repealed the act of cession and asserted its jurisdiction. Civil war was averted by the tact of the North Carolina Governors. Confusion, however, reigned, as there were two bodies of officers, and many settlers neglected to pay taxes to either, though furs, skins, and other articles were made legal tender by the infant State. At the expiration of Sevier's term in 1788, the State of Franklin ended. In this attempt at Statehood the Cumberland settlers did not join. Davidson County was laid out in 1783 and the Davidson Academy (now the University of Nashville) was founded in 1785. Indian troubles threatened the life of the settlement, and the intrigues of the Spaniards, who still held Louisiana and the Mississippi, made the position more difficult. See McGILLIVRAY, ALEXANDER.

In February, 1790, North Carolina again ceded the territory to the General Government, stipulating that all the advantages of the Ordinance of 1787 (q.v.) should be preserved to the inhabitants, except that slavery should not be prohibited. The act of government for the 'Territory South of the Ohio' was passed in April, 1790, and the seat of government was moved from Rogersville to Knoxville. The Indians were severely punished in 1794 and the Spanish influence was broken. In the same year the first Territorial Assembly met. In 1795, as the territory was found to contain more than 60,000 white inhabitants, a constitutional convention was called, which met in January, 1796. A constitution for the 'State of Tennessee' modeled after that of North Carolina was adopted without submission to popular vote; the first General Assembly met March 28th, and the State was admitted June 1, 1796. Almost from the date of admission there was a sharp distinction between East and Middle (West) Tennessee, which was recognized in the appointment of the judiciary. In wealth and material progress the mountainous eastern part lagged behind. The western part of the State began to fill up after 1818, Memphis was laid out in 1819, and three sections came now to be recognized in law. The progress of the State was rapid, though the growth was almost entirely along agricultural lines. The State early began to construct internal improvements. Turnpike roads were built in 1804, and after 1823 roads and canals were pushed forward. The first railroad was chartered in 1831, but the Memphis and Charleston road was not built until 1857. Much State aid was voted to the railroads, and the redemption of the bonds issued for this purpose was a political issue as late as 1882. The eastern part of the State did not share equally in these benefits.

There was a strong Union party in the State at the outbreak of the Civil War, and in February, 1861, the people refused to hold a convention to consider secession, but with President Lincoln's call for troops sentiment changed, and through the influence of Governor Harris the State declared itself by popular vote out of the Union, June 8th, though East Tennessee had voted against secession more than two to one. On June 17th a Union convention of delegates from the eastern counties and a few middle counties met at Greeneville and petitioned to be allowed to form a separate State. The request was ignored by the Legislature, and the presence of a Confederate army prevented further action on the part of the Unionists. During the war the State furnished about 115,000 soldiers to the Confederate cause and 31,092 to the Federal army. When the advance of Federal troops drove Governor Harris from Nashville, Andrew Johnson (q.v.), who had refused to resign his seat in the United States Senate on the secession of the State, was appointed military governor. He attempted to reorganize the State in 1864, and sent up Lincoln electors, who were rejected by Congress. In 1865 the Radical Legislature proceeded to extreme measures. Suffrage was extended to negroes under the Constitution of 1834, which gave that right to every freeman. The State was readmitted July 23, 1866, but there was much disorder. The Ku-Klux Klan (q.v.) appeared, and in 1869 nine counties in Middle and West Tennessee were declared under martial law. For a time after the war the recovery of the State was slow, but the development of the past twenty years has been exceedingly rapid. The principal events have been the conflicts between convict and free labor in the mines in 1891-93, and the Tennessee Centennial Exposition (q.v.), held at Nashville in 1897.

In the Presidential elections Tennessee chose Democratic-Republican electors from 1796 to 1824. In 1828 and again in 1832 the only issue was Jackson, and the voters were almost unanimous for him. In 1836, however, Hugh Lawson White, the States-Rights Democrat, was successful in spite of Jackson's efforts. From 1840 to 1852 Whig electors were chosen, Clay receiving the vote in 1844, though Polk was a resident of the State. In 1856 the vote was cast for Buchanan. The Constitutional Union ticket headed by John Bell was successful in 1860. The State voted for Grant in 1868, but since that time has been Democratic by large majorities. From the State have come many men of national reputation, including three Presidents, Jackson, Polk, and Johnson.

GOVERNORS OF TENNESSEE

STATE OF FRANKLIN

John Sevier	1785-88

TERRITORY SOUTH OF THE OHIO

William Blount	1790-96

STATE OF TENNESSEE

John Sevier	Democratic-Republican:	1796-1801
Archibald Roan	" "	1801-03
John Sevier	" "	1803-09
Willie Blount	" "	1809-15
Joseph McMinn	" "	1815-21
William Carroll	" "	1821-27
Sam Houston	" "	1827-29
William Hall (acting)		1829
William Carroll	Democrat	1829-35
Newton Cannon	States-Rights Democrat	1835-39
James K. Polk	Democrat	1839-41
James C. Jones	Whig	1841-45
Aaron V. Brown	Democrat	1845-47
Neil S. Brown	Whig	1847-49
William Trousdale	Democrat	1849-51
William B. Campbell	Whig	1851-53
Andrew Johnson	Democrat	1853-57
Isham G. Harris	"	1857-62
Andrew Johnson	Military	1862-65
Interregnum		4th March-5th April, 1865
William G. Brownlow	Republican	1865-69
DeWitt C. Senter	Conservative-Republican	1869-71
John C. Brown	Democrat	1871-75
James D. Porter	"	1875-79
Albert S. Marks	"	1879-81
Alvin Hawkins	Republican	1881-83
William B. Bate	Democrat	1883-87
Robert L. Taylor	"	1887-91
John P. Buchanan	"	1891-93
Peter Turney	"	1893-97
Robert L. Taylor	"	1897-99
Benton McMillin	"	1899-1903
James B. Frazier	"	1903—

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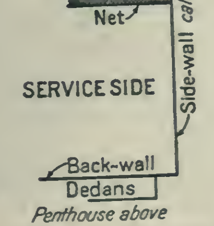
TENNESSEE, The. A formidable Confederate ram crippled by the *Hartford* of Admiral Farragut's fleet, and taken in Mobile Harbor on August 5, 1864.

TENNESSEE, University of. A coeducational State institution at Knoxville, Tenn., founded in 1794 as Blount College. Its title was changed in 1807 to East Tennessee College, in 1840 to East Tennessee University, and in 1879 to its present name. The institution comprises the College of Agriculture and Mechanic Arts and the university proper. The college has an agricultural department with a four years' course and a short course for farmers; an engineering department with four years' courses in mechanical, electrical, and civil engineering and chemistry; a literary department; and an industrial department for colored students (Knoxville College). The university consists of an academic department with courses for the graduate degrees of M.A. and M.S. and professional courses in engineering, law, medicine, and dentistry, the medical and dental departments being situated in Nashville. University extension work is carried on by means of teachers' institutes, farmers' institutes and conventions, and conferences on education. A summer school and a department of education have also been established. The university has a liberal system of accredited scholars whose certificates are accepted in place of the entrance examinations. The State has established 275 free scholarships in the academic department, and one free scholarship is given to each accredited school outside the State. The attendance in 1903 was 756 and the faculty numbered 120. The library contained about 20,000 volumes. The endowment in that year was $425,000 and the income about $103,716.29. The grounds and buildings were valued at $491,929.98.

TENNESSEE CENTENNIAL EXPOSITION. An exposition held in Nashville, Tenn., May 1 to October 30, 1897, to celebrate the one hundredth anniversary of the admission of the State into the Union. The site covered about 200 acres, and a characteristic feature of the landscape plan was the sward planted with the famous blue grass of the region. The buildings, of which there were over a hundred, included those devoted to agriculture, commerce, education, fine arts, history, machinery, minerals and forestry, and transportation, as well as those in which the special exhibits pertaining to children, negroes, the United States Government, and women were shown. The total attendance was 1,786,714, of which the total paid attendance was 1,166,692. The total receipts were $1,101,285, and the disbursements $1,101,246. Consult Justi, *Official History of the Tennessee Centennial Exposition* (Nashville, 1898).

TENNESSEE RIVER. The largest tributary of the Ohio. It is formed by the union of the Holston and the North Fork, which rise in the Alleghany Mountains of southwestern Virginia, and unite near Kingsport in the northeastern part of Tennessee (Map: Kentucky, C 4). According to some authorities the Holston extends to the junction with the French Broad River at Knoxville, and according to others even to the Clinch River at Kingston. The river flows first southwest between the Alleghany ridges, and then makes a great waving curve through northern Alabama from its northeastern to its northwestern corner. Reëntering Tennessee, it flows northward across the State, then northwest across Kentucky to its confluence with the Ohio at Paducah. Its length, including the Holston, is 1200 miles. Its chief affluents are the French Broad, the Clinch, Hiawassee, Sequatchie, Elk, and Duck. Except at the Muscle Shoals in Alabama, navigation is unobstructed from the mouth of the river to Chattanooga, a distance of 450 miles. The Muscle Shoals are a series of rapids, where the river flows over limestone rocks from Florence to Decatur, a distance of 23 miles, but navigation around them has been effected by means of a canal and locks, completed by the United States Government in 1889. Above the Shoals small steamers may ascend the river to Knoxville. Besides Knoxville, the chief cities along its banks are Florence and Decatur in Alabama, and Chattanooga in Tennessee.

TENNIEL, tĕn-nēl′, Sir John (1820—). An English painter and illustrator, born in London. He was practically self-taught. In 1845 he won a prize in the competition for the decoration of Westminster Palace, with a cartoon, "Allegory of Justice," the success of which also secured for him the commission to paint a fresco, Dryden's "Saint Cecelia," in the House of Lords. His most successful work, however, has been in black-and-white. From 1852 to 1901 he was cartoonist for *Punch*, executing over 2000 cartoons. His reputation rests chiefly upon his book illustrations. Among the principal are his drawings for *Æsop's Fables* (1848); Moore's *Lalla Rookh* (1861); Lewis Carroll's *Alice's Adventures in Wonderland* (1866), and its sequel, *Through the Looking Glass* (1870); the *Ingolsby Legends;* and his classical illustrations to the *Legendary Ballads*. In the statuesque and ideal character of the figures, his work recalls the German influence prevalent at the middle of the nineteenth century.



Plan of the right-hand side wall or main wall looked at from above at the dedans.

TENNIS (of uncertain derivation; possibly from OF. *tenez*, impv. of *tenir*, to seize, take, i.e. the ball). A game played with racquet and ball in a covered court. It has been well described as the mother of lawn tennis. It is usually played by two players, a four-handed game being rarely met with in modern tennis. The racquet is of the large-headed, large-handed variety. It has a smaller face but is heavier than the lawn-tennis racquet, in order to counteract the ball, which is heavier than the lawn-tennis ball, although about the same size. The court has walls on all its four sides, and a penthouse along three sides. The spectators are accommodated in the *dedans.* A ball played over the net into this *dedans* counts as a winning stroke to the striker. In front of the *dedans,* over the net and down the right-hand wall, is a *tambour* or protruding buttress. Past the tambour in the wall directly opposite the dedans is the grille. A ball played over the net into this grille makes a winning stroke. In the left-hand side wall there are many openings protected with nettings called galleries, the last gallery being known as the winning gallery, owing to the fact that a ball played over the net into it counts as a winning stroke. All the way down the left-hand side of the court runs the penthouse above the galleries. The penthouse also extends over the dedans and the grille. In tennis, the set consists of six games, though 'deuce' and 'vantage' games may be played, while 'faults' and 'double faults' score as in lawn tennis. The ball must be hit over the net before it is bounded twice, and the scoring is the same as in the better known forms of the game, e.g. 15 love, 15 all, 30-15, 30 all, 40-30, deuce, vantage, deuce, vantage, game.

TEN'NYSON, Alfred, first Baron Tennyson (1809-92). The most representative English poet of Victoria's reign. He was born on August 6, 1809, at Somersby, in Lincolnshire, a village of which his father was rector. Two of his brothers also displayed no slight poetic gifts, Frederick (q.v.), and Charles, afterwards known as Charles Tennyson Turner (q.v.). Alfred spent four years (1816-20) at the grammar school of Louth, a few miles from his home, and for the next eight years his education was directed by his father, a man of some literary talent. He roamed through the woods, laying the foundations of that knowledge of nature for which his verse is conspicuous, read extensively, and tried his hand in the manner of Pope, Thomson, Scott, Moore, and Byron. Fragments of this early work found their way into *Poems by Two Brothers* (1827; reprinted 1893), written in conjunction with his brother Charles. In 1828 the two brothers entered Trinity College, Cambridge, to which Frederick had gone a year earlier. At the university Tennyson was associated with a remarkable group of young men, most of whom formed the famous society known as 'The Apostles.' To this group belonged Thackeray, Spedding, Trench, Monckton Milnes, afterwards Lord Houghton, Merivale, Alford, and Arthur Henry Hallam, son of the historian, who discerned his friend's genius and in 1829 told Gladstone that Tennyson "promised fair to be the greatest poet of our generation, perhaps of our century."

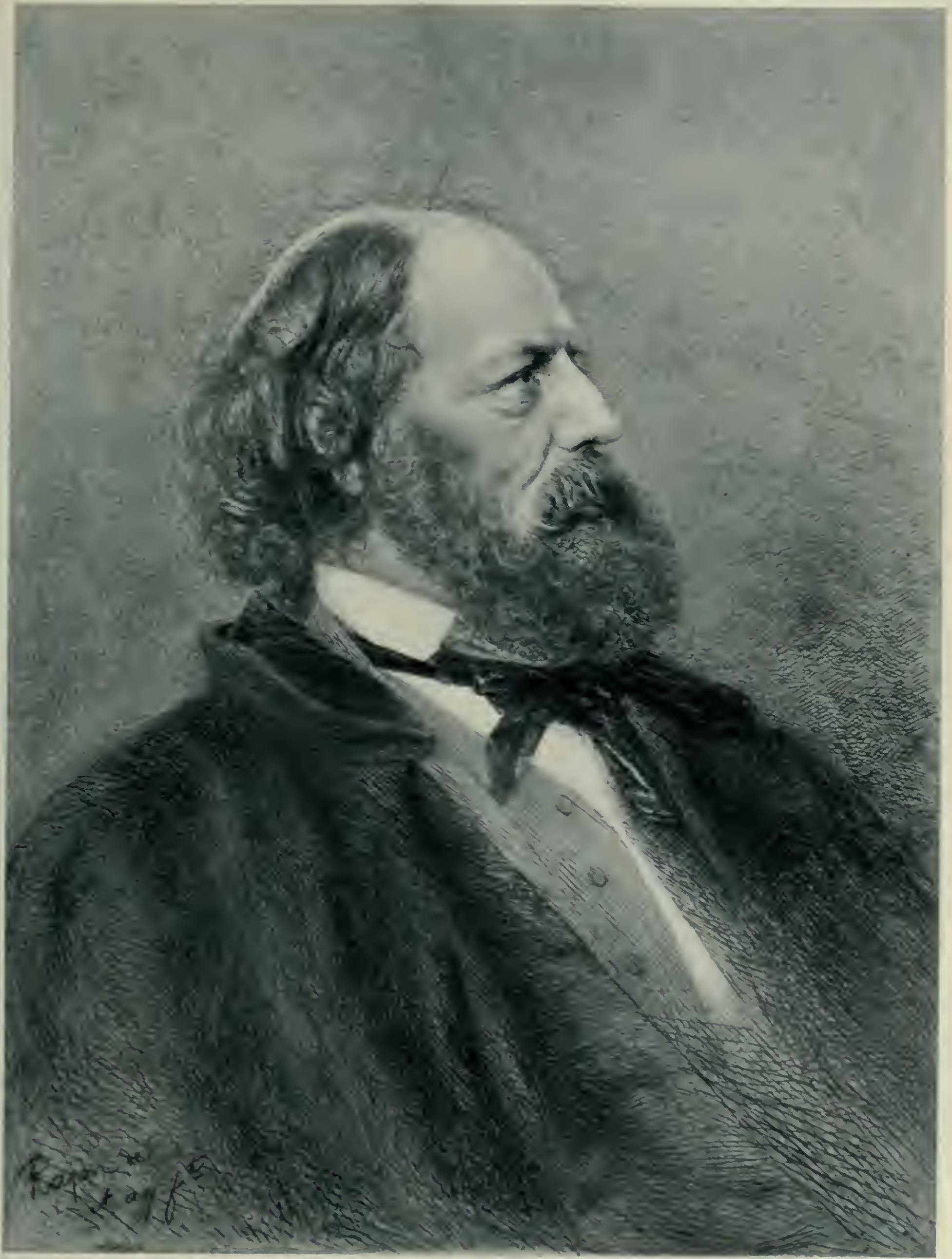
In that same year, with *Timbuctoo,* a poem in blank verse, Tennyson won the Chancellor's gold medal, and while still in residence published the epoch-making volume of *Poems, Chiefly Lyrical.* In 1830, when the slim little book appeared, poetry seemed to be dead. Murray had given up publishing verse, and the novel, under the impulse of the unprecedented success of the *Waverley* series, held the field. Showing the influence of Coleridge and Keats, the poems in this volume were in no sense imitative; rather, they contain in germ nearly all of Tennyson's great original qualities. In the same year he traveled in the Pyrenees with Hallam, and there, in the Valley of Cauterets, he wrote parts of "Œnone."

He left Cambridge without a degree in February, 1831, for various reasons, but chiefly the ill health of his father, who died a few weeks later. The family, however, remained at Somersby for six years longer. The second volume of *Poems* (1833) contained many of his choicest minor pieces: "The Lady of Shalott," "The Miller's Daughter," "The Palace of Art," "The Lotos-Eaters," and "A Dream of Fair Women." Beyond the circle of the poet's friends, the collection was not well received; Lockhart wrote an especially brutal review in the *Quarterly* for April. In September a life-long sorrow fell upon the poet in the death of Hallam, his dearest friend, who was at that time engaged to his sister Emily. For ten years he remained silent, reading largely, revising old poems, and writing new ones. By 1836 he had definitely given his heart to his future wife, Emily Sarah Sellwood, the sister of his brother Charles's wife. But, though deficiency of income seemed an insuperable bar to marriage, and though her relatives forbade even correspondence, Tennyson had no thought of deserting the art to which his life belonged to take up any profession more lucrative than poetry.

In 1842 he gained his public with *Poems* in two volumes, representing a wide range of theme and metrical structure. Here first appeared "Morte d'Arthur," the first sketch of the *Idylls of the King;* "Ulysses," "Locksley Hall," "Godiva," "Break, break, break," and "The Two Voices." Tennyson's place in English poetry was now secure; but fortune seemed far off. His little capital was shattered by a strange investment in wood-carving machinery; and in 1845 Peel was moved by Lord Houghton to grant him a civil-list pension of £200. In 1847 appeared *The Princess,* a romantic medley in musical blank verse, marked at every point by his "curious felicity" of style, and containing some wonderful lyrics. The year 1850 has been called his *annus mirabilis.* In June he published *In Memoriam,* a tribute to the memory of Arthur Hallam. At first not well understood, it has now definitely taken its place with *Lycidas, Adonais,* and *Thyrsis* at the head of English elegies. In the same month he married Miss Sellwood (with whom, he said afterwards, "the peace of God came into my life"); and in November he was appointed poet laureate in succession to Wordsworth.

He settled with his bride at Twickenham, where he lived for three years. Then he leased and shortly afterwards purchased the estate of Farringford, near Freshwater, in the Isle of Wight, where he lived until 1870. After that he divided his time between Farringford and Aldworth, a house which he built on Blackdown Hill, near Haslemere.

In 1855 appeared *Maud, and Other Poems.* "Maud," a great favorite with Tennyson, puzzled the critics, who tried to find in it the result of the author's own experience, though it is rather a vivid dramatic conception, rare with Tennyson. "No modern poem," said Jowett, "contains more lines that ring in the ears of men." The same volume contained the popular "Brook" and "The



TENNYSON
FROM AN ETCHING BY PAUL RAJON

Charge of the Light Brigade." Returning to Arthurian legend, Tennyson published in 1859 four of the *Idylls of the King;* others were added in 1869, and in 1872 they were arranged in sequence, with a completion in "Balin and Balan" (1885). Though his conception of the Arthurian romances has been severely criticised, the *Idylls* are probably his highest achievement. *Enoch Arden* (1864) was the most immediately popular of all his volumes; sixty thousand copies were sold, and the title poem was translated into eight languages. From the epic Tennyson turned to the drama, producing *Queen Mary* (1875), *Harold* (1876), and *Becket* (1884). Besides these magnificent historical pieces are *The Falcon* (1879), *The Cup* (1881), *The Promise of May* (1882), and *The Foresters* (1892), of which *The Cup* was the most successful as an acting play. Tennyson's productive imagination continued active throughout his last years. His last volumes were *Ballads and Other Poems* (1880), containing "Rizpah" and "The Northern Cobbler;" *Tiresias and Other Poems* (1885); *Demeter and Other Poems* (1889), containing "Crossing the Bar;" and the posthumous *Death of Œnone and Other Poems* (1892).

In 1884, after some hesitation, the poet accepted a peerage. He died at Aldworth October 6, 1892, and was buried in Westminster Abbey.

No English poet has produced masterpieces in so many different kinds as Tennyson; and he is the supremely representative figure in literature of the Victorian era, because he touched and reconciled a greater number of its diverse interests than any other writer. Yet he is in constant protest against the individualism which that period inherited from the Romantic revival. The most salient feature of his mental attitude is his sense of law; it is the 'reign of law' as shown by modern science which most attracts him to scientific subjects. The consummate artistic excellence of his verse, resembling in many of its qualities that of Vergil, gives him an abiding place in literature. No better example exists in English of the 'eclectic' style made up of elements inherited from many of his great predecessors, emulating "by turns the sweet felicity of Keats, the tender simplicity of Wordsworth, the straightforward vigor of Burns, the elusive melody and dreamlike magic of Coleridge, the stormy sweep of Byron, the large majesty of Milton;" and he expressed, with such an instrument, a teaching which was uniformly pure, noble, and consoling.

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TENNYSON, CHARLES. See TURNER, CHARLES TENNYSON.

TENNYSON, FREDERICK (1807-98). An English poet, brother to Alfred Tennyson (q.v.), born at Louth, in Lincolnshire. In 1827 he left Eton, as captain of the school, and went up to Trinity College, Cambridge, where he graduated in 1832. He passed most of his time for many years on the Continent, living for a long period at Florence. In 1859 he settled in the Isle of Jersey, where he remained until 1896. He then removed to Kensington, where he died. With his brothers, Alfred and Charles, Frederick wrote verse before his college days. To their *Poems by Two Brothers* (1827) he contributed four poems. In 1854 he published *Days and Hours*, which contained several beautiful and noble lyrics. He published no more until 1890, when appeared *The Isles of Greece*. This volume was followed by *Daphne and Other Poems* (1891) and *Poems of the Day and Year* (1895), in part a reprint of *Days and Hours*. Quoting the sonnet on "Poetic Happiness," Alfred Tennyson said that his brother's poems "were organ-tones echoing among the mountains."

TENNYSON, HALLAM, second Baron Tennyson (1852—). Eldest son of the poet Alfred, Lord Tennyson (q.v.). He was born at Twickenham. He was educated at Marlborough School, and at Trinity College, Cambridge, and studied law at the Inner Temple. To the *Contemporary Review* for November, 1876, he contributed a translation of the Old English song of *Brunanburh*, which was afterward turned into verse by his father. In 1880 he edited, with an introduction, the sonnets and lyrics of his uncle Charles Tennyson Turner (q.v.); and in 1897 he published the authorized life of his father, under the title, *Alfred Lord Tennyson, a Memoir*. He was made Governor of South Australia in 1899. In 1902 he became Governor-General of the Australian Commonwealth, but resigned in the following year.

TENOCHTITLAN, tâ-nŏch′têt-län′. The ancient capital of the Aztecs, occupying the site of the present City of Mexico (q.v.).

TENOR (OF. *tenour*, *teneur*, from ML. *tenor*, chief melody, highest male voice to which this was assigned, Lat. *tenor*, a holding, tone, accent, from *tenere*, to hold, retain). In music, one of the four classes into which voices are divided in respect to their compass. It is the higher adult male voice, with an appropriate range from c to a^1. Music for tenor voices is generally written in the treble clef, or an octave higher than its true pitch. The sign of the C clef is also often used, but it is not placed on the second *line*, but second *space*, so that the music is read as in the treble clef, but an octave lower. Two classes of tenors can be distinctly recognized, the heroic and lyric tenors (*tenore robusto, tenore di grazia*). The heroic tenors have something of the sonorous quality of the barytone in the lower register.

TE′NOS, or **TINOS**, tē′nŏs. An island in the Ægean Sea belonging to the Cyclades (q.v.) (Map: Greece, G 4). It has an uneven surface and covers an area of 79 square miles. On the south coast is the little town of the same name, called also Hagios Nikolaos (Saint Nicholas). It is on the site of the ancient town of Tenos, the remains of whose Temple of Poseidon were laid bare in 1902. The chief industries are wine-making and marble-quarrying. Population of the island, about 12,000. Tenos played an active part in the struggle between the Greeks and Persians, as well as in the Greek Revolution of 1821-27.

TENOT′OMY (from Gk. τένων, *tenōn*, tendon, from τείνειν, *teinein*, to stretch, strain + τομή, *tomē*, a cutting, from τέμνειν, *temnein*, to cut). The division of a tendon; a surgical procedure which usually has for its object the relief of some variety of deformity by severing a permanently contracted muscle at its tendinous portion. The affections in which tenotomy is most frequently found useful are club-foot (q.v.), contractions of the extremities following paralysis, deformity from contraction of the palmar fascia, wry-neck (q.v.), ankylosis of the points, and strabismus (q.v.).

TENREC (Malagasy name). An insectivore of the African family Centetidæ. Of the seven genera and many species, the best known is the tenrec (also spelled 'tendrac' and 'tanrec'), which is about a foot long, and owes its specific name (*Centetes ecaudatus*) to having no tail. Its hairs are rather spiny, but actual spines appear only in the young, which have three lines of them along the back, shed at the time of the arrival of the permanent teeth. The tenrecs are nocturnal animals, natives of Madagascar and the Mascarene isles. Three other species exist. They feed mainly on earthworms, æstivate during the hot season, and produce many young, sometimes more than 20. The flesh is edible, and the animal is so useful in the destruction of worms and insects that it has been introduced into Mauritius and Bourbon. See Plate of Porcupines and Hedgehogs.

TENSE. In grammar (q.v.), the change in the form of a verb which marks the time of the action. See Conjugation; Verb.

TENSKWATAWA, tĕn-skwä′tȧ-wȧ (The Open Door) (c.1775-1834). A Shawnee prophet, younger brother of Tecumseh (q.v.). He attracted no special notice in his tribe until November, 1805, when, at the ancient Shawnee town of Wapakoneta, in what is now northwestern Ohio, he made public proclamation of a wonderful vision during a recent trance, in which he claimed to have been taken up to the spirit world and to have received there a revelation from the God of the Indians, by which they were commanded to return to their primitive condition and customs. In a very short time his followers were numbered by the thousands throughout the region of the Ohio Valley and the upper lakes. He was believed to be the living incarnation of Manabozho (q.v.), the great culture god of the Algonquian race. In the spring of 1808 he removed, together with his brother, from Greenville, Ohio, to a more central location on the Wabash just below the entrance of the Tippecanoe, the new settlement being familiarly known as 'Prophet's Town.' Here the prophet continued to preach, but the battle of Tippecanoe, November 7, 1811, broke his power and prestige. His followers scattered to their tribes until again summoned to battle by the English. Everywhere denounced as a liar and deceiver, he finally found refuge with the Wyandot. On the outbreak of the War of 1812 he crossed over into Canada, but returned when peace was declared and rejoined his tribe in Ohio, removing with them to the West in 1827.

TENT. A portable structure of canvas, skin, rugs, or other fabrics, designed for shelter. Animal skins and foliage doubtless formed the earliest coverings, for which textile fabrics were substituted as civilization advanced. In the Book of Genesis the patriarchs are represented as dwelling in tents, probably much the same as the modern Arab tents, large structures, rude in form, of small height, but covering a considerable space of ground. The early Greek and Macedonian military tents were small coverings of skin, each tent sheltering two soldiers. The Romans used two sorts of tents, one of canvas, constructed with two upright poles and a ridge pole between them, a type familiar to the camping tent of to-day; the other resembling a light hut, a wooden skeleton, covered by bark, hides, mud, straw, or any other material which afforded warmth or protection. This latter type, it may be presumed, was only employed in the winter or for the more permanent camps. Each tent sheltered ten soldiers with their *decanus*. Possibly the tent has reached its highest perfection in Persia, where there are many tribes who dwell in them. They are nearly hemispherical, over a wooden framework, and covered with felt, with worked hangings covering the entrance. The Chinese lower classes also live much in tents, and while their construction is invariably of matting, they are usually of great size and exceedingly comfortable in design. The modern military tents are made of linen or cotton canvas, and latterly since the discovery of khaki (q.v.), and its wide use in military uniforms, tents made of this material have been very largely employed both in England and in America. The largest military tents are those used for hospital purposes. They are oblong in shape with high side walls. The tent most commonly used in military camps usually is round, about twelve feet in diameter, and ten feet high, affording sleeping accommodation to about sixteen men. Many other forms are in occasional use throughout the world, some designed to cover one or two men and so constructed as to be easily carried by the men, others by baggage animals or mules. The 'dog tent' of the United States soldier is a small easily carried contrivance which affords a degree of shelter for one or two men. See Encampment for description and illustration of a United States Army common wall tent.

TENTACULITES, tĕn′tăk-ū-lī′tēz (Neo-Lat. nom. pl., from *tentaculum*, tentacle, feeler, from

Lat. *tentare*, to touch, test, try). An important genus of fossil shells found in Silurian and Devonian rocks and often so abundant that they constitute the greater portion of thin limestone beds. The shells are of delicate, elongate conic form with the outer surface marked by regular transverse striations of either the same or alternate sizes, and also by very delicate longitudinal lines in the hollow between the striations. The species range from one-quarter to three inches in length. See PTEROPODA.

TENT CATERPILLAR. The larvæ of four species of silk-spinning moths of the genus Malacosoma (formerly Clisiocampa). The female of the apple-tree tent caterpillar (*Malacosoma Americana*), a dull reddish brown moth with two oblique pale stripes on the fore wings, lays eggs in ring-like masses fastened to small twigs of apple, cherry, thorn, etc. The caterpillars hatch in the early spring in the nearest fork of the twigs, and spin a web or tent in which they live in company, but which they leave when hungry, to feed upon the surrounding leaves. The tent is enlarged as the creatures grow. They hibernate in the egg stage. The eggs are easily seen in the winter time and may be pruned and destroyed, and the caterpillars may be killed just at nightfall within the tents by burning or spraying with kerosene. The so-called forest tent caterpillar, or forest army-worm (*Malacosoma disstria*), has similar habits, but the ring of eggs is perfectly cylindrical instead of being rather elliptical as with the former species. Both of these species are of Eastern distribution. On the Western coast the larva of *Malacosoma constricta* infests fruit trees in the late summer, and the larva of *Malacosoma Californica* is found upon oaks early in the season.

TEN'TERDEN, CHARLES ABBOTT, first Baron (1762-1832). An English lawyer, born at Canterbury. Abbott graduated at Corpus Christi College, Oxford, in 1785, and soon afterwards was made a fellow. After being a student of the Inner Temple he was called to the bar in 1796. He joined the Oxford circuit, and rapidly acquired a lucrative practice. He published, in 1802, his treatise on *Merchant Ships and Seamen*, in all respects the best written book which had till then appeared on one department of English law and still a standard authority. In 1816 he accepted a puisne judgeship in the Court of Common Pleas; and in 1818 he was knighted, and chosen to succeed Lord Ellenborough as Chief Justice of the King's Bench. He was raised to the peerage in 1827 as Baron Tenterden of Hendon.

TEN THOUSAND, RETREAT OF THE. See ANABASIS and XENOPHON.

TEN THOUSAND A YEAR. A novel by Samuel Warren (1841). The hero is a vulgar draper's clerk, Tittlebat Titmouse, who suddenly becomes rich through sharp legal practice.

TENURE (OF., Fr. *tenure*, from Lat. *tenere*, to hold, retain). The manner in which a person holds or owns real property. The word implies something less than an absolute and unqualified ownership. Before the development of the feudal system, an individual could own a piece of land absolutely, and such allegiance as he might owe to a superior power was a personal matter. However, at the very basis of the feudal system were the ideas of protection and service, of the dominion of the King and the dependence and subordination of the subject. Out of these ideas originated the feudal doctrine that the King should own all the land, and that his subjects were only entitled to hold such portions of it as he might parcel out to them, and on such conditions as he might impose. The Anglo-Saxons held their lands allodially, that is, by absolute and unqualified ownership; but when the Conqueror assumed the throne he parceled out the country among his followers as if it were his private estate, and introduced the intricate feudal *tenures* which had grown up on the Continent. See FEUDALISM.

With respect to their character and dignity, tenures under the feudal system in England may be classified as *free* and *base* or *non-free* tenures.

The most common of the free tenures was that by *knight's service*, which involved allegiance, military service, and other duties to the King or over-lord. This tenure was created by a solemn ceremony, in which the prospective tenant was said to pay *homage* to his lord, who thereby became bound to protect him in exchange for his promises of service and fealty. The chief service was performed by actual military duty when necessary, although at a later period a practice of making payments or sending substitutes, instead of the personal service, was sanctioned. Other heavy burdens incident to this tenure were known as *reliefs, aids, wardships*, and *marriage* (qq.v.), which yielded a large revenue to the great men of the realm.

Less common, but of greater dignity, was the tenure by grand sergeanty, which involved some personal service to the King, usually something other than military duty, as to be his cup-bearer, chief justice, standard-bearer, etc. *Petty sergeanty* did not usually involve personal service, but some tribute, such as rendering to the King annually a weapon, or a pair of spurs. See GRAND SERGEANTY.

Lands were frequently conveyed to the clergy on condition that they sing masses for the souls of the poor or distribute alms at certain intervals. This was known as tenure by *frankalmoign* or 'free alms.' In early times such land also remained subject to the burdens of feudal tenure.

As the rigor of the feudal system relaxed tenure by *socage* became the common and popular manner of holding land. See SOCAGE.

Gavelkind, borough English, and *burgage* tenures were merely forms of socage tenure, changed somewhat by local custom. The Statute of Military Tenures in 1640 converted the military tenures into free and common socage.

During the Norman era there existed in England a large class of people known as *villeins*, who were practically serfs, and were generally attached to the land. They were given small plots to cultivate, and were required to perform the most menial services for the lord at his will. This was known as the tenure of *villeinage*, and was a base or non-free tenure. It became the custom, however, to note the succession of a son to his father, and the character of services performed by the latter, on the *rolls* or records of the Court Baron of the manor. By this custom the services required of villeins in each manor assumed a more certain and definite character, and they were said to hold by virtue of a 'copy of the rolls of the court.' At a later period the payment of rent in some form was substituted for menial services, and the *copyhold* tenant, as he came to be called, became a respectable member of the community. Many copyhold tenures still prevail, and the old practice of resorting to the 'custom of the manor' to ascertain their character or incidents still obtains.

In the United States most of the lands originally granted by the Crown and proprietors of 'plantations' were held in free and common socage, and a modified form of this tenure still obtains in a few States. In most of the States, however, all feudal tenures have been abolished and lands are held *allodially*, that is, absolutely and subject only to the right of eminent domain in the State. See Blackstone and Kent, *Commentaries;* Pollock and Maitland, *History of the English Law* (2d ed., Boston and London, 1899); *Encyclopædia of the Laws of England* (London, 1897-98); Degby, *History of the Law of Real Property* (2d ed., Oxford, 1884); Williams, *Real Property* (19th ed., London, 1902).

TENURE OF OFFICE ACT. A term sometimes applied to an act of Congress passed in 1820, chiefly through the influence of W. H. Crawford, Secretary of the Treasury, creating a four-year tenure for a large number of Federal offices, previously held by an indefinite tenure of good behavior. This act is usually regarded as having prepared the way for the introduction of the spoils system (q.v.). The name Tenure of Office Act, however, is most commonly associated with the important act of 1867, which grew out of the controversy between Congress and President Johnson. It had been the practice from the establishment of the Government in 1789 to concede to the President the right to dismiss without the consent of the Senate all Federal officers appointed by him, inasmuch as the Constitution did not expressly require such consent, and in view of his sole responsibility for the execution of the laws. But on account of President Johnson's opposition to the Congressional policy of reconstruction it was feared by Congress that he would use his great power of dismissal to impede its plan of reconstruction, and accordingly the Tenure of Office Act was passed over his veto on March 2, 1867, providing that the consent of the Senate should be necessary to the dismissal of any officer appointed by and with the advice and consent of that body. Cabinet officials were also included in this. This was a complete reversal of the policy of the Government with regard to removals from office, and the President's disregard of the law in removing Secretary Stanton was the main cause of his impeachment by the House of Representatives. (See IMPEACHMENT.) With the accession of General Grant to the Presidency in 1869, the more objectionable features of the act were stricken out, and finally, in 1887, the act as a whole was repealed.

TENZON, or TENSON (Prov. *tenso,* from Lat. *tensio,* stretching, contention, from *tendere,* to stretch). In Provençal poetry, a debate in verse between two poets, and hence a special metrical form adopted for the purpose. See PROVENÇAL LITERATURE.

TEOCALLI, tā′ō-käl′yē (Nahuatl, house of the god). The ancient Mexican term for a temple and place of sacrifice and worship. The teocallis were commonly low, truncated, four-sided pyramids of earth, stone, or brick, a small temple building being placed on the flat summit. There was also as a rule a sacrificial stone on the summit, where public sacrifices were made. The term has come to be applied more specifically to the teocalli of the City of Mexico. This structure, as described by the early writers, had the usual pyramidal form, and was somewhat more than 80 feet high with a summit surface of 325 by 250 feet. This summit was reached by a terrace winding spirally five times around the pyramid. The great sacrificial stone from this teocalli is still preserved in the City of Mexico.

TE′OS (Lat., from Gk. Τέως). An ancient Ionian city on the west coast of Asia Minor; on a peninsula projecting into the Gulf of the Cayster, northwest of Ephesus. Here was a celebrated temple of Dionysus, and a theatre, of which remains still exist, while the walls of the modern town of Sigliajik contain many interesting inscribed stones from the ancient site. Teos was prosperous till the Persian conquest, when a large part of its inhabitants withdrew to their colony of Abdera in Thrace. It was the birthplace of the lyric poet Anacreon.

TEOSINTE (Mexican name), *Euchlæna Mexicana* or *Euchlæna luxurians.* A tall, stout, leafy plant closely related to and greatly resembling maize or Indian corn. It is a native of the warmer parts of Mexico and Central America, from whence it has been introduced as a forage crop. In its native habitat it grows rapidly, often attaining a height of 10 to 15 feet in a few months. The stalks bear 'tassels' of staminate flowers, and a number of small, flattened, poorly filled ears, the grain of which seldom matures farther north than the Gulf States. On account of its extensive tillering (30-50 stalks often springing from a single root) and its very leafy habit, teosinte produces as much green fodder upon a given area as any other grass. The Louisiana Experiment Station reports 50 tons of green forage per acre. The stalks are tender and the whole plant is readily eaten by stock. The plants may be cut several times during the season, but a single cutting just before the advent of autumn frosts will yield about as much forage as the more frequent cuttings. Teosinte withstands drought fairly well and has been successfully grown as far north as Kansas and Pennsylvania, but has not proved satisfactory at the experiment stations of Michigan, Vermont, Massachusetts, and Maine. An analysis of the green fodder shows it to contain water, 66.77 per cent.; ash, 3.97 per cent.; protein, 2.54 per cent.; fibre, 12.33; nitrogen-free extract, 13.60 per cent.; and fat, 0.79 per cent.

TEPEHUAN, tā′på-hwän′ (mountaineer, or conqueror). A brave and warlike tribe of Piman stock (q.v.) formerly occupying a considerable territory in the Sierra Madre, south of the Tarumari (q.v.), but now restricted to the mountainous region in the extreme northwestern portion of Durango, with adjoining portions of Chihuahua and Sinaloa, Mexico. In former times they were reputed the bravest people of Mexico, and they still are extremely jealous of their tribal rights. They are an industrious, agricultural people, living in houses of logs or stone set in clay mortar, or frequently utilizing the mountain caves for shelter. They cultivate cotton, which they weave into fabrics of beautiful texture and colors. They are now reduced to a mere remnant.

TEPIC, tâ-pēk′. A territory in the western part of Mexico, bounded by the States of Sinaloa and Durango on the north, Jalisco on the east and south, and the Pacific on the west (Map: Mexico, G 7). Area, 11,275 square miles. The surface is low on the coast and mountainous toward the eastern frontier. The population, mostly semi-independent Indians, includes 30,000 Nayarits, engaged chiefly in agriculture. Population, in 1895, 147,776. Capital, Tepic (q.v.). The Nayarit population long resisted the Spanish sway and were not subdued until 1722, and then only nominally. In 1872 they rebelled against the Mexican Government, but were subdued after a bloody struggle. The Territory of Tepic was organized in 1889.

TEPIC. The capital of the Territory of Tepic, Mexico, 28 miles east of the port of San Blas, with which it is connected by a railway (Map: Mexico, F 7). Situated on a plateau 2900 feet above the sea, it commands a fine view of the Pacific; its climate, mild and healthful, attracts many summer residents from San Blas. The streets are straight and lined with well-constructed houses. It has cotton and cigar manufactures. It was founded in 1531 by Nuño de Guzmán. Population, in 1895, 14,560.

TEP′LITZ, or **TÖPLITZ**, tĕp′lĭts. A town of Bohemia, Austria, 46 miles northwest of Prague, in the valley of the Biela, between the Erzgebirge and the Mittelgebirge ranges (Map: Austria, C 1). It is a favorite watering place, famous for its hot springs, which range in temperature from 97° to 120° F., and are almost free from mineral properties. The most important building is the Castle of Prince Clary, which, with its surrounding park and gardens, constitutes the chief resort of the town. Teplitz has important manufactures of buttons, cotton and india-rubber goods, chemicals, glass, pottery, and sugar. The springs have been celebrated since the eighth century. The town is known for the treaty of alliance signed here September 9, 1813, by the monarchs of Russia, Prussia, and Austria against Napoleon. Population, in 1900, 24,117.

TERAMO, tā′rȧ-mṓ. The capital of the Province of Teramo, Italy, 32 miles northwest of Chieti, at the confluence of the Tordino and Vazzola Rivers (Map: Italy, H 5). It lies amid attractive mountain scenery, and has interesting Roman remains. The fourteenth-century cathedral has been recently restored. The Church of Sant' Agostino is a handsome Gothic structure. Pottery, leather, fine furniture, straw hats, and cream of tartar are manufactured. The Gran Sasso d'Italia is often ascended from here. Population (commune), in 1901, 24,563.

TER′APHIM. A Hebrew word, plural in form but of obscure origin, and designating a certain kind of images used for oracular purposes. The teraphim appear to have been of various shapes, in some instances small enough to be hidden in the camel-litter—as in the story of Rachel's theft of the teraphim belonging to her father, Laban (Gen. xxxi. 19, 34), while in others they had a human form and were large enough to be used as a substitute for a man, as in the story of Michal's successful deception of her father, Saul, by placing a teraph in David's bed (I. Sam. xix. 13-16). The reverence paid to the teraphim as household deities lent a persistence to the practices connected with them that survived even Josiah's reform (II. Kings xxiii. 23), and we find teraphim in vogue during the exile (Zech. x. 2). Connected in some way with ancestor-worship, it is not unlikely that there is some relationship between teraphim and Rephaim (q.v.)—the 'shades' of the dead. Consult Schwally, *Das Leben nach dem Tode* (Giessen, 1892).

TER′ATOL′OGY. That portion of biological science which treats of the unusual or grotesque forms which the organs or the whole body may assume. See Malformation.

TERBIUM (Neo-Lat., from *Yt-terb-y*, in Sweden). A metallic element discovered by Mosander in 1843. It was originally found with erbia, yttria, and other rare earths, in the mineral gadolinite from Ytterby, Sweden, but its existence was subsequently disputed, until investigations by Cleve, about 1878, seemed to substantiate its elementary nature. It is, however, still doubtful whether terbium is a single substance or a mixture. The metal itself has never been isolated; its oxide is a dark-orange powder.

TERBORCH, tĕr′bôrk (ter Borch, Terburg), Gerard (1617-81). An eminent genre and portrait painter of the Dutch School. Born at Zwolle, he was first instructed by his father, a draughtsman and etcher of some ability, and went, in 1633, to Haarlem, where he became the pupil of Pieter de Molyn. In the selection of subjects he favored scenes of a peaceful and refined domestic life, occasionally disconcerted by the vicissitudes of love, the favorite theme of his pictures. Only exceptionally he descends into the lower strata of society, as for instance in his earliest picture preserved to us. the "Backgammon-Players," in the Kunsthalle at Bremen. The influence of the grand master of Haarlem, Frans Hals, is noticeable in his first dated picture, "Consultation" (1635, Berlin Museum). To the same period may be assigned the "Knife-Grinder's Family" (ib.) and "Boy with a Dog" (Pinakothek, Munich). In 1635 he went to London and is virtually lost sight of until 1645, when we find him painting portraits at Amsterdam. Thence he went to Münster, where he painted his most celebrated work, the "Peace Congress of Münster" (1648, National Gallery, London), containing sixty likenesses, perhaps the most perfect specimen of miniature portrait-painting. Accompanying the Spanish envoy to Madrid, he found much favor at Court and painted several portraits of Philip IV., by whom he was knighted. In 1650 he was back in Holland, where he married a widow, and settled at Deventer, in 1654. From about that period probably date the portraits of himself and wife in the Amsterdam Museum. A later full-figure portrait of himself is in the Hague Gallery, which also contains the charming picture known as "The Dispatch" (1665).

From 1650 to 1660 he painted most of those conversation pieces which have chiefly made Terborch's name popular, to wit: "The Reading Lesson" (c.1650), "An Offer of Money," and "The Concert" (all in the Louvre); "Paternal

Admonition" (c.1655, Amsterdam and Berlin); "Trumpeter Delivering Love-letter" (Munich); "Officer Writing Letter," and "Officer Reading Letter" (both in Dresden); and the "Guitar-Lesson" (National Gallery, London). All these have in common a forcible treatment of light and coloring, in which a pronounced lemon tint prevails beside a vigorous brownish red or deep scarlet. During the last two decades of his life his technique reached the height of its development. Minutely correct in drawing, rich and highly original in coloring, unsurpassed in the rendering of fabric, always harmonious and delicate in tone, the creations of his last period may well be ranked with those of the greatest colorists. They include: "The Music Lesson" (1660, Louvre), "Lute-Player" (in Antwerp, Cassel, and Dresden), "The Concert" (Berlin), "Lady Washing Her Hands" (Dresden), "Paring an Apple" (Vienna), and "The Letter" (Buckingham Palace, London), one of his most distinguished delineations. A striking example of fine modeling and masterly stuff-painting is "The Smoker," in the Berlin Museum, which also possesses four small full-length portraits of superior merit. His "Meeting of the Town Council" (1667, Town Hall, Deventer) ranks next to his Münster picture as regards the number of figures. In the Metropolitan Museum, New York, may be seen a portrait of himself and another portrait of a gentleman. Consult: Michel, *Terburg et sa famille* (Paris, 1888); Rosenberg, *Terborch und Jan Steen* (Leipzig, 1897); and Lemcke, in Dohme, *Kunst und Künstler*, ii. (ib., 1878).

TERCE. See BREVIARY.

TERCEIRA, tĕr-sā′ē-rȧ. The second largest island of the Azores (q.v.) (Map: Portugal, B 4). Area, 164 square miles. It is of volcanic origin. The coast is lined with precipitous cliffs of lava, and the diversified surface attains a maximum altitude of 3500 feet in Caldeira de Santa Barbara. Wine, lumber, and archil are produced and largely exported. Angra do Heroismo (q.v.), the chief town of the island, is also the seat of government for the entire group. The population of Terceira in 1900 was 56,548.

TER′EBRAT′ULA (Neo-Lat. nom. pl., diminutive of Lat. *terebratus*, p.p. of *terebrare*, to bore, pierce). A large number of fossil shells, chiefly in the Mesozoic formations, have been called Terebratula, but the name appears to be properly applicable only to certain species of the Mesozoic and Tertiary, which are closely allied to Terebratula Phillipsi of the Middle Jurassic. This group appeared in the Devonian, and, with a great expansion during the Mesozoic, it continues to the present day. As a rule the shells have a pentagonal or oval outline, with both valves convex, the ventral beak prominent and arching over the dorsal beak and perforated by a usually large foramen. The surface of the shell is always punctate, but in most species this character can be seen only with the aid of a lens. The earlier species are, as a rule, smooth-surfaced shells, while those of the Mesozoic are sometimes striated and in a few instances plicated.

TEREDO. The generic name of a small bivalve marine mollusk, colloquially called 'shipworm' and 'borer,' which perforates woodwork under water, especially ship's timbers and piling, devouring it and making long, shell-lined tunnels, many being crowded close together, and so weakening the timber that at last it breaks apart. See SHIPWORM.

TEREK, tĕr′ĕk. A river of Southeastern Russia, one of the chief streams flowing from the Caucasus (Map: Russia, G 6). It rises in a glacier near the summit of Mount Kazbec at an altitude of nearly 14,000 feet, and descends the north slope of the Caucasus in a tumultuous course through deep and narrow gorges. It then turns east, and after a total flow of 400 miles enters the Caspian Sea through a large delta. It carries down enormous quantities of detritus, and its delta is advancing into the sea at the rate of over 100 feet a year. The river is navigable 254 miles for small vessels.

TEREK. A territory in the eastern part of Northern Caucasia (see CAUCASUS), bordering on the Caspian Sea. Area, about 28,150 square miles (Map: Russia, F 6). It is bounded on the south by the Caucasus Mountains, many of whose highest peaks it contains. The interior is occupied to a large extent by the offshoots of the main chain and slopes toward the Terek and the coast, which is low and marshy. The region is watered by the Terek and its tributaries, and abounds in mountain lakes. In the lowlands along the coast and the Terek the climate is very unhealthful, and most of the settlements are found in the mountainous districts. Terek produces few minerals aside from petroleum, which is obtained in increasing quantities in the Grozny chain. At Pyatigorsk (q.v.) are the best known of the mineral springs. Agriculture gives occupation to about 80 per cent. of the inhabitants, but only a small portion of the cultivated land is utilized. The chief products are wheat, corn, rye, and hemp. The output of wine is extensive. The natives keep large herds of horses and sheep. Population, in 1897, 933,485. Capital, Vladikavkaz (q.v.).

TER′ENCE (PUBLIUS TERENTIUS AFER) (c.185-c.159 B.C.). A Roman writer of comedies. He was born at Carthage, and was perhaps of African (not Phœnician) origin. He was brought to Rome and there became the slave of the Roman senator Publius Terentius Lucanus, who, out of regard for his handsome person and unusual talents, gave him a good education, and finally manumitted him. On his manumission, he assumed his patron's *prænomen* and *nomen*. His first play was the *Andria*, which was put upon the stage in B.C. 166. Its success was immediate, and introduced its author to the most refined society of Rome, where his engaging address and accomplishments made him a particular favorite. His chief patrons were Lælius and the younger Scipio, after living with whom in great intimacy for some years in Rome he went to Greece, where he spent a year in studying the Greek comedies of Menander, Diphilus, Apollodorus, and others, and adapting them in Latin for the Roman stage. He never returned; and the accounts of how he came by his death are conflicting. He is supposed to have died by drowning in B.C. 159. Six comedies are extant under the name of Terentius, which are perhaps all he produced: *Andria*, *Hecyra*, *Heauton-timoroumenos*, *Eunuchus*, *Phormio*, and *Adelphi*. Terence preserved a sort of charmed life throughout the dark ages when classical literature was almost forgotten, and on the revival of letters was studied as a model by the most accomplished playwrights. His language is pure, almost immaculate, and though inferior to Plautus in comic power, he is more than his match in consistency of plot and character, in tenderness, in wit, and in metrical skill. The best editions are those of Wagner (Cambridge, 1869), Umpfenbach (Berlin, 1870), Dziatzko (Leipzig, 1884), and Fleckeisen (ib., 1901). There are good English translations by Colman (London, 1841) and Riley (New York, 1859).

TERENTIANUS MAURUS, tē-rĕn'shĭ-ā'nŭs mą'rŭs. A Roman poet referred with probability to the end of the second century A.D. His name indicates that he was an African, and he may be identical with the Terentianus, governor of Syene, praised by Martial (i., 87). There is an elegant poem extant by him on prosody and the various metres, *De Literis Syllabis, Pedibus, Metris*. It has been edited by Santen and Van Lennep (Utrecht, 1825), Lachmann (Berlin, 1836), and Gaisford (Oxford, 1855).

TERE'SA, SAINT (1515-82). A famous Carmelite nun and mystical writer. She was born at Avila, in Old Castile. In her eighteenth year she entered a convent of the Carmelite Order in her native city, making her solemn vow on November 3, 1534. In this convent she continued to reside for nearly thirty years. After a time her religious exercises reached a most extraordinary degree of asceticism. She began her work of reforming the Carmelite Order in concert with a few zealous members of her own sisterhood in the Convent of Avila, but afterwards obtained permission from the Holy See, under the direction of Peter of Alcantara, to remove with her little community to Saint Joseph's, a small and very humble convent in the same city, where she established in its full rigor the ancient Carmelite rule, with some additional observances introduced by Teresa herself. This new convent was established in 1562. The general of the Carmelite Order, J. B. Rossi, was so struck with the condition of the convent over which Teresa presided that he urged upon her the duty of extending throughout the Order the reforms thus successfully initiated. Teresa entered upon the work with great energy, and succeeded in carrying out her reforms. (See CARMELITES.) She died at Alba, October 4, 1582, and was canonized by Gregory XV. in 1622, her feast being fixed on October 15. The third centenary of her death was celebrated with great splendor in 1882. Her works consist, besides her famous letters, mainly of ascetical and mystical treatises. Complete editions in Spanish were published at Madrid in 1877 and 1881; an excellent French edition is that of Bouix (Paris, 1859). There are several biographies in English, by Mrs. Cunningham Graham (London, 1894); Whyte (1897); anonymous, with an introduction by Cardinal Manning (Dublin, 1872); the best is Coleridge, *Life and Letters of Saint Teresa* (London, 1881-96).

TEREUS, tē'rē̇-ŭs. See PHILOMELA.

TERGOES, tẽr'gōōs'. A seaport of the Netherlands. See GOES.

TERGOVISTE, tẽr'gō-vĭsh'tē̇, or TARGUVISHTEA. The capital city of the District of Dimbovitza, Rumania, 50 miles northwest of Bucharest, on the right bank of the Jalomitza (Map: Balkan Peninsula, E 2). As the former capital of Wallachia it had a population of 60,000, in the sixteenth century. The town is now an important strategic point. Population, in 1900, 9398.

TERHUNE, tẽr-hūn', MARY VIRGINIA (HAWES) (1831—). An American novelist and journalist, born in Richmond, Va., of New England ancestry. She married in 1856 Rev. Edward P. Terhune of Brooklyn, was editorially connected with *Babyhood*, *Wide Awake*, *Saint Nicholas*, and *The Home-Maker*, and published under the name of 'Marion Harland' many domestic manuals, social essays, sketches of travel, novels, and short stories, among which may be noted: *Alone, A Tale of Southern Life and Manners* (1854); *The Hidden Path* (1855); *Moss-Side* (1857); *Miriam* (1860); *Nemesis* (1860); *Husks* (1863); *Sunnybank* (1866); *At Last* (1870); *Common Sense in the Household* (1871), one of her best known books; *Our Daughters, and What Shall We Do with Them?* (1880); *Sketches of European Travel* (1880); *Judith* (1883); and *A Gallant Fight* (1888).

TERLIZZI, tẽr-lĭt'sē̇. A town in the Province of Bari delle Puglie, Italy, 20 miles west by north of Bari and about 7 miles from the Adriatic (Map: Italy, X 6). It has an ancient castle. It is active commercially. Wine and almonds are leading products. Population (commune), in 1901, 23,232.

TERM (OF. *terme*, from Lat. *terminus*, OLat. *termo*, *termen*, boundary, limit). In the law of real property, the time during which a tenant is entitled to enjoy an estate, according to his lease. The word is also sometimes employed to denote the estate or interest of the tenant, itself.

TERM, OF COURT. In practice the word term denotes a period in which a court holds a session. Under the common law system in England the judicial year was divided into four terms, the names of which indicated the time of the year in which they were held, viz.: Hilary Term, Easter Term, Trinity Term, and Michaelmas Term. These terms were abolished by the Judicature Acts. In the United States the terms of court are arranged with reference to the number of judges available and the probable volume of judicial business to be disposed of. It is usual, however, to have a vacation of several months during the summer.

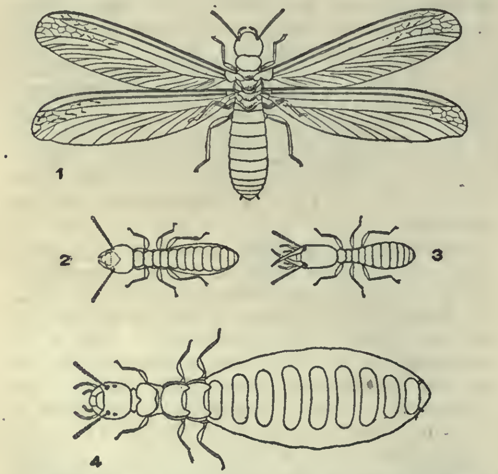
TERMINI IMERESE, tẽr'mē̇-nē̇ ē'mȧ-rā'zȧ. A city on the north coast of Sicily in the Province of Palermo, on the San Leonardo, 21 miles east-southeast of Palermo (Map: Italy, H 9). The busy port is dominated by a plateau on which rise the houses of the well-to-do. In the rear are picturesque hills. Here also is the mediæval castle (now a prison), commanding a fine view. The Ospedale dei Benfratelli contains an historical museum with collections of Greek and Roman antiquities, and paintings by Sicilian artists. The city has a school of navigation and a library. There are extensive tunny and sardine fisheries. The exports include Sicilian macaroni (for which the town is famous), besides wine, olive oil, fruits, grain, and rice. The warm saline springs are much frequented for bathing. Population (commune), in 1881, 23,-

148; in 1901, 18,650. Termini Imerese, the Roman Termæ Himerenses, was founded by the Carthaginians in B.C. 407, after the destruction of the ancient Himera (q.v.), the ruins of which are still to be seen. It had become largely Hellenized when it was captured by the Romans in the First Punic War.

TER'MINUS (Lat., boundary, limit). A Roman divinity presiding over public and private boundaries. His only sanctuary was in the Temple of Jupiter, on the Capitol, where he was honored in the form of a boundary stone, above which was an opening in the roof, that his rites might be performed, as ritual required, in the open air. According to the divergent theories as to the Roman religion, Terminus may be regarded as an early god who later yielded to the growth of the worship of Jupiter, or as a later schematizing offshoot from the original conception of Jupiter as the guardian of all boundaries. The *Terminalia* seems to have been simply a festival of neighbors at their common boundary lines. We also hear of annual sacrifices at the frontier (real or assumed), but dedications to Terminus are unknown before the days of the Empire.

TERMITE (from Lat. *termes, tarmes*, woodworm; connected with *terere*, Gk. *τείρειν*, *teirein*, Lith. *triti, trinti*, OChurch Slav. *tryeti, trŭti*, to rub). Any one of the insects of the order Isoptera, comprising those forms known as white ants. They are not at all related to the true ants, but their general appearance and the fact that they live in societies have given them the popular name. For an account of the community life and of the different castes of the termites, see INSECTS, paragraph on *Social Insects*.

The order Isoptera, which is most numerously represented in the tropics, includes only the single family Termitidæ, from which the common name 'termite' is derived. They undergo practically no transformation. The young when it hatches from the egg is an active, crawling creature with six legs, much resembling the adult except in size. All species are social and the communities consist of both wingless and winged individuals. The males and females which are winged have very long membranous longitudinally veined wings which when in repose lie flat along the back, extending far beyond the tip of the abdomen. The hind wings are of nearly the same shape and size as the front wings, and across the base of each wing is a line of weakness indicating where the wing breaks off after the nuptial flight. The nests, which are often built of earth, are hard and persistent, and are sometimes more than 12 feet high. These 'ant-hills' are divided into chambers and galleries, and there are generally two or three roofs within the dome-shaped interior. The thick walls are perforated by passages leading to the nurseries and storehouses. Termites sometimes attack the woodwork of houses and soon reduce the thickest timbers to a mere shell. Those species which live in trees sometimes construct nests of great size, like sugar casks, of particles of gnawed wood cemented together and so strongly attached to the branches as not to be shaken down even by violent storms.



AMERICAN NORTHERN WHITE ANT (*Termes flavipes*).
1, adult male; 2, worker; 3, soldier; 4, supplementary queen. (After Marlatt.)

In the United States there are comparatively few species, and only one (*Termes flavipes*) which has a northward range. This is the common white ant found frequently living in the joists and other large timbers of houses. In these they make innumerable tunnels, running usually with the grain of the wood, so that, although a great deal of the substance of the wood is devoured, the main longitudinal fibres support the building structure for a long time. In fact, their presence in many houses would not be noticed except for the spring flight of the winged males and females. This species is probably native to North America, although it was accidentally introduced into Europe. A species known as *Termes tubiformans* occurs in Texas, and makes tubes around the grass stems and stems of other plants, while their nests are placed deep in the ground.

The origin of a new termite colony occurs after the nuptial flight when the female's (queen's) wings break off; her body swells with eggs, grows enormously, and egg-laying commences. Unlike the true ants or any of the other social Hymenoptera, the young require very little care from the workers. Just as with the true ants and other social insects, there are many termitophilous or guest insects to be found in the nests of termites. The damage done by termites in tropical regions is very great. In Central America it is almost impossible to erect wooden telegraph poles which will last for any length of time, as they are tunneled by these insects and fall very soon. Consult: Sharp, *Cambridge Natural History*, vol. v. (London, 1895); Howard, *The Insect Book* (New York, 1902).

TERN (Dan. *terna*, Icel. *þerna*, tern), or SEA-SWALLOW. One of a group, the Sterninæ, of small gulls (q.v.), found in most parts of the world, and essentially gulls in habits and appearance. About 75 species are known, varying in size from the Caspian tern (*Sterna tschegrava*), which is nearly two feet long and four and one-half feet across the wings, down to the dainty least tern (*Sterna antillarum*), which is only nine inches long. The typical color of the terns is blue-gray above, white beneath, and black on the crown, but one or two species are pure white, some are black and white, some sooty brown, and some almost wholly black. The 'common' tern is *Sterna hirundo*, abundant on the coasts of the whole Northern Hemisphere and of Africa. It breeds locally on the coast and in the Mississippi Valley from the Gulf States to Greenland, but, owing to incessant persecution, it selects only unoccupied sandy islets for its breeding places, and from New Jersey to Maine its only resorts now are Gull Island, N. Y., and Penikese and Muskeget Islands, Mass. The Arctic tern (*Sterna paradisæa*) is very similar. Its egg is illustrated on the Colored Plate of Eggs of American Game and Water Birds, and is typical of tern's eggs generally. The gull-billed tern (*Gelochelidon Nilotica*) of the Southern States, a cosmopolitan species; the roseate tern (*Sterna Dougalli*) of the Atlantic Coast; the sooty tern, or 'egg-bird,' of the West Indies (*Sterna fuliginosa*), also southern; and the elegant tern (*Sterna elegans*) of the Pacific Coast from California southward, are the most interesting among the 15 or 16 other North American species.

TERNATE, tĕr-nä′tå. A small but important island of the Moluccas, situated off the west coast of the island of Gilolo. Area, about 55 square miles. It consists of an active volcanic peak, rising 5400 feet above the sea. The chief town, Ternate, has a population of about 3000 and a good harbor, but is not of great commercial importance. It is the seat of the Sultan of Ternate, who has large dominions in Celebes, and is the capital of the Dutch Residency of Ternate, which embraces the northern Moluccas and parts of New Guinea and Celebes. See Moluccas.

TERNAUX-COMPANS, târ′nō′ kôɴ′päɴ′, Henri (1807-64). A French historian, bibliographer, and diplomatist, born in Paris. He is best known for his collection of books and manuscripts on the early history of America, one of the most remarkable ever brought together. Facilities for collecting it were increased by his diplomatic employment in Spain, Portugal, and Brazil. He was also once a member of the French Chamber of Deputies. He published a catalogue of Americana before 1700, *Bibliothèque américaine* (1836); also translations of documents in his collection in 20 volumes, *Voyages, relations et mémoires originaux pour servir à l'histoire de la découverte de l'Amérique* (2 series, 1836-40), and other works of less significance.

TERNAY, târ′nå′, Charles Louis D'Arsae de (1722-80). A French naval officer, born at Ternay, in Normandy. He entered the navy in 1738 and fought at Louisburg in the French and Indian War. In 1762. in command of a squadron, he attacked Newfoundland, and captured Saint John's and several British vessels. He was governor of the island of Bourbon (1772-79. In 1780 he commanded the French fleet that brought over to America Count Rochambeau and his forces. He died at Newport soon after his arrival.

TERNI, tĕr′nê. A city in the Province of Perugia, Italy, 59 miles south by east of the city of Perugia, on the Nera River, near its confluence with the Velino (Map: Italy, G 5). The many Roman remains, including an amphitheatre, sculptures, baths, inscriptions, etc., are interesting. The city has a large Government arsenal and extensive iron and steel interests. Woolen goods, brick, olive oil, and wine are also manufactured. Near the city are the famous falls of Terni, in the Velino River—the Cascate delle Marmore—with a total descent of 650 feet. Population (commune), in 1901, 30,641. Terni, the ancient *Interamna*, was of considerable importance under the Romans.

TERN′STRŒMIA′CEÆ (Neo-Lat. nom. pl., from *Ternstrœmia*, named in honor of the Swedish naturalist *Ternström*). According to Bentham and Hooker, an order of about 200 species of dicotyledonous trees and shrubs, natives of warm and temperate countries. They are most abundant in South America; a few are found in North America; some in India and China. The leaves are alternate, leathery, in many species evergreen, generally undivided. The flowers are on axillary or terminal stalks, generally white, sometimes pink or red; the fruit a 2 to 7 celled capsule, containing a few large seeds, often rich in oil. This order contains tea, camellia, and gordonia (qq.v.). Engler divides it into several distinct orders, most of the genera being transferred to the order Theaceæ. The best known American representative of this order is the loblolly bay (Gordonia Lasianthus).

TERPAN′DER (Lat., from Gk. Τέρπανδρος, *Terpandros*). A Greek musician who lived in the seventh century B.C. He was born at Antissa, in the island of Lesbos, went to Sparta, and in 676 was crowned victor in the first musical contest at the feast of Apollo Carneius. He established there the first musical school in Greece and is credited with the enlargement of the compass of the lyre to an octave. He was the first to set poetry regularly to music.

TERPSICHORE, tĕrp-sĭk′ô-rē (Lat., from Gk. Τερψιχόρη, fem. of τερψιχόρος, *terpsichoros*, delighting in the dance, from τέρψις, *terpsis*, enjoyment + χορός, *choros*, dance). In Greek mythology, one of the nine Muses (q.v.). She prescribed over the choral dance. In the later assignment of functions to the Muses, she was regarded as the Muse of the lesser lyric poetry, and was distinguished by the lyre.

TERQUEM, târ′käɴ′, Olry (1782-1862). A French geometer, born at Metz of Jewish parents. In 1804 he was called to Mainz as professor of mathematics in the Lyceum, and afterwards to a similar position in the school of artillery. Returning to Paris in 1814, he was appointed librarian in the artillery depot at Saint-Thomas-d'Aquin. Terquem was a distinguished geometer and is largely known for his *Nouvelles annales de mathématiques*, a publication which he founded together with Gerono in 1842, and which is still continued. He also wrote *Bulletin de bibliographie, d'histoire et de biographie mathématiques* (7 vols., 1855-61).

TERRACE (OF. *terrace, terrasse*, Fr. *terrasse*, from It. *terraccia, terrazzo*, terrace, from *terra*, from Lat. *terra*, earth, land). In geology, a stretch of comparatively level land along the shore of a lake or the ocean or bordering the course of a river and elevated some distance above water level. Terraces frequently occur in series, one rising above the other as the distance from the shore increases. River terraces owe their origin to the cutting down of flood plains; as the channel of a river widens and deepens the flood plain is gradually cut away until only the edges adjacent to the valley walls remain. This process may be repeated several times, giving rise to a succession of terraces of which the oldest have the highest elevation and are farthest removed from the river. The drift terraces so common in the Northern States are remnants of flood plains that were formed when the overloaded streams of the Glacial period filled their preglacial valleys. Lake terraces mark former shore lines and are evidence of a shrinkage in the volume of the lakes. They are well marked around most of the Great Lakes, also on the shores of Lake Champlain and the lakes of the Great Basin. Their abundance has suggested the term Terrace epoch to designate the geological period during which they were produced. See BEACHES, RAISED; LAKE; RIVER; LAKE AGASSIZ; etc.

TERRACINA, tĕr′rȧ-chē′nȧ. A city in the Province of Rome, Italy, 76 miles southeast of the city of Rome, on the Tyrrhenian Sea, and at the southern end of the Pontine Marshes (Map: Italy, H 6). The ancient city occupied a commanding position on the crest of a hill overlooking the modern site. This section affords a magnificent view and has interesting remains of the Roman period, notably those of the imposing Temple of Venus, which until 1894 were supposed to belong to a palace of Theodoric the Ostrogoth. The Cathedral San Cesareo in the modern city, occupying the site of another Roman temple, is of much architectural beauty. Population, in 1901, 11,310. Terracina, the Volscian *Anxur* and the Latin *Tarracina*, was of considerable military importance under the Romans.

TERRA COTTA (It., baked earth). Hard-fired earthenware, especially that which is used for architectural material.

GREECE. Terra cotta statuettes are one of the most common products of ancient art. They are found in considerable numbers in Egypt, from the earliest periods, though often here the clay is covered by a vitreous glaze forming the so-called Egyptian porcelain. Such figures are among the most charming and dainty products of Greek art. The archaic terra cottas are numerous, especially on sacred sites. The later figurines from the fourth century B.C. and the Hellenistic period have been found in tombs at many sites, but the earlier group is best represented by the statuettes from Tanagra in Bœotia, which are strongly influenced by the art of Praxiteles and his contemporaries. In the later period the characteristics of Hellenistic art are seen in terra cottas from Asia Minor (especially Myrina), Sicily, and Southern Italy. The attractiveness of these figures has led to many imitations, which frequently are so skillful that only the expert can detect their origin. The ancient figures were made in molds, sometimes as many as 16 being employed for a single figure; then after baking they were often retouched or engraved, and finally painted in brilliant colors on a coating of white lime. For architecture the pieces were finished in true ceramic painting, simple but of great excellence. In Central Italy, especially in Etruria and Latium, crude brick seems to have been largely employed, and hence terra cotta was used for decorative purposes in important buildings at a time when in Greek lands it had been largely supplanted by stone. In this region also terra cotta seems to have been used much more extensively for large figures than among the Greeks.

MIDDLE AGES AND RENAISSANCE. Throughout the Middle Ages, baked clay was used in architecture, chiefly for floor tiles, but also for roof-crestings and ornamental finials. In the great plain of North Germany, where stone was rare and fictile clay abundant, a whole school of Gothic architecture in brick grew up in the fourteenth century and continued for two hundred years: and the decorative reliefs modeled in clay and used as capitals, friezes, and the like, are of singular interest. Elaborate decorative gables and parapets were made of this material and baked so hard that they are terra cotta rather than brick. In Italy, at the time of the Early Renaissance, the material is used very freely in elaborate detail in churches and in private dwellings. The Renaissance artists used this material freely for sculpture, even for life-size busts, though rarely for statues. (See ROBBIA, DELLA.) Another epoch of art during which terra cotta was freely employed was of the eighteenth century, when, especially in France, terra cotta statuettes and groups were made in great abundance, and vases, clocks, and the like decorated by reliefs and figures in the round were made for decorative effect. The most famous masters of this art were three sculptors of the name of Adam (Lambert Sigisbert, and his brothers Nicholas Sébastien and François Gaspard), and especially Claude Michel, commonly known as Clodion.

NINETEENTH CENTURY. In the nineteenth century the use of terra cotta as a building material was resumed in connection with the Gothic revival and the increasing demand for decorative detail. Toward the close of the century some slight attempts were made to introduce polychromy of a permanent kind in connection with this material. Some of the best terra cotta for buildings is made in the United States; and here also color has been sparingly used. Among its advantages as a building material are the ease with which it may be molded to any desired architectural or sculptural form and indefinitely repeated, its durability, lightness, strength, and cheapness. It may be made in almost any desired color.

MANUFACTURE. A better grade of clay is required for terra cotta than for brick. Oftentimes clays from different localities must be mixed to secure the right color, while such vitrifying ingredients as pure white sand, old pottery or fire brick finely ground, and burned clay, are added to secure partial vitrification. After weathering, the selected clay is ground or washed (see CLAY, par. CLAY-MINING), mixed with the vitrifying ingredients and water; next, the various sorts of clay are piled in layers. Vertical slices from this mass are taken to either a pug mill or rollers for tempering. The material is next sent to the molding room in cakes of convenient size. If only one piece is required, the clay may be modeled by hand, ready for baking; but if the design is to be repeated a model is made and a mold taken, into which the clay is forced by hand. After partial drying the product is turned over to the finisher, who may be more or less skilled, according to the character of the design. After drying, the forms are baked or burned, as described under KILNS.

BIBLIOGRAPHY. Lecuyer, *Terres cuites* (Paris, 1882-85); Cherret, *Die Terrakotten* (Berlin, 1886); Pottier, *Les statuettes de terre cuite* (Paris, 1890). The Greek statuettes are well treated in Hutton, *Greek Terracotta Statuettes* (London, 1899), and less accurately though in more detail in Huish, *Greek Terracotta Statuettes* (ib., 1900). Of special value are: Kekulé, *Griechische Thonfiguren aus Tanagra* (Stuttgart, 1878). A catalogue of ancient terra cottas is in preparation by the Berlin Academy of Sciences under the editorial supervision of Kekulé, of which two volumes have appeared. The Etruscan funeral urns are collected by Brunn and Körte, *I rilievi delle urne etrusche* (Rome, 1870 et seq.). On the use of terra cotta in architecture consult: Dörpfeld, Gräber, Borrmann, and Siebold, *Ueber die Verwendung von Terrakotten am Geison und Dache griechischer Bauwerke* (Berlin, 1881). For application of ornamental terra cotta to buildings, consult Kidder, *Building Construction and Superintendence*, part i., "Mason's Work" (New York, 1896). For the manufacture of the various wall and floor fireproofing materials, roof coverings, and other clay goods often going under the name of terra cotta, also for porous terra cotta and terra cotta lumber, see BRICK; TILES. For the application of these materials, see FIREPROOF CONSTRUCTION.

TERRA DEL FUEGO, tĕr′rȧ dĕl fwā′gȯ. A corrupted form of Tierra del Fuego (q.v.).

TERRAMARE, tĕr′rȧ-mä′rȧ (from It. *terra amara*, bitter earth). The term applied to certain low mounds with level tops in the valley of the Po, which are supposed to have formed the foundations of pre-historic Italian villages. They occur only in marshy districts, and form a development of the lake-dwellings of Switzerland. Since about and above them much débris of the villages accumulated in the course of time, the terramare are of great archæological importance, and present, in this regard, certain analogues with the kitchen-middens of Denmark and the shell-heaps of America. In them are found fragments of bones, pottery, tools, implements of war, and the like, which cast light on the ancient civilization of Italy in the Neolithic period. See ITALY, section on *Ethnology;* KITCHEN-MIDDEN; LAKE-DWELLINGS.

TERRANOVA, tĕr′rȧ-nō′vȧ. A seaport in the Province of Caltanissetta, Sicily, 75 miles east by south of Girgenti (Map: Italy, J 10). There are tunny and sardine fisheries, and manufactures of woolen goods. The exports are grain, wine, sulphur, soda, and cotton. Terranova was built by Frederick II. in the thirteenth century on the site of Gela (q.v.). The ruins of the ancient necropolis have yielded numerous vases. Population (commune), in 1901, 22,114.

TERRAPIN (probably of North American Indian origin). Any of several species of fresh-water or brackish water or 'mud turtles' of the family Emyidæ, natives of tropical and the warmer temperate countries. The neck can be wholly retracted within the shell; the head is flat, and the jaws prolonged into a beak. Terrapin feed partly on vegetable food, but also devour fish, reptiles, and other aquatic animals. They swim very well, and even on land move with much greater swiftness than land-tortoises. The family is represented in the United States by about twenty species. The word terrapin has no exact scientific significance, but in the United States it is more commonly applied to the diamond-back terrapin (*Malaclemmys centrata*). This species is found in salt marshes from New York to Texas, and is gray with black markings. Its flesh is highly esteemed as a table delicacy, and in some places along the southern coast these turtles are reared for market in inclosures in large numbers.

EDIBLE TERRAPIN, OR DIAMONDBACK.

TERRE, tĕr, LA (Fr., the Earth). One of Zola's Rougon-Macquart novels (1887), in which the author presents a brutally realistic study of peasant life.

TERRE HAUTE, tĕr′*e* hōt′. The county-seat of Vigo County, Ind., 72 miles west by south of Indianapolis; on the Wabash River, and on the Cleveland, Cincinnati, Chicago and Saint Louis, the Evansville and Terre Haute, the Terre Haute and Indianapolis, the Southern Indiana, and other railroads (Map: Indiana, B 3). It occupies an elevated site, and is regularly laid out. Terre Haute is the seat of the Rose Polytechnic Institute, Indiana State Normal School, and Saint Mary's Institute. Other noteworthy institutions include the Rose Orphans' Home, Saint Ann's Orphans' Home, Saint Anthony's Hospital, Union Hospital, and Rose Dispensary. The United States custom-house and the county court-house are also prominent structures. There is a public library with about 30,000 volumes. Terre Haute carries on considerable trade, being the centre of a productive section, largely devoted to agriculture and containing valuable coal deposits. It is also an important industrial city. The various manufactures in the census year 1900 had $8,938,107 capital and a production valued at $27,784,619. Of the latter amount, more than half was accredited to the concerns engaged in the distillation of liquors. There are also foundries and machine shops, flour and hominy mills, clothing factories, rolling mills, slaughtering and meat-packing establishments, car works, a brewery, planing mills, and manufactures of carriages, glass, electric motors, stoves, brick, tools, wheels, etc. The government, under the charter of 1902, is vested in a mayor, chosen biennially, and a unicameral council. The subordinate officials, with the exception of the school board, which is elected by the council, are appointed by the mayor. For maintenance and operation the city spends annually about $401,000, the principal items being: schools, $139,000; fire department, $40.000; police department, $30,000; municipal lighting, $27.000; streets, $22,000; and interest on debt, $21.000. Population, in 1890, 30,217; in 1900, 36,673. Terre Haute was founded in 1816 and was chartered as a city in 1833.

TER′RELL. A city in Kaufman County, Texas, 32 miles east of Dallas; on the Texas and Pacific and the Texas Midland railroads (Map: Texas, F 3). It is the seat of the North Texas Hospital for the Insane. It is the commercial centre of a section engaged in farming, cotton-growing, and fruit-growing, and having besides important cattle-raising and lumber interests. It is also of some prominence as an industrial city, being known for the manufacture of cottonseed oil. It has shops of the Texas Midland Railroad, cotton gins, a cotton compress, a flour mill, a foundry, a canning factory, etc. The government is vested in a mayor, elected every two years, and a unicameral council. The waterworks are owned by the municipality. Population, in 1890, 2988; in 1900, 6330.

TERRESTRIAL MAGNETISM. See MAGNETISM, TERRESTRIAL.

TERRIER (OF. *terrier*, from ML. *terrarius*, relating to the earth, from Lat. *terra*, earth, land, so called from its habit of scratching the ground in pursuit of its prey). A small active domestic dog, used in pursuit of vermin. Sixteen distinct breeds of this dog are officially recognized, several of which have two sub-varieties, i.e. rough-haired and smooth. The earliest authentic mention of the terrier is by Dr. Caius, who wrote a Latin treatise on the dog before 1572. He enumerates among the British dogs 'the terrare,' which he described as used to hunt the fox and badger by following them underground. Strutt describes good terriers in the time of James I. (1603-25). This breed was what is now called a fox-terrier, but at that time was black and tan, or pied with white or yellow, of which a large and a small variety were bred. The larger variety became a rough-haired, strong animal, the foundation stock of the English white terrier. This breed, crossed with the bulldog, produced the bull-terrier, a dog of infinite courage, out of which, however, all other bulldog characteristics have been eliminated. The fox-terrier was gradually degraded into a fighting dog, and so lost caste that it became nearly extinct, but was revived about 1865, and became the most popular of all terriers as a pet in the house as well as a useful servant about the stable. While in one direction all the color was being bred out of the original terrier to produce the 'white' dog, so in another direction all the white was being eliminated to produce the pure black-and-tan, until that race was perfected. From the smaller specimens of this breed came, by selection, the toy black-and-tan weighing as little as three pounds. The Welsh terrier is a large wire-haired black-and-tan; and the Irish terrier is a wire-haired yellow variety, claimed to be indigenous and of the highest antiquity. The Bedlington is a wire-haired variety supposed to be a cross between the low-legged, wire-haired Dandie Dinmont and the otter-hound, but it much more strikingly resembles the Irish water dog. The Airedale is a cross of the rough-haired English terrier with the otter-hound; and the Boston terrier is a cross of a smooth-coated terrier with the bulldog.

In contrast to the above group of long-legged, short-bodied, up-standing dogs, with either rough or smooth coats, are the long-bodied, short-legged dogs, with a long and silky covering. This latter group were originally developed in Northern Scotland. They are the Scotch, a rough wire-haired variety; the Dandie Dinmont with a woolier coat; and the Skyes and Clydesdales with long silky coats. The Yorkshire is the only English specimen of the low-bodied, silky-haired terrier. Japan boasts the shan-tung, which is almost indistinguishable from the Skye; and the Maltese terrier, named from the island, has a coat as long and silky as a Blenheim spaniel.

The characteristics of standard varieties are as follows: *Fox-terriers.* Generally gay, lively, and of active appearance, with bone and strength in a small compass, capable of speed and endurance, and weighing about 20 pounds. The head must be broad between the ears and decreasing in width to the eyes; nose tapering and black; ears V-shaped and drooping forward close to the cheek; jaws strong and muscular; legs straight and strong. The coat of the smooth variety is flat and abundant; of the wire-haired variety it is hard, wiry, and broken. The tail, which is usually docked, is set on high and carried gaily, but not over the back. *The bull terrier* is a short-haired terrier, weighing from 15 to 50 pounds, of perfect symmetry, the embodiment of agility, grace, and determination. An all-white coat is most approved, but the American standard permits markings. The tail is left uncropped; in America cropping of the ears is permitted by the standard, but not in England. *The black-and-tan* is judged in three classes not exceeding 7 pounds, 16 pounds, and 20 pounds respectively. He is a typical terrier, jet black, marked with rich mahogany tan as follows: On the head the muzzle must be tanned to the nose, which is black; a bright spot of tan on each cheek, and above each eye; chin, throat, and inside of the ears, and the fore legs up to the knees are tan-color, with black lines up each toe, and a black 'thumb mark' above the foot inside the hind legs. *The Welsh terrier* is a wire-haired variety, black or grizzle and tan in color. The dogs are 15 inches high at the shoulder and 20 pounds in weight. *The Irish terrier* is a wire-haired variety, whole-colored, bright red or wheatten yellow, weighing 24 pounds, active, lively, and lithe—a gamey dog, but with the kindest disposition. *The Bedlington* is a rough-looking, loosely built dog, with the least general expression of the true terrier. He is 15 to 16 inches high and weighs 24 pounds. His coat is shaggy and usually dark blue. *The Airedale,* the latest and largest variety of the family, weighing 40 to 45 pounds, is a wire-haired dog, with the crown, back, and sides black, and the face, throat, and limbs tan; the tail is docked, and the aspect square, trim, and powerful. *The Boston terrier* is purely a pet dog of recent creation, which is as much bulldog as terrier, but has lost the wrinkled face and bowed legs of the former, while retaining its brindled markings and screw tail. It weighs 15 to 30 pounds, and is judged in two classes, large and small. *The Scottish terrier* is a long-barreled, bow-legged, rough-haired dog, weighing from 18 to 20 pounds, with prick ears, and tail carried straight up. This dog has a very sharp, bright, and active expression. His coat is intensely hard and wiry, dense all over his body, and iron-gray, grizzly, or black in color, though sometimes sandy. His feet are large, with strong claws, and he is most capable in unearthing vermin. *The Dandie Dinmont* is from 8 to 11 inches high, weighs from 14 to 24 pounds, and has a mixed coat of hard and soft hair, and a salt-and-pepper color. His ears are long and pendulous. *The Skye terrier,* a good vermin dog, and built low and long (from 8½ to 10 inches high and 22½ inches long), has two coats, the under one short, close, soft, and woolly, the top one 5½ inches long, hard, straight, flat, and free from crisp or curl. The ears and tail are feathered with long soft hair and the tail is never carried higher than the line of the back. In color it is usually a light blue, gray, or fawn. *The Clydesdale,* or *Paisley,* is practically a little Skye with smaller ears, set high and perfectly erect. It is covered with long silky hair, hanging in a fringe down the side of the head. *The Yorkshire* is also practically a smaller Skye, with a more silky coat. He is judged in two classes, one under five pounds and another from 5 to 12 pounds. *The Maltese* was the lap-dog of the Greeks and Romans of the classic period. He is a small, short-legged dog, not exceeding six pounds in weight, with pure white, rather transparent wavy hair, not less than seven inches long. It is called 'terrier' by its devotees, but it might as reasonably be called a spaniel or toy dog. It has almost if not entirely disappeared from Malta.

Consult authorities cited under DOG; and see Plates accompanying that article.

TERRITORIAL WATERS. Waters subject to the jurisdiction of a particular State, as opposed to the high or open seas, which are free to all nations. Territorial waters comprise: First, inclosed waters, such as (a) lakes, rivers, and other inland waters wholly within the confines of a State; (b) lakes or rivers forming the boundary of a State, in which the control of the riparian States, in the absence of exclusive title vested in one of them, extends to the middle of the stream in the case of non-navigable rivers and in navigable rivers to the middle of the deepest channel, boundary lakes being governed by the same rules; (c) bays, straits, sounds, or arms of the sea within headlands belonging to the same State not exceeding two marine leagues apart. Second, uninclosed waters or the open sea to the distance of one marine league outward from low water mark. The status of straits, gulfs, and bays whose central waters lie more than a marine league from any shore and gulfs and bays having a narrow entrance, but broad in extent and reaching far into the land, is not yet clearly defined. They are sometimes claimed as jurisdictional waters, though little occasion has arisen in modern times for the assertion of the claim. To this class belong the bay of Conception in Newfoundland; Delaware Bay, which the United States declared territorial water in 1793; and the 'King's Chambers,' as the waters lying between the headlands of Orfordness and the Foreland were called.

The law relating to inclosed waters is settled. The State within whose territory they lie has title and dominion as well as jurisdiction over them. The title to the land under water and to the shore below high-water mark in navigable lakes and rivers in the United States and ports, harbors, bays, straits, sounds, or arms of the sea is vested in the particular States bounding thereon for the public use and benefit unless otherwise disposed of by such sovereign power, but always subject to the constitutional prerogative of the Federal Government of regulating interstate and foreign commerce thereon. In England and States adopting the common-law principle, these rules apply only to tide waters, all other navigable streams being subject to riparian ownership. (See TIDE WATERS.) Although the sovereignty to which the waters belong has exclusive jurisdiction both civil and criminal over its inclosed waters, a concurrent jurisdiction is sometimes given by usage or treaty to the State of ownership over criminal acts committed on foreign vessels in such waters where its authority is not invoked and where the parties are exclusively foreign and no breach of the peace is committed. Where territorial waters form a channel of communication between two portions of the high sea, the right of innocent passage exists to both the merchant and naval vessels of States at peace with the territorial power, subject to the observance of reasonable regulations relating thereto. The Strait of Dardanelles and the Bosporus are, however, not regulated by the rules of international law, but are the subject of special treaties between the powers. By the convention of October 29, 1888. the Suez Canal was made neutral to all nations. See SOUND DUTIES.

The law relating to the uninclosed waters is not so clearly defined. While claims to dominion over whole seas have vanished from international law, the last assertion being that of the United States to control over Bering Sea (see BERING SEA CONTROVERSY) for the protection of the seal fisheries, yet the process of departure has left behind a remnant of claims to territorial power over considerable stretches of water along the coasts of maritime States, though it is doubtful just how far some of these are alive at the present time.

The nature of the sovereignty does not include ownership, but is a right of jurisdiction limited to the protection of its coasts from the effect of hostilities between other belligerent States, the prevention of frauds upon its customs laws, the regulation of fisheries therein, and the usufructory right to such fisheries. The valid exercise of these prescribed rights is limited to a marine league from low-water mark, and except to secure these, it may not make laws or interfere with the travel of ships over these waters. Apparent exceptions to this rule are sometimes cited in the case of regulations requiring ships entering territorial waters to take on board a pilot at a greater distance than a league from the coast and imposing a penalty for failure to comply with such requirements and customs laws and Hovering Acts authorizing municipal seizures beyond a marine league. Of the latter class are the British acts of 1736 and 1784, asserting jurisdiction for revenue purposes to a distance of four leagues and those of the United States in 1797, 1799, and 1807, to the same effect. Many other maritime nations have similar provisions in their laws. There is some doubt, however, whether the right to make such seizure for violation of customs acts could now be maintained against the remonstrance of a foreign State. See MARE CLAUSUM; HIGH SEAS.

TERRITORIES (OF. *territorie*, Fr. *territoire*, from Lat. *territorium*, district, from *terra*, earth, land). The name given in the United States to certain parts of the national domain which have not been erected into States. In 1903 they were Arizona, New Mexico, Oklahoma, the Indian Territory, the District of Columbia, and Alaska on the Continent, Porto Rico in the West Indies, and Hawaii, the Samoan Islands, Guam, and the Philippine Islands in the Pacific, aggregating a total area of about 962,630 square miles. They may be classified as (1) organized Territories; (2) unorganized Territories; (3) the Federal District; and (4) the insular possessions. In the first class belong Arizona, New Mexico, and Oklahoma. To the second belong the Indian Territory and Alaska. The organized Territories and Hawaii among the insular possessions have popularly elected local legislatures of two chambers chosen for a term of two years by a suffrage determined by local law. This legislative power extends to all rightful subjects not inconsistent with the Constitution and laws of the United States, but any law passed is subject to the veto of Congress. The executive power is vested in Governors appointed for a term of four years by the President of the United States with the consent of the Senate. In the organized Territories there is a series of courts of which the higher ones are held by judges appointed for a term of four years by the President. These courts are not, however, a part of the Federal judiciary. The other important officers of the Territory are likewise appointed by the President and are paid from the Treasury of the United States. The Governors and judges of the Supreme Court receive $3000 a year. The Territories are not regularly represented in Congress, but are allowed to send a delegate, who is given a seat in the House of Representatives with a right to take part in the debates, but not to vote. For the government of Alaska, the Indian Territory, the District of Columbia, Porto Rico, the Samoan Islands and the Philippine Islands, see these titles.

By the United States Constitution the National Congress is given power "to make all needful rules and regulations respecting the territory or other property belonging to the United States." From the beginning this clause was construed as giving the powers incident to jurisdiction as well as to ownership, and even before the adoption of the Constitution the Northwest Territory was regularly organized by the old Confederation Congress, which for this purpose passed the famous Ordinance of 1787. (See NORTHWEST TERRITORY.) This ordinance served as the model for much of the subsequent legislation in the same field, though there were a number of important variations. Thus, in the organization of the Territories of Tennessee and Mississippi the clause of the Ordinance of 1787 prohibiting slavery was omitted. Of the present States of the United States all, except the original thirteen and Vermont, Maine, Kentucky, West Virginia, Texas, and California, have passed through the Territorial stage. Vermont, Kentucky, Maine, and West Virginia were each formed out of territory which belonged to one of the original thirteen States, and Texas and California were regularly admitted to Statehood without ever having been organized as Territories. The size of many of the Territories, however, differed widely from the size of the States which bear the same names, and there has been a radical changing of boundaries. Thus the Territory of Mississippi originally included Alabama; the Territory of Indiana as organized in 1804 contained all of the Northwest Territory except Ohio; the Territory of Illinois as organized in 1809 included the land now constituting the States of Illinois and Wisconsin, and part of Upper Michigan; the Territory of Michigan after 1834 included all of the territory north of Missouri, Illinois, Indiana, and Ohio, and between Lakes Erie and Huron and the Missouri River; the Territory of Oregon as organized in 1848 covered all the territory of the United States north of latitude 42° N., and west of the Rocky Mountains; and the Territory of Nebraska as organized in 1854 contained land now in Montana, the Dakotas, Wyoming, and Colorado.

In connection with the slavery controversy the extent of the power of Congress over the Territories and the District of Columbia early became the subject of debate. Those who favored the restriction of slavery by constitutional means, including members of the Free-Soil and Republican parties (qq.v.), made the question of Congressional prohibition of slavery in the Territories a constant and in some cases a paramount political issue, while the pro-slavery partisans, recognizing that a Territory free from slavery would develop into a State free from slavery and thus disarrange the balance between the free and slave States in the national Senate, fought with great vigor and tenacity all proposed measures which had in view slavery prohibition in the national domain. As early as 1820 petitions were presented for abolition of slavery in the District of Columbia. By the Missouri Compromise (q.v.) of 1820 it was provided that Territories south of the line of latitude 36° 30′ N. might have slavery, while those north of that line should not. The question again came up in 1850, when, as one of the compromise measures, Utah and New Mexico were organized without reference to slavery (see COMPROMISE OF 1850), and in 1854 the so-called principle of popular or squatter sovereignty was established by the passage of the Kansas-Nebraska Bill (q.v.), which had for its basis the right of each Territory to determine for itself whether or not the institution of slavery should obtain within its limits. (See POPULAR SOVEREIGNTY.) In 1859, in the Dred Scott Case, the Supreme Court of the United States decided in an *obiter dictum* that the power of Congress over the Territories was limited by the obligation placed upon Congress to protect private rights in property, that slaves were property, and that, therefore, Congress could not constitutionally prevent slaves from being carried into any of the Territories. In 1862, however, slavery was abolished and slaves were emancipated in all national territory held or to be acquired.

The Territorial stage is one of preparation for the Commonwealth status. The Constitution empowers Congress to erect the Territories into States and admit them into the Union whenever it sees fit. Usually when the Territory has a population equal to that of the Congressional district the inhabitants memorialize Congress to pass an 'enabling act' empowering them to form a constitution, and prescribing the conditions to be fulfilled. In a number of instances, however, the inhabitants without asking for an enabling act have adopted a constitution and then applied for admission to the Union. As the language of the Constitution is not mandatory, but permissive, the question has arisen as to whether Congress in admitting new States may impose such conditions as it chooses, especially if such conditions were not imposed upon the original States. This was the main question in the controversy over the Missouri Compromise (q.v.), since which time Congress has admitted a number of new States under conditions which were not imposed upon the old States.

After the Spanish-American War the exact status of Territories as compared with the National Government and the rights and duties of the National Government with regard to Territories again came into controversy. In 1901, however, in the Insular Cases, the United States Supreme Court decided that Congress may freely determine when new Territories are to be incorporated into the Union, can create such forms of government as it sees fit for all regions outside the limits of the States, and can legislate differently for different parts of the national domain.

TERROR, MOUNT. See EREBUS AND TERROR.

TERROR, REIGN OF. See FRENCH REVOLUTION.

TER′RY, ALFRED HOWE (1827-90). An American soldier, born at Hartford, Conn. He studied at the Yale Law School, was admitted to the bar in 1849, and in 1854 was appointed Clerk of the Superior Court of Connecticut. He was a colonel in the State National Guard from 1854 until May, 1861, when he and his regiment entered the service of the Federal Government. He participated in the first battle of Bull Run, was mustered out the following month, and in September reëntered the service as colonel of the Seventh Connecticut Infantry. From that time until April, 1864, he was engaged in the military operations along the South Atlantic coast. He was promoted to the rank of brigadier-general of volunteers in 1862, and in 1864 he was given command of the Tenth corps of the Army of the James. In January, 1865, he commanded the second, and successful, Fort Fisher expedition. (See FORT FISHER.) Soon afterwards he occupied the city of Wilmington, N. C., which had been the last refuge of the blockade runners. For his services he was commissioned major-general of volunteers, and brigadier-general and brevet major-general in the Regular Army. From June, 1865, to August, 1866, he commanded the Department of Virginia. He was then placed in command of the Department of Dakota, and in 1876 he commanded the main column which drove Sitting Bull and his followers into Canada after the massacre on the Little Big Horn. Later he commanded the Department of the South and the Military Division of Missouri. He retired in 1888.

TERRY, EDWARD O'CONNOR (1844—). An English comedian and manager. He was born in London, and began his career upon the stage in 1863 in Hampshire. In 1867 he made his appearance in London at the Surrey Theatre. Then followed successful engagements at the Strand (1869) and Gaiety (1876) theatres, among his characters being *Paul Pry*, *Little Don Cæsar de Bazan*, and *Bluebeard*. In 1886 he presented at the Olympic Theatre his comedy of *The Churchwarden*. He opened Terry's Theatre in October, 1887, and there, a few months later, produced *Sweet Lavender*, himself playing Dick Phenyl. In 1892 he revived *The Magistrate*. In the season of 1897-98 he appeared in *The White Knight*.

TERRY, ELLEN ALICIA (1848—). A distinguished English actress, known in private life as Mrs. E. A. Wardell. She was born at Coventry. Her first appearance on the stage was as the boy Manilius in Charles Kean's revival of the *Winter's Tale*, at the Princess's Theatre, 1856. In March, 1863, Miss Terry made her appearance at the Haymarket in London, but with her marriage in 1864 she retired from the stage. She reappeared for a short time in 1867, and at length resumed her career in 1874. In 1875 she joined the Bancrofts at the Prince of Wales's Theatre, where she acted the part of Portia. Early in 1878 she had a great success in Wills's play of *Olivia* at the Court Theatre. At the end of the same year she began her long association with Henry Irving at the Lyceum, as Ophelia to his *Hamlet* (December 30, 1878). Of her rôles in the long list of his subsequent productions, only a few can be enumerated, her Portia in *The Merchant of Venice* (1879), which is perhaps her most complete success; Ruth Meadows in *Eugene Aram* (1879); Camma in Tennyson's tragedy of *The Cup* (1881); Juliet (1882); Viola in *Twelfth Night* (1884); Marguerite in *Faust* (1885); Fair Rosamund in Tennyson's *Becket* (1893); Madame Sans-Gêne in Sardou's play (1897); and Clarisse in *Robespierre* (1899). Her work has evoked a great variety of criticism, but its womanly charm is unfailing, and her leading place among English actresses is on the whole undisputed. Her first visit to America with Irving was in 1883, when she won a welcome, repeated many times since. Consult: Hiatt, *Ellen Terry and Her Impersonations: An Appreciation* (London, 1898); Scott, *Ellen Terry* (New York, 1900); id., *The Drama of Yesterday and To-Day* (London, 1899); Cook, *Nights at the Play* (1883); Winter, *Shadows of the Stage* (New York, 1892).

TERRY, MILTON SPENSER (1840—). A Methodist Episcopal minister, educator, and author. He was born it Coeymans, N. Y., educated at Troy University and Yale Divinity School. He entered the New York Conference 1863, serving churches around New York City, 1863-84. He became professor in the Garrett Biblical Institute, Evanston, Ill., in 1885. He has published *Biblical Hermeneutics* (1883); *Sibylline Oracles* (1890); *The New Apologetic* (1897); *Biblical Apocalyptics* (1898); *The New and Living Way* (1902); and several biblical commentaries.

TERSCHELLING, tĕr-skĕl′lĭng. One of the West Friesian Islands, in the North Sea, belonging to the Province of North Holland, Netherlands (Map: Netherlands, D 1). Area, about 20 square miles. Population, in 1899, 3929.

TERSTEEGEN, tĕr′stā-gen, GERHARD (1697-1769). A German mystic, noted as a hymn writer. He was born at Mörs and was a weaver of silk ribbons. After his conversion he practiced great self-denial in order to get means to help the poor. His religious ideas are like those of Angelus Silesius and Poiret, but the cast of his theology is Reformed. Besides his *Letters* (1773-75), he wrote *Lebensbeschreibungen heiliger Seelen* (1733-53) and *Geistliche Brosamen* (1769-74). A collected edition of his writings appeared at Stuttgart (1844-45). Consult: Jackson, *Gerhard Tersteegen* (London, 1832); Winkworth, *Christian Singers of Germany* (ib., 1869).

TERTIAN FEVER. See MALARIA.

TERTIARY (Lat. *tertiarius*, one of the third rank, i.e. after the male and female members strictly belonging to an order, from *tertius*, third, from *tres*, three). A class in the Roman Catholic Church, who, without entering into the seclusion of a monastery, aspire to practice as far as possible in ordinary life the counsels of perfection laid down in the Gospel. Whatever earlier traces of this institution may be observable, there is no dispute that it was under the organizations founded by Saint Francis and Saint Dominic that it reached its full development. The rules for tertiaries, such as they have since substantially been maintained, were made public in 1221. The intending members must restore all ill-gotten goods, must renounce all evil practices, and abandon all feuds and enmities with their neighbors. Wives cannot be received without the consent of their husbands. The obligation of a tertiary, once accepted, is irrevocable, unless the party should be released, or should enter into a more strict religious life. The members are required to renounce luxury; they must frequent the sacraments; hear mass, if possible, daily; observe the fasts of the Church, as well as certain special austerities; cultivate charity toward all, with special obligations toward needy, sick, or afflicted brethren; and practice with more than common fervor the great Christian virtues. It is to be observed, however, that none of these obligations were supposed to bind the members under pain of mortal sin. Consult Adderly and Masson, *Third Orders* (London, 1902).

TERTIARY SYSTEM. A term applied in geology to the group of rocks included between the Cretaceous and the Quaternary systems. It is one of the two periods constituting the Cenozoic era, the Quaternary being the other period. The term Tertiary was first suggested when it was considered that all strata were divisible into three groups, primary, secondary, and tertiary. The first two have been replaced in most localities by other names, but the third is still used, although not with its original significance. The Tertiary is one of the most interesting periods of geological history, presenting most complete sections and a great abundance of organic remains, and yet there has been much difficulty in classifying its different members correctly. The rocks are mostly unconsolidated and have rarely been laid down over great areas, so that in the United States, alone, there are no less than three or four separate regions of Tertiary rocks, in each of which a different series of subdivisions has to be adopted. The following classification of the American Tertiary is that compiled by W. H. Dall:

Pliocene series	
Miocene series	
Oligocene series	Upper or Chipola stage Lower or Vicksburg stage
Eocene series	Jackson stage Claiborne stage Chickasaw stage Midway stage

These main epochs and stages are recognized in all the Tertiary areas of the United States, of which there are four, viz. the Pacific Coast, Western interior, Atlantic Coast, and Gulf States. The section in the last mentioned area is taken as the type.

At the end of the Cretaceous period a great topographic revolution took place in many parts of the world, and at that time the American continent had practically received its present form. The marine Tertiary deposits are found, therefore, chiefly along the borders of the continent, while the interior areas are of fresh-water formation, or perhaps in part æolian deposits. Many of the highest mountain ranges of the world, such as the Alps, Atlas, Caucasus, and Himalayas, were uplifted in the Tertiary period, their height being due to the fact that they are young geologically and consequently have not suffered greatly from erosive agencies.

The life of the Tertiary period presents many similarities to that of the present, although modern types had already begun to appear to some extent in the Cretaceous. In early Tertiary time the climate was very mild over the entire globe, and there was an abundant plant growth far to the north, plants being found in the rocks in many parts of Greenland. A gradual cooling of the climate followed, until at the end of the Tertiary there began the formation of the great continental glaciers that subsequently spread over so much of the temperate zone. The faunal changes that occurred during this period were in many respects remarkable. Of the smaller animals—the ammonites, belemnites, and other molluscan types that swarmed in the Cretaceous—few lived in the Tertiary. The great reptiles had also disappeared, but their place was taken by still more gigantic mammals. The fishes, amphibians, and birds closely resembled modern tpyes.

The Tertiary deposits inclose a variety of economic minerals. In the Cordilleran region many of the metalliferous veins are probably of Tertiary age, as are also some of the bituminous coals and lignites, in this same area, notably in Washington and Oregon. In the Tertiary beds of the Atlantic and Gulf States are many deposits of brick, pottery, and fire-clays, while much of the green sand obtained in the Atlantic coastal plain region is of Tertiary age. In Texas deposits of limonite are known in this formation, while in Florida and South Carolina there are great supplies of rock phosphate. Petroleum and mineral tar are obtained from the Tertiary deposits of southern California.

Bibliography. Dall, *A Table of North American Tertiary Horizons*, Eighteenth Annual Report United States Geological Survey, part ii., page 323; Dana, *Manual of Geology;* Geikie, *Text-Book of Geology*. Other references will be found under the titles referred to below. See Geology; Paleontology; Eocene; Miocene; Pliocene.

TERTUL′LIAN (Lat. *Tertullianus*), Quintus Septimius Florens (born before 160, died after 220). One of the earliest Latin Church Fathers, a prolific writer, and the creator of ecclesiastical Latinity. He was born in Carthage, of heathen parentage, and trained for the profession of the law, which he practiced in Rome. Becoming a convert to Christianity shortly before the end of the second century, he returned to Carthage, where he was made presbyter and spent the rest of his life. About the year 203 Tertullian became a Montanist, and he was thenceforth unsparingly severe in his views of ecclesiastical discipline and in his judgments upon the alleged moral laxity of the 'psychics,' as he called the members of the Catholic Church. No other figure in the early Church stands out so distinctly as does this Carthaginian lawyer-priest. His intensity of character, alert intellect, blunt speech, keen satire, dialectical skill, moral strenuousness, and bitter partisanship, all combine to render him a marked personality. It was no doubt largely the result of his training that the expression of Tertullian's views was made in such a form as to imprint upon Western theology a legalistic character which it never lost, and which, through Augustine, passed over into Protestantism. He enjoys the further distinction of being the first to formulate in Latin the principles by which Catholic orthodoxy could infallibly be known. His *Prescription of Heretics*, for the clearness with which it enunciates these principles, has not improperly been described as 'a classic.' Were it not for his Montanist errors, Tertullian would rank among the greatest of the Latin Fathers. The time and circumstances of his death are unknown; there is no trace of him after about the year 220.

Among his many writings, the best known is the *Apology*, written probably in 197. It is a splendid vindication of the Christians against the attacks and false charges of the heathen world. His polemical zeal was further directed against Jews and heretics, e.g. in his *To the Nations, Against the Jews, Against Marcion, Against the Valentinians,* and *Against Praxeas,* the last named being especially valuable for the history of doctrine. He wrote many tracts on subjects connected with morals and church discipline, e.g. *On Baptism, Penance, Prayer, Patience, Idolatry,* and *Shows.* His characteristic strictness comes out even more strikingly in such works as those on *Women's Apparel, The Veiling of Virgins, Monogamy, The Exhortation to Chastity,* and *Fasting.* Consult: Rainy, *The Ancient Catholic Church* (New York, 1902); Simcox, *History of Latin Literature* (London, 1883); Cruttwell, *Literary History of Early Christianity* (ib., 1893); Teuffel-Schwabe, *History of Roman Literature,* translated by Warr (ib., 1900); Ebert, *Geschichte der Litteratur des Mittelalters* (Leipzig, 1889). The *Works* of Tertullian are published in the *Corpus Scriptorum Ecclesiasticorum Latinorum*, tom. xx., ed. by Reifferscheid and Wissowa (Vienna, 1890); an English translation will be found in *The Ante-Nicene Library*, American ed., vols. iii. and iv. (New York, 1885 et seq.).

TERUEL, tā'rōō-āl'. The capital of the Province of Teruel, in Aragon, Spain, on the left bank of the Guadalaviar, 72 miles northwest of Valencia (Map: Spain, E 2). It is a quaint old town with a handsome Gothic cathedral. Population, in 1900, 9538.

TÉRU-TERU. A lapwing-plover (*Vanellus Cayenensis*) of the eastern part of South America, whose specific characteristics are the long crest and long blunt yellow spur; also its sharp repetitive cry copied in its local name. Its habits on the pampas, where in the breeding season it executes remarkable 'dances,' are described at length by Hudson, who says the bird seems absolutely fearless of man at that period dashing into his face until it becomes a nuisance. Consult Hudson, *Argentine Ornithology* (London, 1888).

TERZA RIMA, tĕr'tsȧ rē'mȧ (It., third rhyme, triple rhyme). A verse form of Italian origin, of which the first and most notable use was made by Dante in the *Divina Commedia*. Each stanza consists of three lines (usually hendecasyllables) with two rhymes; lines 1 and 3 repeat the middle rhyme of the preceding stanza, and thus the series of stanzas is closely interwoven. The series or *canto* is closed by a single line rhyming with the mid verse of the foregoing stanza. The whole scheme may be represented in this way: a b a, b c b, c d c . . . y z y z. Ordinarily the end of a stanza coincides with a pause in the thought, but so cohesible is the form that in the canto the strophic individuality may escape notice. There are several theories as to the development of the terza rima; it is doubtless based on an earlier form, but rather on the *serventese* (Provençal *sirventès*) than on the *ritornello*. Sir Thomas Wyatt, who was much under the influence of Italian models, introduced the stanza into English, choosing it for three satires. Sir Philip Sidney experimented with it in his *Arcadia*, and Milton tried it in a version of the second Psalm. There have been some attempts to preserve the original metre of the *Divina Commedia* in English translation, notably by Byron, who made a version of the Francesca episode in the *Inferno*. Byron's *Prophecy of Dante* is also written in terza rima. The best English specimen of this difficult stanza is Shelley's *Ode to the West Wind*. Consult: Cassini, *Sulle forme metriche italiane* (2d ed., Florence, 1890); Stengel, "Romanische Verslehre," in Groeber's *Grundriss der romanischen Philologie* (Strassburg, 1893, vol. ii., part i.); H. Schuchardt, *Ritornell und Terzine* (Halle, 1875); G. Paris, in *Romania*, vol. iv. (Paris, 1875); and Alden, *English Verse* (New York, 1903).

TESCHEN, tĕsh'en (Pol. *Cieszyn*). A town of Austria or Silesia, 63 miles west-southwest of Cracow, on the right bank of the Olsa (Map: Austria, F 2). It was formerly the capital of the Duchy of Teschen. It has manufactures of modules, carriages, clocks, screws, and furniture. There are also breweries, distilleries, flax-spinning mills, and book-binderies. Teschen is celebrated for the peace, May 13, 1799, which closed the War of the Bavarian Succession. Population, in 1900, 20,454.

TES'LA, Nikola (1857—). An American electrician, born in Croatia. After a course in the schools of his native province, he studied engineering at Gratz to prepare himself as a professor of mathematics and physics, but becoming interested in electricity, he devoted himself to the study of engineering. He worked in the telegraphic engineering department of the Austrian Government until 1881, where he was engineer to an electric company. He then came to America and found employment for a while with the Edison Company at Orange, N. J. Subsequently he devoted himself to experimental research and invented much improved apparatus. He devised the principle of the rotary magnetic field, which made possible the transmission of power by means of the alternating current, particularly on long-distance lines, a system since extensively employed. He is the inventor of various electrical appliances, including dynamos, transformers, induction coils, oscillators, and arc and incandescent lamps, but is principally known for his researches in the matter of alternating currents of high frequencies and very high potentials.

TESSIN, tĕs-sēn′. The German name of the Swiss Canton of Ticino (q.v.).

TEST ACTS. Numerous acts of the English Parliament imposing religious tests upon persons in public office. The most famous are the Corporation Act of 1661 and the Test Act of 1673. The Corporation Act directed that all magistrates should take the oaths of allegiance and supremacy, as well as an oath renouncing the doctrine that it is lawful to take arms against the King, and provided that they must receive communion according to the rites of the Church of England. The Test Act, so called, imposed the like conditions on the holders of all public offices, civil and military, and obliged them in addition to abjure all belief in the doctrine of transubstantiation. Both of these acts were the result of the struggles against the Catholics in the reign of Charles II. They were repealed in 1828 as regards most of the provisions. See England.

TESTAMENT (OF., Fr. *testament*, from Lat. *testamentum*, will, publication of a will, from *testari*, to make a will, attest, testify, from *testis*, witness). Literally, a calling upon witnesses. Technically, in Roman law, a will; an act by which a person determines what person or persons shall take his property after his death. The oldest form of testation at Rome was a declaration in the presence and with the sanction of the Roman people in assembly or meeting as an army on the eve of battle. Of the scope and effect of this form of testation little is known. It could, apparently, be employed by patricians only, and it probably affected only such property as did not form part of the household estate (*pecunia* as distinguished from *familia*). In any case, the later Roman testament was developed on a different and independent basis. It started as a sale (*mancipatio*) of the inheritance, and became a secret and revocable instrument, signed and sealed by the testator and seven witnesses. As this mancipation testament is the ancestor of the testament or will in all modern countries, its development is described under Will. In English and American law the term testament is seldom employed except in the formal phrase 'last will and testament,' though its related terms—*testator*, one who disposes of property by will; *intestate*, one who dies without a will; *intestacy*, the state of leaving property undisposed of by will; and *testamentary* in various combinations, as 'testamentary act,' 'testamentary guardian,' 'letters testamentary,' etc.—are in common use. Consult the authorities referred to under Will.

TESTAMENT OF LOVE, The. A prose work erroneously credited to Chaucer by Speght in the 1598 edition. It was written about the close of the fourteenth century by a prisoner in peril of his life, and modeled on Boethius's *Consolation of Philosophy*, substituting for philosophy Divine Love.

TES′TAMEN′TUM PORCEL′LI (Lat., Last Will of a Little Pig). An amusing Latin skit parodying the legal testamentary forms. It is of unknown authorship, and was written before the fourth century A.D. According to Saint Jerome, it was a favorite piece for recitation by schoolboys. The little pig disposes of his various parts to his friends and relatives, all of whom bear names suggestive of some form of pork. The text is printed in Bücheler's smaller edition of Petronius (Berlin, 1886), and is edited with English notes in Peck and Arrowsmith's *Roman Life in Latin Prose and Verse* (New York, 1894).

TESTIMONY (from Lat. *testimonium*, testimony, from *testis*, a witness). The declarations or statements as to the facts in issue made by witnesses in a judicial proceeding. This may include such written statements as are admissible under the rules of evidence. Although the terms evidence and testimony are often used interchangeably, the former is strictly a more general term, including every legal means of proving facts, as, for example, the introduction of an object for inspection by the jury, whereas testimony is properly only that portion of the proof which is directly adduced from witnesses. A party may impeach or show to be false the testimony of his adversary's witnesses, but cannot impeach the credibility of one of his own witnesses. The testimony in a case includes both the direct and cross-examination of witnesses. See Evidence, and the authorities there referred to.

TESTING MACHINE. A machine employed for testing and determining the strength of materials used in construction and engineering works. In order to determine the strength of a given material such as the iron or steel used in a boiler or engine, the wood of a building, or brick, stone, cement, etc., it is usual to select small samples and submit them to stresses of varying degrees, from which the characteristics of the material may be learned and various numerical values obtained. Testing machines may depend upon the action of an hydraulic press or of a system of screws and gears by means of which a given force applied can be greatly multiplied by the time it is directly exerted on the piece under test. The various tests will be found discussed under Strength of Materials, to which the reader is referred.

TESTRY, tĕs′trē′. A village of France, near Péronne, in the Department of Somme, noted as the scene of a battle (687) in which Pepin of Heristal, the Austrasian Mayor of the Palace, defeated the forces of Neustria and Burgundy, thus bringing the three Frankish kingdoms under his power. See Franks.

TESTU′DINA′TA. The reptilian order Chelonia (q.v.).

TESTU′DO (Lat., tortoise). A device of Roman warfare, by means of which a body of men advanced for assault. The attackers would move in close order, with their shields held above their heads, the edges overlapping. The effect closely resembled the shell of a tortoise (*testudo*), and proved a very effective protection from the darts and weapons of the defenders. A later improvement was the *testudo* machine, which moved on wheels and was roofed over, and under the protection of which soldiers could destroy or undermine the walls of the defenses. A modified form of the same principle is seen in the flying sap.

TET′ANUS (Lat., from Gk. τετανός, spasm, tension, from τείνειν, *teinein*, to stretch, strain), or Lockjaw. An infectious disease characterized by tonic spasms of the voluntary muscles, with marked exacerbations. The contractions may be confined to the muscles of the lower jaw (trismus), to certain other groups of muscles, or involve all the muscles of the body. The disease is dependent on a bacillus, discovered by Nicolaier in 1884, and cultivated by Kitasato in 1889. The bacillus forms a slender rod with rounded ends, and exists in dust and surface soil. This accounts for the fact that wounds infected by dust are often followed by tetanus. The organism gains entrance to the tissues often through wounds so slight as to be overlooked. The disease may follow surgical operations or childbirth, infecting the mother through the parturient canal and the child *via* the cut umbilical cord. Vaccination wounds are sometimes the port of entry for the bacillus. In a very few instances the disease is claimed to be *idiopathic* and to follow exposure to cold or damp.

After an injury the disease sets in usually within ten days. Without any warning the patient feels a stiffness at the back of the neck, and then in the jaws, so that he is unable to open his mouth widely or to masticate properly. These symptoms continue for a day or two, or the patient may rapidly come to the stage of general rigidity, in which the muscles of the trunk and extremities are affected. The back becomes rigid and arched (opisthotonus); the muscles of the abdomen become hard and boardlike; respiratory movements are limited by the rigid muscles. By this time the jaw is firmly closed by contraction of the masseter muscles, and the other muscles of the face drawn into the painful smile known as the *risus sardonicus*. When this stage has been reached violent convulsions of the hitherto rigid muscles supervene. During a paroxysm the patient's teeth are tightly clenched, while the breathing process is held in temporary suspension, with imminent danger of death. The spasms are intensely painful, and occur at first at intervals of half an hour or more with gradually increasing frequency as the disease progresses. Muscular contractions are sometimes so forcible as to rupture a muscle or break a bone. In a majority of cases the disease progresses to a fatal end in a few days; the paroxysms become more violent and frequent and death comes from exhaustion, fixation of the respiratory muscles, or spasm of the glottis. There may be little fever during the attack, but before death an extraordinary rise in temperature may take place.

The treatment of tetanus is unsatisfactory. About 90 per cent. of the traumatic cases die, and about 50 per cent. of other cases, the result depending to a great extent on the size of the wound and severity of the infection. The bacilli multiply and produce their toxins in the neighborhood of the injury, and when this can be found it is to be opened freely and treated with antiseptics to prevent further infection. The drugs having the best results in tetanus are chloral, potassium bromide, and calabar bean, with the occasional use of chloroform to control violent spasms and opium to produce sleep. In many cases cure follows the injection of an antitetanic serum, derived from the blood of a horse that has been rendered immune by repeated injections of a culture of the bacillus. (See SERUMTHERAPY.) A great many cases of infantile tetanus can be prevented by antiseptic treatment of the stump of the umbilical cord. Tetanus in infants (*trismus nascentium*) is very fatal, being uninfluenced even by antitoxin. Consult: Moschcowitz, *Tetanus* (Philadelphia, 1900); Bassano, *Recherches expérimentales sur l'origine microbienne du tétanos* (Paris, 1900).

TETANUS, IN ANIMALS. A disease attributed to the action of Bacillus tetani, which attacks domestic animals, most frequently horses and sheep. It is usually produced by cold and wet, by intestinal worms, obstinate constipation, or injuries. Considerable doubt exists, however, as to the nature of spontaneous tetanus. The symptoms usually come on gradually, involving most of the muscular structures, which become hard and rigid. The nose is protruded, the limbs move stiffly, the tail is upraised, the bowels are constipated. The patient must be kept perfectly quiet, and in an airy but comfortably warm place, and plentifully supplied with cold water, and soft, sloppy, but nutritious food, which he will usually greedily suck in through his firmly closed teeth. Any discoverable wound should be fomented or poulticed; bleeding, sedatives, and all causes of irritation must be avoided. The only promising treatment thus far discovered consists in injections of antitetanus serum as soon as the disease is diagnosed. Many cases of tetanus may be prevented by applying antiseptic washes to wounds in which the tetanus bacillus may become lodged. In adult animals most cases are fatal: but among young animals, especially when the attack results from exposure to cold, many recoveries occur.

TÊTE DE PONT, tât d*e* pôɴ (Fr., bridgehead). An important field-work fortification, generally open at the gorge. The flanks rest on the banks of a river, thus securing command of or covering one or more bridges. See FORTIFICATION.

TE′THYS (Lat., from Gk. *Τηθύς*). In Greek mythology, daughter of Uranus and Gæa, and, by Oceanus, mother of the Oceanids and river gods.

TETRACHORD (from Gk. *τετράχορδος*, *tetrachordos*, having four strings, from *τέτρα-* *tetra-*, four + *χορδή*, *chordē*, string, cord). In music, a system of four tones comprised within the compass of perfect fourth. The Greek scales were composed by joining two tetrachords. In the Middle Ages the tetrachord was superseded by the hexachord, introduced by Guido d'Arezzo. See GREEK MUSIC.

TETRADYMITE (from Gk. *τετράδυμος*, *tetradymos*, four-fold, from *τέτρα-*, *tetra-*, four; so called from its frequent occurrence in twin crystals). A mineral bismuth telluride frequently containing sulphur and selenium. It is crystallized in the hexagonal system, has a metallic lustre, and is of a steel-gray color. It is found in Norway, Sweden, and in the United States at various localities in Virginia and North Carolina.

TET′RAGRAM′MATON (Gk. *τετραγράμματον*, word of four letters, neu. sg. of *τετραγράμματος*, *tetragrammatos*, having four letters, from *τέτρα-*, *tetra-*, four + *γράμμα*, *gramma*, letter, from *γράφειν*, *graphein*, to write). A term used to designate the name of Israel's God, consisting of the four letters Y H W H. In the Massoretic text it occurs 6823 times and is written with the vowels of Adonai 'Lord' (originally 'my Lord'), or with those of Elohim, 'God.' By these vowels the reader was warned not to pronounce the divine name, but to substitute for it Adonai or Elohim. (On the reasons for this custom, see JEHOVAH.) It is found as early as in the second century B.C. in the Greek version (see BIBLE), which uses Κύριος, *Kyrios*, 'Lord,' for the tetragrammaton. The editorial revision of Book II. in the Psalter (Psalms xlii.-lxxii.) also substitutes for it Elohim. There is little room for doubt that the original pronunciation was Yahwe, the final *h* being inaudible. According to Theodoret the Samaritans (q.v.) pronounced the name Ἰαβέ, *Yabe* or *Yave*, and this statement is borne out by extant Samaritan hymns where the rhyme indicates that pronunciation. The same pronunciation is ascribed to a Christian sect by Epiphanius and is found in Egyptian papyri. An Ethiopic manuscript gives the form Yawe, in which the vowels are indicated. The name *Iao* frequently found in manuscripts and papyri goes back to Yahu. That Yahu or Yah existed in Syria as a divine name before the Hebrew invasion is probable and receives some support from Egyptian inscriptions. The fact that it occurs chiefly in late Old Testament writings may be due to an archaistic tendency not seldom seen in connection with the liturgy. Yah at the end of a name and Yeho at the beginning meet us so often in pre-exilic times that it is likely to be very old. It is also significant that Yahwe never seems to be used in theophorous names. Since it was at all times permitted to pronounce Yahu, it is not strange that the Greeks and Romans should have got the impression that the name of the god of the Jews was *Iao*. The earliest datable occurrence of the tetragrammaton is in the inscription of King Mesha of Moab, c.840 B.C. Through the Samaritans and certain Jewish sects the knowledge of the proper pronunciation was perpetuated. While the Samaritans of the seventeenth century refused to divulge this secret, Sabbatai Zewi (see MESSIAH), the famous mystic and claimant to the Messiahship, insisted upon the pronunciation of the tetragrammaton. The hybrid form Jehovah, made up of the consonants of Yahwe and the vowels of Adonai, was first used in 1520.

Consult: Baudissin, *Studien zur semitischen Religionsgeschichte* (Leipzig, 1876); Driver, in *Studia Biblica* (Oxford, 1885); Dalman, *Der Gottesname Adonaj und seine Geschichte* (Leipzig, 1889); W. Max Müller, *Asien und Europa* (Leipzig, 1893); Dietrich, in *Zeitschrift für alttestamentliche Wissenschaft* (Giessen, 1883); Deissmann, *Bibelstudien* (Marburg, 1895).

TETRAHEDRON (from Gk. τέτρα,- *tetra-*, four + ἕδρα, *hedra*, base). A solid bounded by four planes. It appears in nature, and as a crystal is classified as a secondary form of the octahedron, produced by removing the alternate angles or edges of the latter. See POLYHEDRON.

TETRALOGY (from Gk. τετραλογία, *tetralogia*, group of four dramas, from τέτρα-, *tetra-*, four + λόγος, *logos*, word). (1) In Greek drama, a series of three tragedies and a satyric drama presented in sequence. The satyric drama was in some cases connected with the tragedies in subject, but its main purpose was to relieve the tension caused by the trilogy. (2) A musical drama in four parts. Wagner's famous tetralogy, *Der Ring des Nibelungen*, consists of *Das Rheingold*, *Die Walküre*, *Siegfried*, and *Götterdämmerung*. See TRILOGY.

TETRAMETER. See VERSIFICATION.

TETRAPOLITAN CONFESSION. See SACRAMENTARIAN.

TE'TRARCH (Lat. *tetrarches*, from Gk. τετράρχης, governor of a fourth of a country, from τέτρα-, *tetra-*, four + ἄρχειν, *archein*, to rule). Originally, the governor of one of four divisions of a kingdom or country; but, in the usage of the later Roman Empire, any minor ruler, especially in the East, possessing sovereign rights within his territory, but dependent on, and in many cases removable at the pleasure of, the Emperor. This was especially the case in Syria, where the princes of the family of Herod are called indiscriminately by this title (Luke iii. 1) and by that of king (Matt. xiv. 9). The tetrarch in this latter sense was in truth a sovereign, although a dependent sovereign; and there are instances in which the title seems to have been applied to really independent sovereigns of small principalities.

TETSCHEN, tĕch′en. A town of Bohemia, situated on the right bank of the Elbe, near the Saxon frontier. An active industrial place, having a number of factories and carrying on a lively trade, it is the emporium for the shipping traffic on the Elbe, and with its picturesque surroundings is also the culminating point of that part of the Elbe Valley included in Saxon-Bohemian Switzerland. The handsome château of Count Thun, built in 1667-73, with a fine park, garden, and hothouses, library, and collection of coins and weapons, was once fortified and a place of some importance in the Seven Years' War. Population, in 1890, 7299; in 1900, 9698, Germans.

TETTENBORN, tĕt′en-bôrn, FRIEDRICH KARL, Baron (1778-1845). A German soldier, born in the Principality of Sponheim. He entered the Austrian Army in 1794, serving in the wars of the French Revolution. At the battle of Wagram, in 1809, he won distinction by his bravery. Just before the invasion of Russia by Napoleon in 1812 he entered the Russian Army as a lieutenant-colonel, commanded Kutusoff's vanguard, and greatly harassed the French on their retreat. In 1813 he entered Berlin, together with the Russians, and thence proceeded to Hamburg, which he occupied, but whence he was driven, May 30th. He next fought against Davout and Pecheux and captured Bremen October 15th. He served with Bernadotte in Jutland and on the Rhine in 1814. In France, during the invasion of the Allies, he did excellent service in keeping open communications. In 1818 he entered the service of Baden, and in 1819 was promoted to be lieutenant-general, and was sent as Ambassador to Vienna, where he died.

TETUAN, tĕt-wän′. A town of Morocco about 30 miles southeast of Tangier, on the Martil. It lies in the midst of fine gardens and is surrounded by dilapidated walls. In the background loom the Rif Mountains. The rows of white houses rise in terraces. The streets are narrow and dirty, but there are many fine residences built by the Moors expelled from Spain. Gun-barrels, coarse woolen cloth, and sashes are manufactured. Grain, fruits, wool, silk, leather, and beef cattle are exported, mainly to Gibraltar.

The port, fortified by two forts, is one mile below the town at the mouth of the Martil, and is the only open Mediterranean port in the country. Population, about 25,000, of which 6000 are Jews. Tetuan was the centre of operations in the Spanish-Moroccan War of 1859-60. General O'Donnell received the title of Duke of Tetuan.

TET′ZEL, Johann (c.1460-1519). A German Dominican, famous for his connection with the Reformation through Luther's attacks on his sale of indulgences. He was born at Pirna, in Saxony, about 1460, and educated at the University of Leipzig, where he graduated in 1487, soon afterwards entering the Dominican Order. Being a popular and effective preacher, he was intrusted with the proclamation of an indulgence, first on behalf of the Teutonic Knights from 1504 to 1510, and from 1516, as a subordinate of Albert of Brandenburg, Archbishop of Mainz, on the occasion of the indulgence published in favor of contributors to the building fund of Saint Peter's at Rome. It was in opposition to the preaching of Tetzel that Martin Luther published his celebrated theses, on October 31, 1517. Tetzel published a series of counter-theses in the following January, and in May a reply to Luther's celebrated sermon on indulgences. In January, 1519, he was called upon to appear before the Papal legate Von Miltiz to answer charges made against him, and was severely rebuked for unguarded language and improprieties in procedure. For his life consult Hermann (Frankfort, 1883); Paulus (Mainz, 1898); Körner (Frankenberg, 1880); Kayser, *Geschichtsquellen über Tetzel* (Annaberg, 1877); and Röhm, *Zur Tetzel-legende* (Hildesheim, 1890).

TEUBNER, toip′nẽr, Benedictus Gotthelf (1784-1856). A German bookseller, printer, and publisher. He was born at Gross-Kraussnigk, and became a bookseller at Leipzig in 1811. His house soon grew to be one of the most important in Germany. In 1832 he founded a printing house in Dresden. The firm is best known for cheap, accurate, and scholarly editions of Greek and Latin classics.

TEU′CER (Lat., from Gk. *Τεῦκρος*, *Teukros*). The name of two kings in Greek legend. The first seems merely an invented eponymous hero for the *Teucri*, traditionally the early inhabitants of the Trojan plain. He is not mentioned in the early epic, but later is called the son of the river-god Scamander and a nymph of Mount Ida. Another version brought him from Crete. It was said that he gave his daughter, Bateia, in marriage to Dardanus (q.v.), who succeeded him as king. The other Teucer appears in the *Iliad*, and remained a popular figure of legend. He was the son of Telamon, King of Salamis, and Hesione, daughter of Laomedon, King of Troy. He accompanied his half-brother Ajax (q.v.) to Troy, where he was the best archer among the Greeks, but on his return his father would not allow him to land at Salamis because he had not avenged the death of his brother Ajax nor brought back Tecmessa and her son by Ajax, Eurysaces. Teucer sailed for Cyprus, where he founded another Salamis.

TEUFELSDRÖCKH, toi′fels-drĕk, Herr. In Carlyle's *Sartor Resartus*, the eccentric German professor whose speculations on the 'philosophy of clothes' forms the vehicle for the satire of the work.

TEUFFEL, toi′fel, Wilhelm Sigmund (1820-78). A German classical scholar, born at Ludwigsburg. He studied at Tübingen, where he became professor in 1849. His principal work is the *Geschichte der römischen Litteratur* (Leipzig, 1870, 5th ed. 1890). It has been translated into English. Teuffel also published *Studien und Charakteristiken zur griechischen und römischen sowie zur deutschen Litteraturgeschichte* (Leipzig, 1871, 3d ed. 1889), and *Lateinische Stilübungen*, besides editions of the *Persæ* of Æschylus and the *Clouds* of Aristophanes.

TEUTOBURGER WALD, toi′tō-bo͝ork′ẽr vält. See Arminius.

TEUTONES. See Teutonic Race.

TEUTONIC AND SCANDINAVIAN MYTHOLOGY. See Scandinavian and Teutonic Mythology.

TEUTONIC KNIGHTS (The Teutonic Knights of Saint Mary's Hospital at Jerusalem). An order of knighthood, which originated in a brotherhood formed by German knights in 1190 during the siege of Acre by the Crusaders and recognized by Pope Clement III. in 1191. In 1198 this association was changed into an order of knighthood as a balance to the political influence of the Templars and Hospitalers. Hermann von Salza, grand master from 1210 to 1239, saw no future in Palestine, and the order engaged in the conquest of the heathen Prussians, inhabiting the Baltic regions to the northeast of Germany. After a fierce struggle of half a century they completed their subjugation in 1283. Christianity was planted with fire and sword, cities were founded, and the land was colonized by Germans. In 1237 the Teutonic Knights absorbed the order of the Brothers of the Sword, and so acquired Livonia and Kurland. They waged long wars with the Lithuanians for the possession of the territory intervening between these regions and the Prussian country. Early in the fourteenth century they extended their dominion westward, making themselves masters of Danzig and Little Pomerania (Pomerellen). They became a great power and their State prospered, but the Knights themselves remained a ruling aristocracy, and were hated by the conquered natives and Germans alike. In 1410 the power of the Teutonic Knights sustained a great blow through their defeat in the battle of Tannenberg at the hands of the Poles and Lithuanians. In 1466 they were compelled in the Treaty of Thorn to cede West Prussia to Poland and to agree to hold East Prussia as a Polish fief. Half a century later the Knights of the Sword cut loose from the Teutonic Knights, whose dominion was now restricted to East Prussia. In 1525 the grand master, Albert of Brandenburg (q.v.), having embraced Protestantism, laid down his office and converted the State over which he ruled into the hereditary Duchy of Prussia, for which he did homage to the King of Poland. The order was composed of knights, priests, and servants. The rule followed was that of Saint Augustine. The insignia was the white mantle with the black cross. After the secularization of the Prussian domain of the Teutonic Knights the order continued to exist in Germany, having numerous possessions, mostly of very small extent, scattered throughout the Empire. Its head resided at Mergentheim (now a town of Württemberg). The order was abolished by Napoleon in 1809, and its possessions were confiscated. It was revived as an Imperial Austrian order in 1834. Its head is an Austrian archduke. Consult: Strehlke, *Tabulæ Ordinis Theutonici* (Berlin, 1869); Voigt, *Geschichte des deutschen Ritterordens* (1857-60).

TEUTONIC LANGUAGES (Lat. *Teutonicus*, from *Teutoni, Teutones*, a people of ancient Germany, connected with Goth. *þiuda*, AS. *þēod.*, OHG. *diot*, Ir. *tūath*, Lith. *tautà*, Oscan, *touto*, country, people), or Germanic Languages. The group of languages of the Indo-Germanic family (see Indo-Germanic Languages) spoken by the Teutonic or Germanic stock. (See Teutonic Race.) It is divided into three main groups: East Teutonic, North Teutonic, and West Teutonic, or perhaps, more familiarly, East Germanic, North Germanic, and West Germanic. It has been the custom, for very slight grammatical reasons, to group East and North Germanic together as East Germanic, but the threefold division is now definitely established.

East Germanic. This division seems to be entitled to the collective name Vandal. The more prominent East German peoples were the Goths (q.v.), the Vandals (q.v.) (in the narrower sense), and the Burgundians. (See Burgundy.) Of the last-named only scanty linguistic remnants have survived, which are discussed by R. Kögel, in Haupt's *Zeitschrift für deutsches Altertum*, vol. xxxvii. (Berlin). Of the language of the Vandals likewise little remains. The remnants of their dialect are treated by Wrede, *Ueber die Sprache der Vandalen* (Strassburg, 1886). The most important of the East Germanic peoples were the Goths. (See Gothic Language.) The Gothic language perished with their empires, except that a last remnant of Goths found an oasis in the Crimean peninsula. Busbecq, a Flemish traveler, in the middle of the sixteenth century, still heard the Gothic language spoken there, and selected eighty-six words as specimens of the language (Krim or Crimean Gothic). Our knowledge of Gothic depends almost entirely upon the language of the Visigoths in the Roman province of Mœsia, as written down by Ulfilas (q.v.). Here the Teutonic dialects emerge for the first time from semi-barbarism into literary form.

North Germanic. The four dialects of this group, Swedish, Danish, Norwegian, and Icelandic, show but slight traces of dialectic difference before the eleventh century, as is proved by the evidence of the Norse runes (q.v.). The Scandinavian languages after the eleventh century, however, are divided into East and West Scandinavian, or East and West Norse. The eastern division consists of Swedish (including the dialect of the island of Gotland) and Danish; the western division of Norwegian and Icelandic.

West Germanic. Linguistically West Germanic is best divided into Anglo-Saxon or English, Frisian, Low German (Old Saxon), Franconian, and High German.

Anglo-Saxon or English.—The history of the English language may be divided into four periods: (1) Anglo-Saxon with its four slightly differentiated dialects, Northumbrian and Mercian, forming the Anglian branch, and West Saxon and Kentish (Jutes), forming the Southern branch. Anglo-Saxon records begin with the eighth century; the language lasted till the middle of the thirteenth century, when it assumed the character of (2) Old English (1250-1350), followed by (3) Middle English (1350-1550), to which succeeded (4) Modern English. See Anglo-Saxon Language and Literature; English Language.

Frisian.—Frisian is still spoken in Holland, but in general Low German has taken its place. A branch of this language, called North Frisian, is still spoken in the southern part of the west coast of Schleswig and in the adjacent islands, Sylt, Föhr, and Amrum, as well as Helgoland. Old Frisian and the Anglian dialect of Anglo-Saxon are closely related in grammar and vocabulary. See Frisian Language.

Low German (Old Saxon).—Low German speech differs markedly from Anglo-Saxon. The name Saxon has spread so far from its original home that we may safely suppose that the Saxons in the course of their conquests in North Germany spread their name politically, but at the same time blended their speech with that of the conquered tribes. In its modern continuation Old Saxon is Plattdeutsch. See German Language; Plattdeutsch.

Franconian.—The Franconian dialects of the present day in Middle Germany (Middle Franconian, Rhenish Franconian, and East Franconian) differ but little from High German. (See German Language.) The Lower Franconians (Franks) settled in the Netherlands during the early centuries of the Christian Era. The Franconian dialect spoken there down to the sixteenth century is called Old Low Franconian. It is continued to the present day in the Dutch of Holland, and in the Flemish of Flanders in Belgium. See Dutch Language; Flemish Language.

High German.—For the character of High German speech, for its extent and distribution in modern times, and for the development of literary Modern High German, see German Language.

General Characteristics. The Teutonic languages have, perhaps, more than any other Indo-Germanic languages, developed striking special characteristics which differentiate them from the remaining languages of the family. These concern vocalism, consonantism, declension, and conjugation. As regards vocalization the Teutonic treatment of ablaut (q.v.) is peculiar. In the common Indo-Germanic period ablaut was a purely phonetic phenomenon, but in the Teutonic languages, owing to the prevailing loss of the reduplication (q.v.) in the perfect of the verb, and the reduction or loss of endings, ablaut has been adapted to a quasi-grammatical property. Thus the changes of the root vowel in Greek δέρκομαι, δέδορκα, ἔδρακον, are identical with those in German *werde, ward, geworden*, but in the Greek the vocalic changes are not associated consciously with the changes of tense. On the other hand, in the German *ward* the vowel *a* carries the preterite sense of the verb. Even more clearly the vowels have become grammatical in English *sing, sang, sung*, and many similar sets. The prominence of the ablaut has also contributed to analogical spread, and a considerable degree of generalization which has resulted in the six so-called ablaut-series which comprise the majority of the so-called strong verbs. Some of the types of these series in Gothic are: *beita, bait, bitum*, 'to bite;' *kiusa, kaus, kusum*, 'to choose;' *binda, band, bundum*, 'to bind.' The phenomenon known as umlaut (q.v.), that is, the assimilation of a given vowel to the vowel of a neighboring syllable, although it rests upon a universal phonetic tendency, is also specially prominent in all periods of the history of Teutonic speech. Thus, in Old High German *a* changes to *e* before *i* in a following syllable; singular *lamb*, 'lamb,' but plural *lembir* (New High German *Lamm* and *Lämmer*); or *u* changes to *ü* (*ui*) before *i* in a following syllable; singular *chrūt*, 'weed,' but plural *chriuter, chriutir* (New High German *Kraut* and *Kräuter*). Umlaut has also been adapted to grammatical distinction, as in German *Mann, Männer*, and English *man, men;* in the latter case, owing to the loss of endings the umlaut of *men* has become the sole sign of the plural.

Very characteristic is the treatment of the Indo-Germanic lingual and nasal vowels in all Teutonic languages, as *u* + lingual or nasal, giving the groups *ur, ul, um*, and *un;* e.g. Indo-Germanic **u̯l̥qos*, Skt. *vr̥ka*, 'wolf,' appears in Gothic as *wulf*, and Indo-Germanic **k̑m̥tom*, Skt. *śatam*, 'hundred,' appears in Gothic as *hund*.

The most characteristic of all Teutonic phenomena is the series of changes which has taken place in the original Indo-Germanic stop consonants, the so-called shift or 'rotation' of consonants, known as Grimm's law (q.v.). A group of exceptions concerning the continuance in Teutonic of the Indo-Germanic tenues, both aspirate and non-aspirate, as either surd or sonant fricatives, according to the position of the word-accent, was explained by Karl Verner. See VERNER'S LAW.

In the domain of noun-declension the most important Teutonic phenomenon is the spread of the *n*-stems, giving rise to the important distinction between the weak declension (*n*-declension) and the strong declension (declensions without *n*). Especially, every adjective may be inflected according to the weak or *n*-declension, being then used as the so-called definite form of the adjective in connection with the definite article, in distinction from the indefinite adjective with the indefinite article. The starting point for this is prehistoric. Already in Indo-Germanic times adjectives were substantivized by transition to the *n*-declension. A parallel to the double adjective is found in the Balto-Slavic languages, which have produced a 'definite' adjective by compounding the 'indefinite' with the pronominal stem *i̯o-*.

The most important feature of the Teutonic languages in the field of conjugation is the distinction between strong and weak verbs, based in the main upon the different treatment of the perfect. The strong verbs were originally primary; they employed the non-thematic, and very largely reduplicated, perfect of Indo-Germanic times; as Gothic present *waírþa*, 'I become,' perfect *warþ* The weak verbs were mostly secondary or denominative present stems, which supplied their perfect by a periphrastic form made by fusion of the verb-stem with a preterite form of the root *dhē*, 'to set,' as Gothic present *nasja*, 'I save,' perfect *nasida*. Especially in the later periods of Teutonic speech the historical limits of the two classes are effaced. The old type of preterite-presents, which are presents in function, also associate with themselves the weak perfect, so that German *weiss*, 'know' (Gothic *wait*, Greek *οἶδα*) forms the weak perfect *wusste*, 'knew.' Consult: Grimm, *Deutsche Grammatik* (new ed., Berlin and Gütersloh, 1870-97); Streitberg, *Urgermanische Grammatik* (Heidelberg, 1896); Dieter, *Laut- und Formenlehre der altgermanischen Dialekte* (Leipzig, 1898 et seq.); Paul, *Grundriss der germanischen Philologie* (2d ed., Strassburg, 1901 et seq.). See also the articles on the various languages of the Teutonic group and the bibliographies there given.

TEUTONIC RACE. The name applied to a division of the European peoples, comprising nearly the whole or the bulk of the population of the German Empire, the Scandinavian countries, the Netherlands, Great Britain, Switzerland, the United States, Canada, Newfoundland, Australia, New Zealand, and Cape Colony, about two-thirds of the inhabitants of Cisleithan Austria, and half the population of Belgium (Flemings). It is also represented by large numbers in Hungary and in the Baltic Provinces, Finland, and other parts of Russia, and is found scattered over the whole world. They have long heads and faces, very light hair, blue eyes, tall stature, and narrow, aquiline noses. The oldest traceable home of the Teutons seems to have been in the region between the middle and lower courses of the rivers Elbe and Oder. Adjacent tracts, reaching to the river Vistula in the east, to the Harz Mountains and the Thuringian forest in the south, from the Elbe to the Rhine in the West, and across Denmark to the Scandinavian peninsula in the north, were all occupied by Teutons about the second century B.C. Pliny and Tacitus mention the Basternæ, or Bastarnæ (q.v.), who appear on the Black Sea about B.C. 200. Next of the Germanic races to force their way southward were the Cimbri (q.v.), who came down about 2000 years ago from their northern home in the Cimbrian (Danish) peninsula, were joined by the Helvetian Teutones, and penetrated as far as Upper Italy, only to be destroyed by Marius in B.C. 102-101. Cæsar, bent upon conquering Gaul, clashed with another German tribe, the Suevi (Swabians). The defeat of Ariovistus in B.C. 58, and the subsequent invasions of Germany by the Roman legions, prevented the Germanization of Gaul, and confined the Germans within the Rhine. Several centuries after Christ came the later migrations. Of these the principal ones were those of the Burgundians, Vandals, and Goths, from Eastern Germany southward toward the Danube, and thence westward into Italy, Gaul, Spain, and Africa, and the conquest of the Celtic Britain by the Saxons, Jutes (Danes), and Angles. Later followed the piratical Viking raids of the Norse Danes and Norwegians into the northern islands of Europe, into France (Normandy), and the Mediterranean coast. Simultaneously with these movements occurred the colonization of Iceland, followed by the settlement of Greenland. Afterwards came the Norman conquest of England and of Southern Italy and Sicily.

The original home of the Burgundians (q.v.) was on the west side of the upper course of the river Vistula. In the third century A.D. they migrated to the region of the Lower Danube. At the end of the same century they migrated westward; at the beginning of the fifth they founded their kingdom in the Rhenish Palatinate. This kingdom was destroyed in 437 by the Huns; the Burgundians settled in Savoy, and thence they founded a new State on the banks of the river Rhone, which fell into the hands of the Franks in 534. After that they were Romanized. See BURGUNDY.

The earliest traceable home of the Vandals seems to have been on the shores of the Baltic. From there they seem to have migrated to the region of the Riesengebirge ('Vandal Mountains') to the north of Bohemia. But in the third century they are found in the far south in Dacia by the side of the Goths. At the beginning of the fifth century they moved with other German tribes into Gaul, thence into Spain, finally crossing over into North Africa to found there in 429 their famous empire. This was destroyed by the Byzantine Emperor Justinian in 534. See VANDALS.

The earliest home of the Goths in historic times seems to have been to the east of the Burgundians on the east side of the upper course of the river Vistula. In the third century A.D. they had settled in the Roman province of Dacia north of the Lower Danube and in the adjoining region north of the Black Sea. At that time they were already divided into Visigoths, or West Goths, and Ostrogoths, or East Goths. The Gepidæ, a closely related tribe, had followed them south and were located to the north of the Visigoths. Momentum was imparted to this great Teutonic mass by the incursions of the Huns, who began at that time to pour into Europe through the great gate between the Ural Mountains and the Caspian. The East Goths submitted to the Huns. The Visigoths, after seeking refuge in the Roman dominions south of the Danube, began that important westward movement which first landed them in Italy, whence they were expelled; next in Gaul, of which they conquered the region between the rivers Rhone and Loire, and the Pyrenees; and finally in Spain, where they sustained themselves until they succumbed to the Saracens in 711. The Ostrogoths, submitting to the Huns, became part of Attila's empire, but after his death achieved independence and founded their State in Pannonia (Hungary). In 488 they broke into Italy, finally vanquished King Odoacer in 493, and founded their own short-lived kingdom, which succumbed to Justinian's generals, Belisarius and Narses (536-53). See GOTHS.

The North Germans advanced from the northernmost part of the common Teutonic territory, that is, from Schleswig-Holstein, into Denmark, whence they passed to Schonen (Scania), the southernmost part of Sweden, gradually spreading from there over the Scandinavian peninsula, and the islands to the westward, especially Iceland.

The Western Continental Germans were divided by Tacitus and Pliny into three groups: the Ingvæones, who coincide with the Low German peoples along the north coast of Germany; the Istævones, corresponding to the Franconians; and the Hermiones (q.v.), corresponding to the High Germans. The principal Low German races were the Saxons, the Frisians, and the Franconians or Franks. The ancient seat of the Saxons was on the eastern side of the mouth of the river Elbe; to the north of them in Schleswig-Holstein were the Angles. In the middle of the fifth century the British King Vortigern called in the aid of the Saxon chief Hengist as a hired auxiliary. With the related Jutes (q.v.), the Saxons overran England south of the Thames; during the same century the Angles occupied Central and Northern England. To this mixture of Celts and Teutons the Norman Conquest (1066) added a new and peculiar ingredient, Teutonic as to stock, Romance as to speech and institutions. See ANGLO-SAXONS.

The Continental Saxons (Old Saxons), the great nation whom Charlemagne forcibly converted to Christianity, are in the first centuries after Christ the occupants of Lower Germany. At the root they are the same Saxons who together with the Angles accomplished the conquest of Britain. The Frisians are the westernmost division of the Ingvæonic Teutons. Their ancient home was on the North Sea, in the marshes found about the Zuider Zee, and from there east as far as the river Ems.

The Franconians or Franks (q.v.) are a more modern name for the ancient Istævones. Their original home was on both sides of the middle and lower course of the Rhine.

The High German peoples coincide almost exactly with the third division of the West Germans whom Pliny calls Hermiones, Tacitus Herminones. Their territory anciently extended very much farther to the north than in mediæval and modern times. Adjoining the Saxons to the southeast dwelt the Lombards (q.v.) before they started on their long migration to Italy (568). Southwest of them were the Semni or Semnones, and due south of them the Hermunduri or Thuringians. To the west of them, along the lower course of the river Main, were the ancient seats of the Suevi (Swabians) and Alemanni. Again to the east of the Thuringians, in the present Kingdom of Bohemia and parts of Bavaria, dwelt at the beginning of our era the powerful people of the Marcomanni (q.v.). After Charlemagne's conquest of the Avars the Bavarian Marcomanni crossed the river Enns and colonized part of the present German provinces of Austria. Consult: Bremer, "Ethnographie der germanischen Stämme," in Paul, *Grundriss der germanischen Philologie*, vol. iii. (Strassburg, 1896 et seq.).

TEWFIK (MOHAMMED) **PASHA**, tū′fīk pȧ-shä′ (1852-92). Khedive of Egypt from 1879 to 1892. He was the eldest son of Ismail Pasha, who secured from the Sultan a firman decreeing the khedival succession to Tewfik instead of his brother Halim, who would have become Khedive under the order of succession then in force. Tewfik was fond of country life, and spent most of his time before his accession on his estates. He was interested in educational matters and founded several schools. In February, 1879, when the Ministry of Nubar Pasha was dismissed (see EGYPT), Prince Tewfik became president of the Council, but he, like Nubar, showed too much sympathy with Egypt's European creditors and soon retired. On June 26, 1879, the Sultan deposed Ismail and Tewfik became Khedive, at a time when Egypt was deeply embarrassed financially and the power of the Khedive was much curtailed. His general policy was modern and European, and the year 1880 witnessed the establishment of the dual control of Egypt by England and France. Tewfik soon had to face the rebellion of the Nationalists under Arabi Pasha (q.v.), and Egypt was rescued from anarchy by the intervention of England, which thereby established a controlling influence in the country. The conquest of the Sudan by the Mahdi occurred during Tewfik's reign and its recovery was not begun till after his death, which took place near Cairo, January 7, 1892. Consult Penfield, *Present Day Egypt* (New York, 1899).

TEWKESBURY, tūks'bĕr-ĭ. A town and Parliamentary and municipal borough in Gloucestershire, England, on the Avon, 10 miles northeast of Gloucester (Map: England, D 5). The parish church, an ancient and noble edifice in Norman, is a noteworthy architectural feature, and there are interesting remains of a great Benedictine abbey founded in the twelfth century. Tewkesbury is famous as the scene of the battle fought within half a mile of it on May 4, 1471, when the Yorkists under Edward IV. and the Duke of Gloucester inflicted a signal defeat on the Lancastrians. Population, in 1891, 5269; in 1901, 5419. Consult: Blunt, *History of Tewkesbury* (2d ed., London, 1877); Massé, *Tewkesbury Abbey Church* (London, 1900).

TEX'ARKAN'A. The name of two adjoining cities situated on each side of the boundary between Arkansas and Texas, 145 miles southwest of Little Rock; on the Texas and Pacific, the Saint Louis, Iron Mountain and Southern, the Saint Louis Southwestern, the Kansas City, Pittsburg and Gulf, and other railroads (Map: Texas, H 3). One of the municipalities is the county seat of Miller County, Ark., and the other is in Bowie County, Texas. They form, however, practically one industrial community. There are a fine post-office building, two city halls, and Saint Agnes Academy, besides several handsome residences and business blocks. Texarkana has considerable importance in commerce and manufactures. It is the centre of large timber interests, and ships also cotton, cottonseed oil, and hides. Foundries and machine shops, various plants connected with the cotton industry, railway shops, lumber mills, and furniture and pottery factories constitute the leading industrial establishments. Population, Texarkana in Texas, in 1890, 2852; in 1900, 5256; Texarkana in Arkansas, in 1890, 3528; in 1900, 4914.

TEX'AS. A South Central State of the United States, popularly called the 'Lone Star State.' It is, next to Florida, the southernmost State of the Union, lying between latitudes 25° 51′ and 36° 30′ N., and between longitudes 93° 27′ and 106° 43′ W. It is bounded on the north by Oklahoma and Indian Territory, on the east by Arkansas and Louisiana, on the southeast by the Gulf of Mexico, on the southwest by Mexico, from which it is separated by the Rio Grande, and on the northwest by New Mexico. It is of an irregular triangular shape with the apex pointing south and a square 'panhandle' extending northward. Its greatest length from north to south is about 800 miles, and its greatest breadth about 750 miles. It is the largest State in the Union, having an area of 265,780 square miles, of which 3490 square miles constitute water surface. Its area is larger than the combined area of the Atlantic States from Maine to Virginia, inclusive, and nearly one-third greater than that of the whole German Empire.

TOPOGRAPHY. In general the land rises gradually toward the western boundary by a succession of broad and more or less terraced slopes running parallel with the Gulf coast. Five or six well-marked topographical regions may be distinguished. The first is the coastal plain, a continuation of the same formation in the other Gulf States. It rises gradually from sea level to an altitude of 500 feet about 150 miles inland, and is very level in its lower portion, becoming somewhat hilly near its inner border. The coast itself is lined almost throughout its length of 375 miles by lagoons cut off from the sea by long, narrow sand islands. The largest and southernmost of these lagoons is the Laguna Madre, whose water is almost stagnant and very salt. The northern lagoons generally extend some distance inland in large, irregular bays and estuaries, lined partly by low marshy shores, partly by high bluffs. The principal bays are those of Galveston, Matagorda, San Antonio, and Corpus Christi. West of the coastal plain extends a belt of rolling country known as the Black Prairie, about 100 miles wide in the north and south, but very narrow in its middle portion. It is succeeded on the northwest by a very broad belt of country called by geologists the Central Denuded Region. This rises from a height of 600 feet in the east to over 2000 feet in the west, being bounded by the escarpment of the Llano Estacado, and is a rugged and much eroded, though not mountainous, region, with ridges, prairie valleys, isolated tablelands, and irregular depressions. It is bounded on the west and southwest by the Plateau Region, a southern continuation of the Great Plains. South of the 'Panhandle' this forms a large, flat-topped table-land, the Llano Estacado, which from an altitude of 4000 feet falls on the east into the Denuded Region in a high, steep, and ragged escarpment cut back by several large river valleys. On the southeast it runs out into a lower plateau of different formations known as the Grand Prairie. This sweeps around the southern end of the Denuded Region, and geologically, and according to some also topographically, it runs northward between the latter and the Black Prairie, though it is here much lower than in the south. It extends southward to the Rio Grande Valley, and is bounded on the southeast by an escarpment. The last topographical region is the portion of the State lying beyond the Pecos River in the southwest. This is a rugged mountainous country with a number of high isolated and barren ridges inclosing broad and arid valleys. The highest point is Baldy Peak, with an altitude of 8382 feet.

HYDROGRAPHY. Practically all the rivers of Texas flow in parallel courses southeastward through the State. With the exception of the Canadian River in the north and the Rio Grande with the Pecos in the south, which rise in the Rocky Mountains, all the larger rivers rise on the eastern edge of the Great Plains, the Llano Estacado, and the Grand Prairie. The extreme northern part of the State belongs to the Mississippi Basin. The Canadian River crosses the Panhandle to join the Arkansas, while the Red River rises on the escarpment of the Llano Estacado and forms for a long distance part of the northern State boundary. The independent rivers flow directly to the Gulf of Mexico, and all, except the Brazos and Rio Grande, empty through estuaries into the coast lagoons. The principal rivers are the Sabine, on the Louisiana boundary, the Neches, Trinity, Brazos, Colorado, Guadalupe, San Antonio, Nueces, and the Rio Grande. Most of these rivers flow through deep cañons immediately after leaving the Great Plains. Several of them are navigable for considerable distances at high water, but their mouths are generally obstructed by bars.

Climate. As Texas reaches to within two and a half degrees of the tropical zone, it naturally has a warm climate, but the great range in latitude, and to some extent in altitude, produces also a considerable range in climatic conditions. Although warm, the climate is drier and less enervating than that of the other Gulf States. The mean temperature in July at Galveston on the coast is 83.7°, at El Paso in the extreme west 81.9°, and at Amarillo in the northwest 76°. The corresponding figures for January are 52.7° at Galveston, 44.5° at El Paso, and 31.9° at Amarillo. On the coast the temperature seldom falls below the freezing point, while in the northwest it may fall several degrees below zero. In the western uplands, on the other hand, the temperature rises above 100°, while on the coast the maximum is between 90° and 95°. In winter the State is subject to severe north winds, known as *northers*, which often lower the temperature 50° in a few hours. In the eastern section the southeast winds from the Gulf are prevalent and bring abundant rain to that part of the State. The rainfall decreases rapidly westward, so that in the western part it is insufficient for agriculture. In the eastern portion near the mouth of the Sabine River the rainfall is sometimes over 60 inches, while in the extreme south, even near the coast, it is sometimes only five inches in a year. The normal annual average at Galveston is 49 inches, at Corpus Christi 30, at Austin 34, at Abilene, nearly in the centre of the State, 25, at Amarillo in the Panhandle 22, and at El Paso 9 inches.

Soil. The alluvial bottom lands around the lower river courses are the most fertile portions of the State. Next to these ranks the Black Prairie belt, which is covered with a remarkably fertile marl formed by the mixture of clay with the disintegrated Cretaceous limestone. The soil of the coastal plain is generally sandy; in some places the sand is mixed with clay to form a black loam. In the northwest there are heavy deposits of red clay containing much potash, but little nitrogenous matter. The soil on the southern plateau is thin, but the Llano Estacado is covered with a red sandy loam which would be rendered fertile by irrigation.

Flora. The principal forest area of Texas is in the extreme eastern portion. In the sandy coastal plain the pine is the prevailing tree, long-leaf pine in the lower and short-leaf pine in the higher pine barrens. Westward toward the centre of the State the deciduous species predominate, including oaks, elm, maple, hickory, sycamore, mulberry, sweet gum, ash, and walnut. The Osage orange is also common here, and the palmetto in the eastern part lends a tropical aspect to the vegetation. In the river-bottoms the characteristic species are cottonwood, pecan, live oak, and cypress. Along the western border of the Black Prairie two parallel belts of hardwood forest, chiefly oak, and known as the Cross Timbers, extend southward as far as the Brazos River. To the south and west of these the State is practically treeless except along the river courses. There are also scattered areas of scrub and chaparral composed largely of mesquite, the most characteristic tree of western Texas. Still farther west even the prairie grasses give place to or grow in the midst of a desert flora in which the yuccas and cacti are predominant.

For Fauna, see United States; also Rocky Mountains.

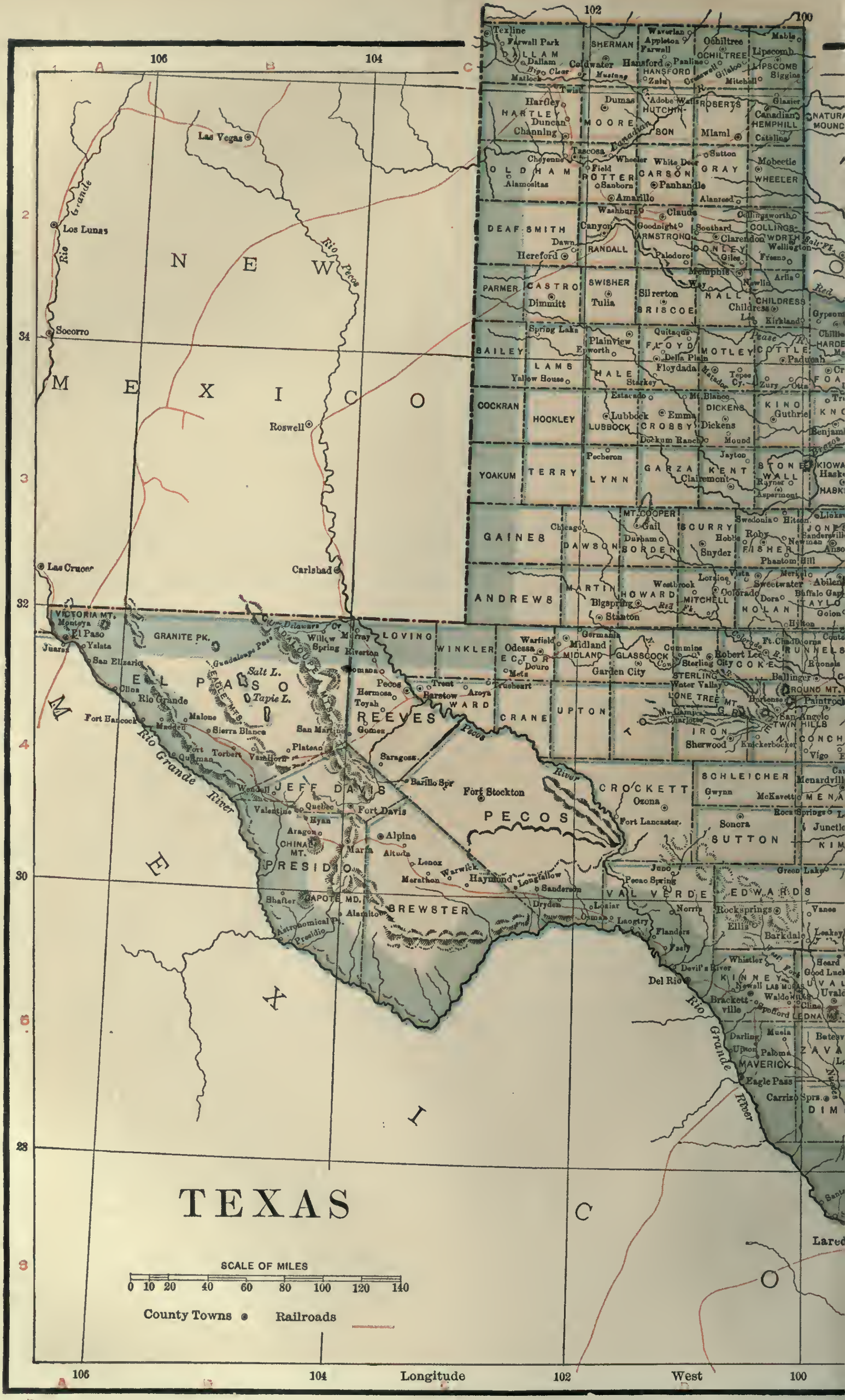
Geology and Minerals. The oldest rocks of the State come to the surface in the Central Denuded Region. In the southern part of this region, west of Austin, there is a small area of Archæan rock surrounded by a narrow outcrop of Cambrian and Silurian strata. To the north of this there is a considerable area of Carboniferous formation followed on the northwest along the eastern base of the Llano Estacado by a still larger region referred by some to the Permian, by others to the Jurassic system. Another large area of Paleozoic and early Mesozoic rocks is found in the Trans-Pecos region, where the predominant formation is the Jura-Trias, with small scattered outcrops of Carboniferous and other Paleozoic, together with some recent igneous rocks. The Llano Estacado, like the Great Plains to the north, is of very recent formation, consisting of lacustrine Tertiary deposits. The southern plateau or Grand Prairie region is older, being of Lower Cretaceous formation, and this formation also skirts the central Paleozoic area on the east. It is succeeded on the east by a band of Upper Cretaceous strata constituting the Black Prairie belt. Beyond this the entire coastal plain is composed of marine Tertiary deposits. Workable beds of bituminous coal occur in the central portion of the State, and large deposits of lignite are stretched along the western border of the coastal plain. In the eastern part of the State, near the mouth of the Sabine, petroleum deposits of great extent have been found at a depth of about 1000 feet. Iron and copper ores, as well as lead and tin, occur in the southeastern part of the central region, and silver is found in the west. The Trans-Pecos region, still but partly explored, probably contains varied mineral deposits, the most important being the cinnabar ores found in the Cretaceous limestone in the south. The most important of the remaining minerals in the State are the immense beds of gypsum found in the Permian strata of the northwestern Red Lands.

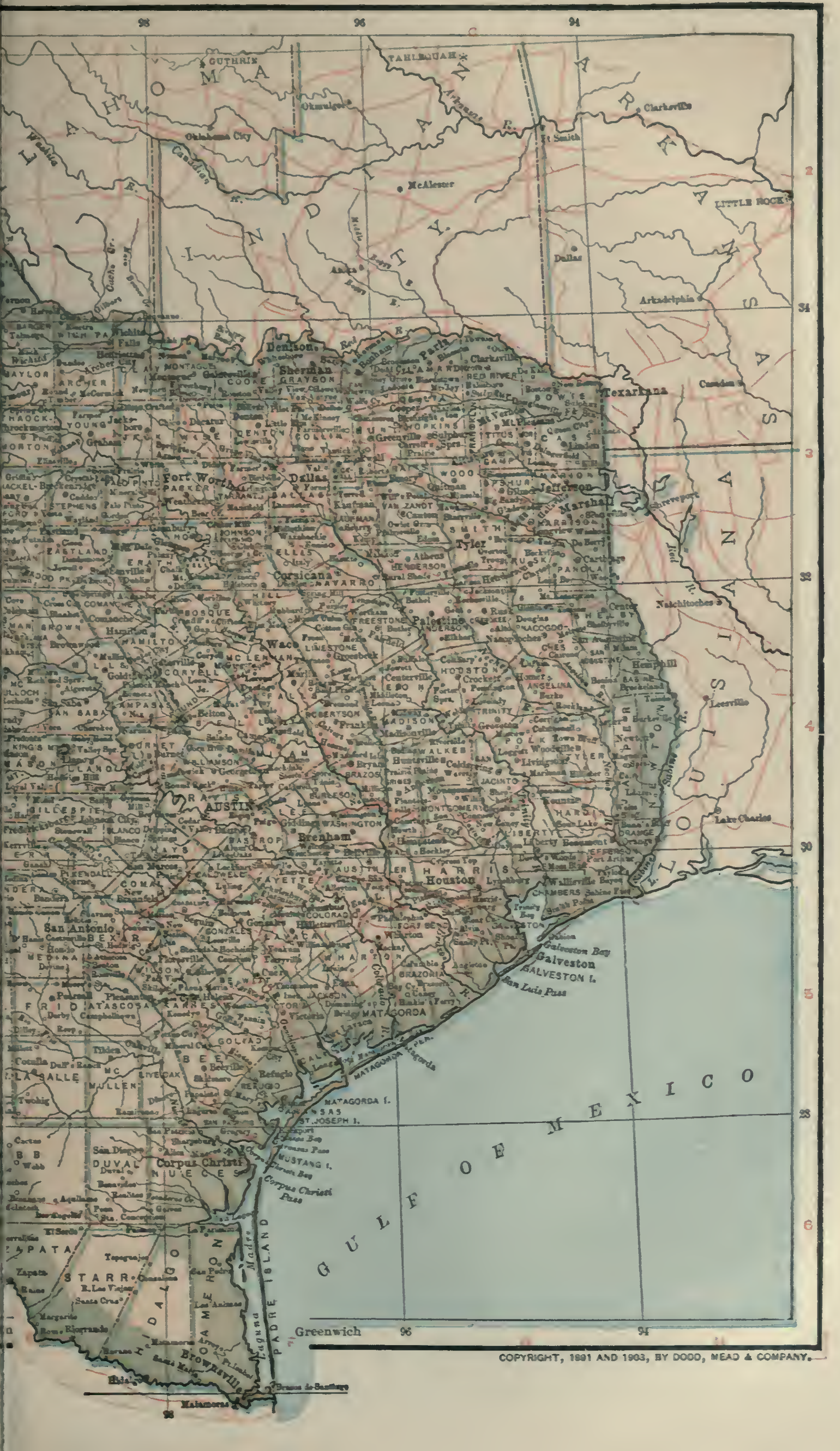
Mining. Mining, which had until recently been of little importance, bids fair to acquire large proportions. The value of coal increased almost steadily from $412,300 in 1891 to $1,907,024 in 1901. In the latter year there were mined 787,700 short tons of bituminous coal and 296,681 short tons of lignite. The production of petroleum practically began in 1897. The yield has increased very rapidly, amounting to 4,393,658 barrels in 1901. The silver exploited in the same year was valued at $283,440. Brick and tile made from local clays in that year amounted to $1,632,189. Gypsum is mined in the northwestern part. Cinnabar and salt are mined and some granite, sandstone, and limestone are quarried. There are a number of valuable mineral springs.

AREA AND POPULATION OF TEXAS BY COUNTIES.

(Continued OVER.)

County.	Map Index.	County Seat.	Area in square miles.	Population.	
				1890.	1900.
Anderson	G 4	Palestine	1,060	20,923	28,015
Andrews	C 3		1,591	24	87
Angelina	G 4	Lufkin	880	6,306	13,481
Aransas	F 6	Rockport	295	1,824	1,716
Archer	E 3	Archer City	960	2,101	2,508
Armstrong	D 1	Claude	870	944	1,205
Atascosa	E 5	Pleasanton	1,182	6,459	7,143
Austin	F 5	Bellville	712	17,859	20,676
Bailey	C 1		1,000	.....	4
Bandera	E 5	Bandera	1,007	3,795	5,332
Bastrop	F 4	Bastrop	881	20,736	26,845
Baylor	E 3	Seymour	957	2,595	3,052
Bee	F 5	Beeville	875	3,720	7,720
Bell	F 4	Belton	1,091	33,377	45,535
Bexar	E 5	San Antonio	1,268	49,266	69,422
Blanco	E 4	Johnson City	762	4,649	4,703
Borden	D 3	Gail	892	222	776
Bosque	F 4	Meridian	972	14,224	17,390
Bowie	G 3	Boston	907	20,267	26,676
Brazoria	G 5	Angleton	1,438	11,506	14,861
Brazos	F 4	Bryan	510	16,650	18,859
Brewster	C 4	Alpine	5,008	710	2,356
Briscoe	D 1	Silverton	850	......	1,253
Brown	E 4	Brownwood	911	11,421	16,019
Burleson	F 4	Caldwell	677	13,001	18,367
Burnet	F 4	Burnet	1,010	10,747	10,528
Caldwell	F 5	Lockhart	530	15,769	21,765
Calhoun	F 5	Port Labaca	592	815	2,395
Callahan	E 3	Baird	882	5,457	8,768
Cameron	F 6	Brownsville	2,203	14,424	16,095
Camp	G 3	Pittsburg	217	6,624	9,146
Carson	D 1	Panhandle	860	356	469
Cass	G 3	Linden	945	22,551	22,841
Castro	C 1	Dimmit	870	9	400
Chambers	G 5	Wallisville	648	2,241	3,046
Cherokee	G 4	Rusk	990	22,975	25,154
Childress	D 1	Childress	690	1,175	2,138
Clay	E 3	Henrietta	1,250	7,503	9,231
Cochran	C 3		959	.....	25
Coke	D 4	Robert Lee	850	2,059	3,430
Coleman	E 4	Coleman	1,302	6,112	10,077
Collin	F 3	McKinney	828	36,736	50,087
Collingsworth	D 1	Wellington	867	357	1,233
Colorado	F 5	Columbus	948	19,512	22,203
Comal	E 5	New Braunfels	569	6,398	7,008
Comanche	E 4	Comanche	828	15,608	23,009
Concho	D 4	Paintrock	941	1,065	1,427
Cooke	F 3	Gainesville	1,000	24,696	27,494
Coryell	F 4	Gatesville	1,115	16,873	21,308
Cottle	D 1	Paducah	956	240	1,002
Crane	C 4		850	15	51
Crockett	D 4	Ozona	3,004	194	1,591
Crosby	D 3	Emma	984	346	788
Dallam	C 1	Texline	1,463	112	146
Dallas	F 3	Dallas	900	67,042	82,726
Dawson	C 3	(Unorganized)	900	29	37
Deaf Smith	C 1	Hereford	1,477	179	843
Delta	G 3	Cooper	268	9,117	15,249
Denton	F 3	Denton	865	21,289	28,318
Dewitt	F 5	Cuero	880	14,307	21,311
Dickens	D 3	Dickens	918	295	1,151
Dimmit	D 5	Carrizo Springs	1,164	1,049	1,106
Donley	D 1	Clarendon	878	1,056	2,756
Duval	E 6	San Diego	1,887	7,598	8,483
Eastland	E 3	Eastland	947	10,373	17,971
Ector	C 4	Odessa	976	224	381
Edwards	D 4	Rocksprings	2,408	1,970	3,108
Ellis	F 3	Waxahachie	1,066	31,774	50,059
El Paso	B 4	El Paso	9,353	15,678	24,886
Encinal	.....	(Unorganized)	.....	2,744	......
Erath	E 3	Stephenville	1,110	21,594	29,966
Falls	F 4	Marlin	844	20,706	33,342
Fannin	F 3	Bonham	940	38,709	51,793
Fayette	F 5	Lagrange	962	31,481	36,542
Fisher	D 3	Roby	836	2,996	3,708
Floyd	D 1	Floydada	1 036	529	2,020
Foard	E 3	Crowell	636	......	1,568
Fort Bend	G 5	Richmond	897	10,586	16,538
Franklin	G 3	Mount Vernon	325	6,481	8,674
Freestone	F 4	Fairfield	947	15,987	18,910
Frio	E 5	Pearsall	1,064	3,112	4,200
Gaines	C 3		1,590	68	55
Galveston	G 5	Galveston	438	31,476	44,116
Garza	D 3		821	14	185
Gillespie	E 4	Fredericksburg	1,140	7,056	8,229
Glasscock	D 4	Garden City	952	208	286
Goliad	F 5	Goliad	817	5,910	8,310
Gonzales	F 5	Gonzales	1,079	18,016	28,882
Gray	D 1	(Unorganized)	860	203	480
Grayson	F 3	Sherman	1,012	53,211	63,661
Gregg	G 3	Longview	287	9,402	12,343
Grimes	G 4	Anderson	770	21,312	26,106
Guadalupe	F 5	Seguin	717	15,217	21,385
Hale	D 3	Plainview	1,036	721	1,680
Hall	D 1	Memphis	868	703	1,670
Hamilton	E 4	Hamilton	858	9,313	13,520
Hansford	D 1	Hansford	860	133	167
Hardeman	E 1	Quanah	532	3,904	3,634
Hardin	G 4	Kountze	844	3,956	5,049
Harris	G 5	Houston	1,761	37,249	63,786
Harrison	G 3	Marshall	873	26,721	31,878
Hartley	C 1	Channing	1,460	252	377
Haskell	E 3	Haskell	813	1,665	2,637
Hays	F 4	San Marcos	647	11,352	14,142
Hemphill	D 2	Canadian	860	519	815
Henderson	G 3	Athens	940	12,285	19,970
Hidalgo	E 6	Hidalgo	2,328	6,534	6,837
Hill	F 4	Hillsboro	1,006	27,583	41,355
Hockley	C 3		977	......	44
Hood	F 3	Granbury	436	7,614	9,146
Hopkins	G 3	Sulphur Springs	666	20,572	27,950
Houston	G 4	Crockett	1,192	19,360	25,452
Howard	D 3	Bigspring	888	1,210	2,528
Hunt	F 3	Greenville	888	31,885	47,295
Hutchinson	D 1	Plemmons	850	58	303
Irion	D 4	Sherwood	800	870	848
Jack	E 3	Jacksboro	858	9,740	10,224
Jackson	F 5	Edna	888	3,281	6,094
Jasper	H 4	Jasper	977	5,592	7,138
Jeff Davis	B 4	Fort Davis	1,922	1,394	1,150
Jefferson	G 5	Beaumont	1,100	5,857	14,239
Johnson	F 3	Cleburne	740	22,313	33,819
Jones	E 3	Anson	900	3,797	7,053
Karnes	F 5	Karnes City	740	3,637	8,681


TEXAS
SCALE OF MILES
0 10 20 40 60 80 100 120 140
County Towns
Railroads
Longitude
West
106
104
102
100
32
34
30
28
NEW MEXICO
MEXICO
EL PASO
REEVES
PECOS
JEFF DAVIS
PRESIDIO
BREWSTER
CROCKETT
VAL VERDE
Rio Grande River
El Paso
Fort Stockton
Alpine
Marfa
Del Rio
Amarillo
Lubbock
Roswell
Carlsbad
Las Vegas
Las Cruces
Socorro
Los Lunas



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AREA AND POPULATION OF TEXAS BY COUNTIES.

County.	Map Index.	County Seat.	Area in square miles.	Population.	
				1890.	1900.
Kaufman	F 3	Kaufman	932	21,598	33,376
Kendall	E 5	Boerne	613	3,826	4,103
Kent	D 3	Clairemont	777	324	899
Kerr	E 4	Kerrville	1,210	4,462	4,980
Kimble	E 4	Junction	1,302	2,243	2,503
King	D 3	Guthrie	928	173	490
Kinney	D 5	Brackettville	1,269	3,781	2.447
Knox	E 3	Benjamin	947	1,134	2,322
Lamar	G 3	Paris	903	37,302	48,627
Lamb	C 3	....	1,021	4	31
Lampasas	E 4	Lampasas	755	7,584	8,625
Lasalle	E 5	Cotulla	1,707	2,139	2,303
Lavaca	F 5	Hallettsville	992	21,887	28,121
Lee	F 4	Giddings	666	11,952	14,595
Leon	G 4	Centerville	1,066	13,841	18,072
Liberty	G 4	Liberty	1,162	4,230	8,102
Limestone	F 4	Groesbeck	987	21,678	32,573
Lipscomb	D 1	Lipscomb	850	632	790
Live Oak	E 5	Oakville	1,123	2,055	2,268
Llano	E 4	Llano	977	6,772	7,301
Loving	C 4	....	873	3	33
Lubbock	D 3	Lubbock	982	33	293
Lynn	D 3	....	821	24	17
McCullough	E 4	Brady	1,110	3,217	3,960
McLennan	F 4	Waco	1,080	39,204	59,772
McMullen	E 5	Tilden	1,180	1,038	1,024
Madison	G 4	Madisonville	488	8,512	10,432
Marion	G 3	Jefferson	384	10.862	10,754
Martin	C 3	Stanton	900	264	332
Mason	F 4	Mason	968	5,180	5,573
Matagorda	G 5	Bay City	1,135	3.985	6,097
Maverick	D 5	Eagle Pass	1,332	3,698	4,066
Medina	F 5	Hondo	1,284	5,730	7,783
Menard	E 4	Menardville	888	1,215	2,011
Midland	C 4	Midland	972	1,033	1,741
Milam	F 4	Cameron	1,044	24,773	39,666
Mills	E 4	Goldthwaite	604	5,493	7,851
Mitchell	D 3	Colorado	807	2,059	2,855
Montague	F 3	Montague	976	18,863	24,800
Montgomery	G 4	Conroe	1,066	11,765	17,067
Moore	C 1	Dumas	885	15	209
Morris	G 3	Daingerfield	278	6,580	8,220
Motley	D 1	Matador	984	139	1,257
Nacogdoches	G 4	Nacogdoches	962	15,984	24,663
Navarro	F 3	Corsicana	1,136	26,373	43,374
Newton	H 4	Newton	903	4,650	7,282
Nolan	D 3	Sweetwater	828	1,573	2,611
Nueces	F 6	Corpus Christi	2,460	8,093	10,439
Ochiltree	D 1	Ochiltree	864	198	267
Oldham	C 1	Tascosa	1,470	270	349
Orange	H 4	Orange	392	4,770	5,905
Palo Pinto	E 3	Palo Pinto	971	8,320	12,291
Panola	G 3	Carthage	814	14,328	21,404
Parker	F 3	Weatherford	888	21,682	25,823
Parmer	C 1	(Unorganized)	873	7	34
Pecos	C 4	Fort Stockton	8,312	1,326	2,360
Polk	G 4	Livingston	1,110	10,332	14,447
Potter	C 1	Amarillo	874	849	1,820
Presidio	B 4	Marfa	3,970	1,698	3,673
Rains	G 3	Emory	252	3,909	6,127

County.	Map Index.	County Seat.	Area in square miles.	Population.	
				1890.	1900.
Randall	C 1	Canyon	872	187	963
Red River	G 3	Clarksville	1,061	21,452	29,893
Reeves	C 4	Pecos	2,610	1.247	1,847
Refugio	F 5	Refugio	802	1,239	1,641
Roberts	D 1	Miami	860	326	620
Robertson	F 4	Franklin	913	26,506	31,480
Rockwall	F 3	Rockwall	171	5,972	8,531
Runnels	E 4	Ballinger	1,073	3,193	5.379
Rusk	G 3	Henderson	915	18,559	26,099
Sabine	H 4	Hemphill	577	4,969	6,394
San Augustine	G 4	San Augustine	570	6,688	8,434
San Jacinto	G 4	Coldspring	636	7,360	10,277
San Patricio	F 5	Sinton	700	1,312	2,372
San Saba	E 4	San Saba	1,150	6,641	7.569
Schleicher	D 4	El Dorado	1,355	155	515
Scurry	D 3	Snyder	821	1,415	4,158
Shackelford	E 3	Albany	926	2,012	2,461
Shelby	G 4	Center	814	14,365	20,452
Sherman	C 1	Coldwater	850	34	104
Smith	G 3	Tyler	984	28,324	37,370
Somervell	F 3	Glenrose	200	3,419	3,498
Starr	E 6	Rio Grande	2,510	10,749	11,469
Stephens	E 3	Breckenridge	926	4,926	6,466
Sterling	D 4	Sterling City	821	......	1,127
Stonewall	D 3	Rayner	777	1,024	2,183
Sutton	D 4	Sonora	1,517	658	1,727
Swisher	C 1	Tulia	850	100	1,227
Tarrant	F 3	Forth Worth	900	41,142	52,376
Taylor	E 3	Abilene	900	6,957	10,499
Terry	C 3	....	828	21	48
Throckmorton	F 3	Throckmorton	821	902	1,750
Titus	G 3	Mount Pleasant	421	8,190	12,292
Tom Green	D 4	San Angelo	2,553	5,152	6,804
Travis	F 4	Austin	1,036	36,322	47,386
Trinity	G 4	Groveton	704	7,648	10,976
Tyler	G 4	Woodville	925	10,877	11,899
Upshur	G 3	Gilmer	587	12,695	10,266
Upton	C 4	(Unorganized)	1,190	52	48
Uvalde	E 5	Uvalde	1,579	3,804	4,647
Valverde	D 4	Delrio	3,034	2,874	5,263
Van Zandt	G 3	Canton	877	16,225	25,481
Victoria	F 5	Victoria	883	8,737	13,678
Walker	G 4	Huntsville	754	12,874	15,813
Waller	G 5	Hempstead	510	10,888	14,246
Ward	C 4	Barstow	858	77	1,451
Washington	F 4	Brenham	568	29,161	32,931
Webb	E 6	Laredo	3,421	14,842	21,851
Wharton	F 5	Wharton	1,137	7,584	16,942
Wheeler	D 1	Mobeetie	851	778	626
Wichita	E 3	Wichita Falls	606	4,831	5,806
Wilbarger	E 3	Vernon	932	7,092	5,759
Williamson	F 4	Georgetown	1,169	25,909	38.072
Wilson	E 5	Floresville	784	10,655	13,961
Winkler	C 4	....	888	18	60
Wise	F 3	Decatur	843	24,134	27,116
Wood	G 3	Quitman	688	13,932	21,048
Yoakum	C 3	(Unorganized)	840	4	26
Young	E 3	Graham	821	5,049	6,540
Zapata	E 6	Carrizo	1,269	3,562	4,760
Zavalla	E 5	Batesville	1,328	1,097	792

(OVER.)

Fisheries. In 1897 the value of the catch for the year was $237,496, this figure being less than for 1890. The oyster, trout, sheepshead, and red snapper rank in importance in the order named.

Agriculture. The enormous area of Texas with its favorable physical and climatic conditions has made it one of the leading agricultural States in the Union. In 1900 there were 125,807,017 acres, or 74.9 per cent. of the total land area, included in farms. This was three times greater than the corresponding area in any other State. But the improved area—19,576,076 acres —was not so great as in some other commonwealths. The average size of the farms, which decreased rapidly prior to 1880, has increased since that year, being 357.2 acres in 1900. The recent increase is due to the inclosure into farms of extensive pastures in the west. Thus the average size of farms or ranches in the entire State is 357.2 acres, while in Red River County it is only 50.6 acres. In 1900 there were 11,220 farms of over 1000 acres each, containing an aggregate of 88,159,247 acres. In that year 7.3 per cent. of the farms were operated by cash tenants and 42.4 by share tenants. The number of the latter almost doubled between 1890 and 1900. Considerably over one-fourth of the farms are operated by negroes, but only 26.1 per cent. of these are owned by them. The State ranks fifth in the aggregate value of farm products. Crop-raising is mainly confined to the eastern and central parts, the light rainfall in the west adapting that section better to grazing than to tillage.

While there is a great variety of crops, the State is best known for its cotton, the value of which in 1899 was $84,332,713, or over one-half the total value of all crops. In that year 27.9 per cent. of the production of the United States was grown in Texas. The acreage devoted to the crop was more than twice that for any other State and much greater than that for any country of the world. There was an increase of 80.6 per cent. between 1880-90, and 76.9 per cent. in the following decade. The main cotton belt extends northeastward from Travis County to Grayson, Fanin, and Lamar counties, though there is a secondary belt southward through Bexar County toward the Gulf. After cotton, by far the most important crop is corn. The acreage devoted to it increased 62.9 per cent. between 1890-1900. A rapid increase also has recently taken place in the raising of wheat. From twenty-second in rank in 1898 the State rose to sixth in 1900. The area devoted to oats, the only other important cereal, is also increasing. The cereals mentioned, except wheat, which is confined more to the north, are grown in nearly all parts of the State. The Gulf Coast region is well adapted to the cultivation of rice, and since 1897, in which year rice irrigation began, much progress has been made in rice culture. In 1902 the area in rice was estimated at over 200,000 acres. The greatest development has occurred in the vicinity of Beaumont and in the Colorado River Valley. The acreage in hay and forage in 1899 was 148.5 per cent. greater than ten years before. Kafir corn is grown in the more arid sections. Dry peas, potatoes, sweet potatoes, sugar cane, sorghum cane, and peanuts are other crops worthy of mention. In 1899 26,276 acres were devoted to watermelons. The number of orchard fruits increased 88.4 per cent. between 1890 and 1900. The peach trees numbered in the latter year 7,248,358 and constituted 65.7 per cent. of the total number of trees. In 1899 there were 49,652 acres irrigated, including 8,700 acres of rice in the coast counties. In the arid west, the Rio Grande and the Pecos and Nueces rivers are the chief sources of water supply. The normal flow of water in the Rio Grande has been greatly reduced through the increased use of its water farther north in New Mexico and Colorado, so that much of the area covered by ditches in El Paso County cannot be supplied with water. There are two large regions now being developed in the southwest, where artesian wells are used in irrigation.

The following table shows the increase in acreages:

CROP	1900, acres	1890, acres
Cotton	6,960,367	3,934,525
Corn	5,017,690	3,079,907
Wheat	1,027,947	352,477
Oats	847,225	528,924
Hay and forage	938,024	377,523
Kafir corn	22,813	....
Sugar cane	17,824	16,284
Sorghum cane	26,803	28,547
Rice	8,711	178
Potatoes	21,810	11,831
Sweet potatoes	43,561	52,506
Dry Peas	33,947	....
Peanuts	10,734	1,560

Stock-Raising. Texas ranks second in the value of live stock, and far exceeds all other States in the number of cattle. The State is probably more widely known for its grazing interests than for any other industrial feature. There is no other part of the country in which ranching has been carried on so extensively. The use of the pasture lands has occasioned much trouble between the settlers and the ranchmen, the former violently opposing the attempts of the ranchmen to monopolize the public lands by inclosing it with barbed wire fences. A number of laws have been passed protecting the interests of the settlers. The total number of cattle in 1900 was 7,279,935, not including 2,148,261 spring calves. Only one other State had half this number of cattle. The practice is extensively followed of shipping or driving the cattle into other States for market feeding.

The decrease in dairy cows as shown in the table below is only apparent, being due to a change in the method of enumeration. Twice as much milk was reported in 1900 as in 1890. There has been a gain in the number of horses, mules, and swine. The State ranks first in the number of mules and third in the number of horses. The number of mules more than doubled between 1890 and 1900. However, the number of sheep decreased nearly two-thirds in the same period. Sheep-grazing seems to be giving way to cattle-raising. In the following table of holdings on farm and range, the two census years shown are not strictly comparable, since the 1890 figures do not include the number of animals on ranges separately reported, and consisting of over 2,300,000 cattle and about 800,000 sheep:

STOCK	1900	1890
Dairy cows	861,023	1,003,439
Other cattle	8,567,173	5,198,113
Horses	1,269,432	1,026,002
Mules and asses	523,690	227,432
Sheep	1,439,940	3,454,858
Swine	2,665,614	2,252,476

Manufactures. Manufacturing was quite unimportant until after 1880. Between that year and 1890 the value of products increased 239.9 per cent., and in the following decade 69.5 per cent.; in 1900 the product was estimated at $119,414,982. In the latter year there were 48,152 persons employed as wage-earners, or 1.6 per cent. of the total population. The industry has the advantage of a very abundant supply of raw materials, the State ranking first in the production of cotton, and having large timber resources and a heavy production of grain. The recent increase in the output of coal also greatly subserves the industry. Texan manufactures dependent upon resources of cotton are peculiar in that they do not include textiles, a branch of the industry which has become prominent in some other Southern States. In the manufacture of cottonseed oil and cake, on the other hand, the State ranks first. The value of products for the latter industry increased 329.3 per cent. between 1890 and 1900. During the last census year there were 24,354,695 gallons of cottonseed oil obtained, or 26.1 per cent. of the total for the United States for that period. Cottonseed meal and cake are extensively used as food for cattle. In the allied industry of cotton-ginning the State also ranks first. The figures given in the table below do not include ginneries operated in connection with saw, grist, and cottonseed-oil mills, or for the use exclusively of plantations on which they are located. The Texas ginneries first introduced the custom of pressing the cotton after ginning into the so-called 'round bales,' and this process is becoming very general. The manufacture of flouring and grist mill products is a growing industry, drawing its supply from Oklahoma and the Indian Territory as well as from the large local production. The extensive railroad interests of the State have necessitated a large number of repair shops, employing 2354 wage-earners. The manufacture of saddlery and harness is a thriving industry centred largely in the city of Dallas. Printing and the manufacture of malt liquors and of clay products are other leading industries. Manufacturing is well distributed over that State and there are no prominent centres, the only cities in which the value of products exceeds $10,000,000 being Dallas and Houston. The following table shows the relative importance of the leading industries in the census years indicated:

INDUSTRIES	Year	Number of establishments	Average number wage-earners	Value of products, including custom work and repairing
Total for selected industries for State	1900	5,793	30,119	$73,024,636
	1890	2,503	21,737	43,189,273
Increase, 1890 to 1900	......	3,290	8,382	$29,835,363
Per cent. of increase	......	131.4	38.6	69.1
Per cent. of total of all industries in State	1900	47.1	62.5	61.2
	1890	47.5	62.5	61.3
Cars and general shop construction and repairs by steam railroad companies	1900	56	6,633	$8,314,691
	1890	31	2,354	2,860,235
Clay products—total	1900	171	1,859	1,212,266
	1890	143	2,072	1,311,270
Brick and tile	1900	143	1,579	1,020,205
	1890	124	1,956	1,214,690
Pottery, terra cotta, and fire-clay products	1900	28	280	192,061
	1890	19	116	96,580
Cotton, ginning	1900	3,222	4,295	5,886,923
	1890	572	2,440	1,172,298
Flouring and grist-mill products	1900	289	705	12,333,730
	1890	690	1,626	9,903,455
Foundry and machine shop products	1900	99	1,343	2,682,426
	1890	59	782	1,874,059
Liquors, malt	1900	9	585	2,689,606
	1890	7	401	1,702,087
Lumber and timber products	1900	637	7,924	16,296,473
	1890	314	7,485	11,942,566
Lumber, planing mill products, including sash, doors, and blinds	1900	76	657	1,605,297
	1890	62	949	2,700,941
Oil, cottonseed and cake	1900	103	2,478	14,005,324
	1890	13	866	3,262,596
Printing and publishing—total	1900	772	2,547	4,577,110
	1890	447	2,069	3,971,410
Book and job	1900	118	718	1,189,700
	1890	56	469	1,213,888
Newspapers and periodicals	1900	654	1,829	3,387,410
	1890	391	1,600	2,757,522
Saddlery and harness	1900	359	1,093	3,420,790
	1890	165	693	2,488,356

Forests and Forest Products. There are valuable forests in the eastern part of the State, but to the westward they become inferior and finally give way entirely. While the wooded area is estimated at 64,000 square miles, or 24 per cent. of the total area, the timber upon much of this is fit for little else than fire wood. From Texarkana southward to a point about 100 miles north of Beaumont are forests of short-leaf pine of only moderate quality. From this point southward to Jefferson County is a fine forest of long-leaf pine, having an average stand of merchantable timber ranging from 6000 to 35,000 feet per acre. The lumber industry, which had developed but little prior to 1880, has since made rapid strides. (See table above.) The crop consists almost entirely of yellow pine. The Beaumont and Orange districts are the largest centres of the industry.

Transportation and Commerce. The railroads had developed but little prior to 1870. in which year there were 711 miles. In 1880 the mileage had increased to 3244, in 1890 to 8709, and in 1900 to 9991. Only two other States had a greater mileage in 1900. The eastern part of the State is well supplied with both east and west and north and south lines, many of them making connection with important trunk lines. The Southern Pacific, Texas Pacific, and Colorado Southern pass westward through the State, but there are large areas in western and southern Texas quite unpenetrated. There is a Railroad Commission, which is authorized to adopt all necessary rates, charges, and regulations; to govern and regulate traffic; to correct abuses and prevent unjust discrimination and extortion; to classify and subdivide freight, etc. The Commission has been unusually successful. It has done much to prevent pooling, and has recovered for the State a considerable area of land. The long coast line gives the State the advantage of a number of good harbors and a direct foreign trade. The customs districts are Galveston, Corpus Christi, Saluria, Paso del Norte, and Brazos de Santiago. Most of the foreign trade passes through these districts, and Galveston has become the second largest Gulf port and the sixth largest port in the United States. In 1901 the foreign trade through this port, consisting almost wholly of exports, amounted to $102,811,101.

Banks. Only one bank was chartered during the life of the Republic of Texas. In 1838 an effort was made to establish a national bank, with $7,000,000 to be borrowed in France, but the negotiations broke off. The Constitution of 1845, adopted after the admission of Texas into the Union, prohibited the creation of new banks. The necessary banking business was performed by the one existing bank and by private bankers. When after the Civil War the 'reconstruction' forces came in, a new Constitution was adopted which did not have this prohibitory clause, and in 1871 a free banking law was passed. Five or six banks availed themselves of this law, but after the reconstructionists were overthrown and 'home rule' again established, the old prohibitory rule was again included in the Constitution of 1875. The few State banks continued a long time, but had gone out of business by the end of the century. Because of this prohibition, national banks reached a high degree of development, and their number rapidly increased. In 1866 there were four national banks. By 1890 there were 189 national banks, and by 1902 the number grew to 339, with a capital of $25,261,000; surplus, $7,967,000; cash, etc., $9,373,000; deposits, $74,042,000; and loans, $80,755,000. There are a number of private banks, but the State takes no official cognizance of them.

Finances. The fiscal history of the Republic of Texas was mainly a record of debts, as the strained relations with Mexico demanded a greater expense than the taxable property of the young Republic could bear. The issue of loans was only stopped by the inability to float them. An investigation by the Legislature of the State in 1848 ascertained the nominal debt to be $9,647,253, to which the value of $4,807,764 was assigned, as Texas decided to redeem its debt at its actual value when issued. By 1850 the nominal amount and assigned value of the debt were respectively $12,322,443 and $6,818,798. The sum of $10,000,000 which the State received from the Federal Government canceled the debt and left a surplus. By 1856 there was no State debt, and the surplus was over $1,000,000. Several loans were made during the Civil War, but the war debt was repudiated by the first 'reconstruction' Legislature. The disarranged condition of the finances necessitated the issue of new bonds in 1870 and the following years. Six railroad companies were assisted by loans aggregating $2,000,000. By 1875 there was a debt of $4,644,000. But the overthrow of the reconstruction forces in 1875 caused a radical change in the financial policy of the State. The Constitution of that date prohibited any further issue of bonds, except for war purposes, as well as the lending of the State's credit to private enterprises. Because of the difficulty of paying the interest, the debt continued to grow for some time and in 1880 reached its maximum of $5,566,928, after which it steadily declined. The policy of the State has been to buy its own bonds for investment of the school and university funds. The income of the State is derived mainly from a general property tax and sale and lease of public land. Total receipts in 1902 amounted (as far as can be calculated from the accounts of 30 different funds) to about $8,744,000, and disbursements about $7,104,000. The cash balance was $2,200,000.

Government. The Constitution now in operation was adopted by the constitutional convention held in 1875. An amendment in order to become a part of the Constitution must receive a two-thirds vote of the members elected to each House, and a majority vote of the State electors voting at a popular election.

Voters must have resided one year in the State and six months in the district where the vote is cast; and if financial measures are voted upon, taxpayers alone are allowed to vote. The suffrage is denied to soldiers, marines, and seamen employed in the service of the army or navy of the United States.

Legislative. Senators are elected from districts of contiguous territory for terms of four years, and are limited to 31 in number. Representatives are elected for terms of two years from counties or districts of contiguous counties according to population, being apportioned one to every 15,000 inhabitants, provided the number should never exceed 150. The Legislature meets biennially at a time provided by law and at such other times as the Governor may demand. If any member removes his residence from the district or county for which he was elected, his office becomes vacant. The compensation of members cannot exceed $5 per day for the first 60 days of each session, nor $2 per day for the remainder of the session in addition to mileage.

Executive. A Governor, Lieutenant-Governor, Secretary of State, Comptroller, Treasurer, Commissioner of the General Land Office, and Attorney-General are elected for a term of two years. The Lieutenant-Governor and president pro tem. of the Senate are in the line of succession to the Governorship in case of vacancy in the office of Governor. The Governor may veto any bill or portion of any appropriation bill, but a two-thirds vote of each House overcomes the veto. The Governor grants reprieves, commutations, and pardons, and under regulations remits fines and forfeitures.

Judicial. The Supreme Court consists of a Chief Justice and two associate justices, who are elected for six years. The Court of Criminal Appeals consists of three judges, also elected for six years. The State is divided into judicial districts, in each of which a judge is elected for a term of four years. Each county elects a county judge who serves for two years.

Texas has sixteen Representatives in the Lower House of the National Congress. The capital is Austin.

Population. The following figures show the growth of the population: 1850, 212,592; 1860, 604,215; 1870, 818,579; 1880, 1,591,749; 1890, 2,235,523; and 1900 3,048,710. From twenty-fifth in rank in 1850, Texas advanced to sixth in 1900. The per cent. of gain from 1890 to 1900 was 36.4, which was much greater than that for any other of the more populous States of the Union. The bulk of the population is confined to the eastern half of the State. The average density in 1900 was 11.6, as against 25.6 for the Union. Texas has received a much larger number of immigrants than any other Southern State. The foreign-born numbered 179,357 in 1900. The negroes numbered 620,722, the rate of gain between 1890 and 1900 (27.2 per cent.) being less than that for the whites. There were 36 cities in 1900 having over 4000 inhabitants each, the aggregate population of which amounted to 14.9 per cent. of the total population. The cities with more than 10,000 inhabitants were: San Antonio, 53,321; Houston, 44,633; Dallas, 42,638; Galveston, 37,789; Fort Worth, 26,688; Austin, 22,258; Waco, 20,686; El Paso, 15,906; Laredo, 13,429; Denison, 11,807; and Sherman, 10,243.

Religion. The Baptists are numerically the strongest Church, followed closely by the Methodist. These two bodies together contain considerably over two-thirds of the church membership. The Disciples of Christ (Christian), Presbyterians, and Episcopalians are the only other Protestant sects numerically important.

Education. The per cent. of illiteracy is not nearly so great as in most Southern States, being, in 1900, 14.5 of the total population ten years of age and over—whites 6.1 and blacks 36.0. The State is exceptional among the States of the South in that the public schools have a heavy endowment—a fact largely responsible for its educational progress. In September, 1902, the permanent school fund aggregated $42,563,229. Of this, $10,638,951 was represented by bonds; $15,549,277 by land notes; $16,250,000 by school lands; and $125,000 by cash. There was a county permanent school fund in August, 1902, aggregating $6,596,506, of which nearly $2,000,000 represented lands held by the counties. The permanent free school fund had in 1902 received from the State a total of 43,986,131 acres of land, of which 22,080,225 acres were still unsold. In addition to the State endowment, each county has an independent endowment of four leagues of land. The Governor's report of 1903 estimated the State receipts for public schools for the fiscal year at $3,881,190, the sources of which were the ad valorem tax of 18 cents on the $100, one-quarter of all occupation taxes, the poll tax ($1), the interest in bonds and notes, and the land rentals. This was supplemented in the counties by the receipts from their own school lands; and many districts also levied local school taxes. The total receipts for the year ending August, 1902, was $6,021,830, and the expenditures on public schools, $4,599,630. There is a striking difference in the condition of schools in different localities. There are two distinct forms of school organization. Thirty-three of the 224 counties retain a form of organization known as the community system, under which there are no metes and bounds to a school community, and therefore no local school tax can be imposed. The school community is organized *de novo* each year. This system was applied tentatively to all counties after the adoption of the present Constitution. Under it the schools are often too small, and since there are no local taxes, the school buildings are usually rented. A law of 1884, providing for districting the counties, is gradually being applied. This district system has a continuous board of trustees chosen by the people, and makes possible the levying of local taxes. Cities and towns may be constituted independent districts with the right to levy a tax of 50 cents on the $100 for the maintenance of public schools, and may vote a bonded debt for buildings, whereas the latter right is not allowed the rural districts, and this tax levy is limited to 22 cents on the $100.

In 1900 there were 261 independent school districts, 100 of which were municipal corporations. High schools are common in the towns, and in 1899 there were 150 schools whose graduates could enter the State University without examination. There is a uniform text-book law which applies generally, except to cities of 10,000 inhabitants and over. The scholastic population in 1901 was 729,217, the enrollment 571,786, and the average attendance 383,900. There are over 1500 teachers, more than half of whom hold State certificates, a large number of the certificates being for life. To enable teachers better to qualify themselves, the State provides summer normal schools with a term of four weeks, there being, in 1900, 118 such schools, with an aggregate attendance of 5100. The regularly maintained State normal schools are at Denton, Detroit, Huntsville, and Prairie View. The State receives aid from the Peabody fund. The State University is located at Austin, with a medical branch at Galveston, and the Agricultural and Mechanical College at Bryan. There are a large number of denominational institutions, among which are the Polytechnic College (Methodist Episcopal South), Fort Worth; Southwestern University (Methodist Episcopal South), Georgetown; Texas Christian University (Christian), Hermosa; and Baylor University (Baptist), at Waco. There are a number of colleges for colored students.

Charitable and Penal Institutions. The State insane asylums are at Austin, San Antonio, and Terrell, and had a total of 3145 inmates on December 1, 1902. It is claimed that there are no insane persons in jails or poor farms. The Deaf and Dumb Asylum (school) at Austin had 450 pupils in December, 1902. On the same date the Blind Asylum (school) had 168 pupils, and the Deaf, Dumb and Blind Asylum (school) for Colored Youths, in August, 1902, 94 pupils. Both of these institutions are located at Austin, as is also the Confederate Soldiers' Home. The State Orphans' Home at Corsicana contains 308 children. In 1899 a colony for epileptics was authorized to be established at Abilene. There is a purchasing agent who secures supplies for all the eleemosynary institutions, and the cost of maintenance has been greatly reduced since the creation of this office.

The old system of leasing convicts is being abolished, and the convict farm system has developed in its stead. The State owns two large farms for male convicts and smaller ones for female convicts and consumptive convicts. Convicts are also worked upon other than State farms according to the share rent system. Others are leased to farmers or for railroad work. From 2000 to 2500 convicts are annually employed upon share or contract farms, and about 400 upon the State farms. The State penitentiaries are located at Huntsville and Rusk. The total number of convicts October, 1900, was 4109. The penal system is ordinarily self-sustaining. The reformatory at Gatesville receives penal offenders under seventeen years of age.

MILITIA. The population of militia age, in 1900, numbered 599,221; the organized militia, in 1901, 3080.

HISTORY. The first Europeans to tread the soil of Texas were in all probability Cabeça de Vaca and three other survivors of the Narvaez expedition of 1528. (See NUÑEZ CABEÇA DE VACA.) Cabeça de Vaca's account of his wanderings through Texas stimulated Mendoza, the Viceroy of Mexico, to send a party northward under Friar Marcos de Niza to search for the mythical Cibola or Seven Cities, rumored to be golden as Mexico. It returned empty-handed, as did an expedition led by Vasquez de Coronado (q.v.). Several other expeditions probably penetrated Texas during the next hundred years, notably those of Espejo in 1582, Sosa in 1590, and Governor Oñate of New Mexico in 1601 and in 1611. An *entrada* in 1650, led by Capt. Hernân Martin and Diego del Castillo, is said to have reached the Tejas (Texas) tribe of Indians in the region of the Neches and Sabine; and one in 1684 under Padre Nicolás Lopez and Capt. Juan Domingo de Mendoza crossed the Rio Grande into the Pecos country. The first town in the State, lying 12 miles north of El Paso, was founded in 1682 and called Taleta.

The history of the State practically begins in 1685 with the landing of La Salle (q.v.), and though his attempt at colonization ended in failure, the Spaniards took fright, fearing that France might seize the land. In 1690 Alonzo de Leon and Padre Manzanet were sent to found a mission in that quarter, which was to serve the double purpose of holding the country and of converting the natives to Christianity. Mission San Francisco de los Tejas was accordingly founded among the Tejas Indians not far from the Neches River. The next year another expedition came out under Teran, but nothing resulted, and for years after Teran's *entrada* no further attempts were made by the Spaniards to occupy Texas. However, French activity in Louisiana roused them. In 1714 Juchereau de Saint-Denis, a bold French trader, led an expedition across the country to the Rio Grande, where he was made prisoner and sent to Mexico City. His account of Texas fired the Viceroy and Council to renew their efforts to occupy the country. In 1716 Captain Domingo Ramón was chosen to lead an expedition which founded several missions. He settled San Antonio de Bejar, which in the course of time became the centre of the most prosperous group of missions in the Province of Texas, as it was now called, the name of the original settlement among the Tejas Indians having come to be applied to the whole region.

For a half century mission founding went on, but it became early apparent that failure was certain. Most of the establishments were abandoned, and some of them were moved about in the wilderness. The Indians themselves destroyed more than one mission. When, in 1763, France surrendered Louisiana to his Catholic Majesty, the prime reason for the occupation of Texas no longer existed, as there could be no further French aggression from Louisiana. So the missions in the region of the Neches and Sabine were abandoned, and only those about San Antonio de Bejar—Alamo, Concepción, San José, Espada—showed any signs of surviving. There came in time to be three main foci of settlements—at Nacogdoches in the east; at what is now Goliad in the south; and at San Antonio de Bejar in the southwest. The latter completely overshadowed the others in importance.

In 1799 Philip Nolan, an American, invaded the country from Louisiana with a small party for the ostensible purpose of purchasing horses. Two years later on a second expedition the Spaniards attacked the adventurers, killing some and shipping the rest off to the mines of Mexico. This, however, was the beginning of the end of the Spanish régime. After the purchase of Louisiana in 1803, the people of the United States, and especially the inhabitants of the Southwest, looked upon Texas as part of the destined dominion of the Republic and never lost an opportunity to strike at the Spanish power. Indeed, in 1806 it looked as though war must result with Spain over the possession of the region. The United States claimed westward to the Rio Grande on the strength of the French occupation; Spain as stoutly disputed the claim, and in October, 1806, armies of the two powers stood facing each other across the Sabine. However, Gen. James Wilkinson, who commanded the Americans, was glad of the opportunity given him by the retreat of the Spaniards to the west of the Sabine and by the excitement attending the rumored conspiracy of Aaron Burr to make a neutral ground treaty with the opposing commander, Herrera, which practically conceded to Spain the territory west of the Sabine.

In 1810, when the great revolution in Mexico against Spain had begun, the Southerners sympathized intensely with the natives, and before very long were lending secret aid to Mexico. A filibustering expedition into Texas was led by James Long, a Natchez merchant and ex-officer in the United States Army. At Nacogdoches Texas was declared a republic and a provisional government organized; but the Spanish forces soon broke it up. For several years the coast of Texas became a rendezvous for pirate and adventurer. Louis de Aury, Captain Jerry, General Mina, and Lafitte are best known. They made Galveston Island their headquarters. From here sailed the famous Mina on his expedition against the Spaniards in Mexico; and from here Lafitte the pirate scoured the Gulf till the United States Government broke up the settlement. The first score of years of the nineteenth century witnessed the expiration of the Spanish power in Texas. What with the filibustering expeditions and hostile Apaches and Comanches, and the great struggle for independence in Mexico, the Spanish foci of civilization were all but extinguished. When the harsh Spanish law which forbade the entry of Americans into the region could no longer be enforced, the frontiersmen from Kentucky, Tennessee, and Louisiana wandered in with their families. They came to stay.

In 1821 Moses Austin secured from the Mexican Government the right to establish a colony in Texas. He died soon after, but his son Stephen took up the work. Being free to choose the location for his colony, Austin selected the lower Brazos and Trinity valleys. Before long many *empresarios* had been granted, plastering over with claims the whole region from the Sabine to the Nueces. Discontent with the Mexican rule was not long in appearing. This reached a crisis on December 16, 1826. The struggle which ensued is known as the Fredonian War. A band of dissatisfied Americans, headed by Benjamin Edwards, proclaimed the eastern part of the State an independent republic with Nacogdoches as its capital. A skirmish in which one man was killed and one wounded practically ended the uprising. The times were ripening, however, and a change was soon to come.

The United States was making repeated offers to the Mexican Government to buy Texas, but this only made the Mexicans more determined to retain it at any cost. The Mexicans, resenting all attempts of the United States to possess the land, turned their attention to the Texans. Decrees were drawn up prohibiting slavery in Mexico, and forbidding further colonization. These decrees were specially aimed at Texas, and roused much bitterness and indignation. The march of events was hastened by the closing of all Texas ports, except Anahuac, and by the presence of military forces. An uprising occurred in June, 1832, which led to the removal of certain obnoxious officials. This was followed by the calling of a convention which elected Stephen F. Austin President. Petitions were drawn up asking the Mexican Government for free trade for three years, begging for a grant of land from the State to promote education, and asking for a separate government. Austin was sent with the petition to Mexico, but could not gain a hearing and was made a prisoner. During 1833 and 1834 the Mexican Government acceded to certain reforms; but in 1835 the spirit of revolt reappeared among the colonists. Then the Mexican Government made another attempt to collect duties at the Texas ports. An armed schooner was sent to Anahuac, but having committed various outrages, a Texas vessel captured it and the struggle against Mexico was precipitated. The first victory was that of Gonzales, October 2, 1835, when the Texans put the Mexicans to flight. On October 8th Colonel James Bowie and Captain J. W. Fannin defeated the Mexicans near Mission Concepción, a few miles below San Antonio; on December 11th that city was taken. A provisional government was formed, Henry Smith was elected Governor, and Sam Houston major-general of the Armies of Texas; Branch T. Archer, William H. Wharton, and Stephen F. Austin were appointed commissioners to the United States. Many Americans, principally from Mississippi, hurried to the assistance of the Texans. Dissension among the Texans, however, nearly proved disastrous. In March, 1836, two parties, one under Johnson and the other under Grant, were captured by the Mexicans, and the prisoners slaughtered; also Fannin's command, which had been in possession of the Goliad fortress, surrendered and was shamelessly massacred. In all, nearly five hundred Texans met death. In February-March occurred the heroic defense of the Alamo (q.v.). March 2d the Texans issued a declaration of independence, and as if to answer this, Santa Anna, the Mexican President, hurried his army in three columns eastward over the country. On April 21st the Texan army under Houston on the field of San Jacinto avenged the slaughter of Fannin's men and the Alamo. (See SAN JACINTO, BATTLE OF.) Santa Anna, a prisoner, was glad to sign a treaty in which he engaged to do what he could to secure recognition of the independence of Texas with boundaries not to extend beyond the Rio Grande.

Thus was launched the Republic of Texas. A constitution was ratified in September, 1836, and Houston was elected President. Austin was made the capital. The great and ever pressing need of the Republic was money. With little taxable property, the Government ran deeper and deeper in debt. By 1841 the amount reached $7,500,000. To the financial difficulties of the Republic was added the aggravation of invasions from Mexico, which had never abandoned her claims on the country. Three times Mexican forces reached San Antonio, but the Mexicans always retreated without attempting to hold the place.

Meantime the independence of Texas had been recognized by the United States, France, Holland, Belgium, and Great Britain, and the presence of the representatives of these powers lent zest to the interest with which the subject of the annexation of Texas to the Union was invested. The question of annexation was bound up with that of slavery, and the whole Union was agitated. (See under UNITED STATES.) The matter became finally a national issue, and James K. Polk was elected President on a platform favoring annexation; but before he took office a joint resolution was passed by Congress making an offer of Statehood to Texas. This was accepted by the Texans, and in December, 1845, the State was formally admitted into the Union. The Mexican War (q.v.), originating in a dispute over the boundaries of Texas, followed, and the first fighting took place near the Rio Grande, at Palo Alto (May 8, 1846).

As a State of the Union Texas grew rapidly. Politics played small part until the wave of secession reached its borders. Texas, a slave-holding State, thereupon seceded from the Union (February 1, 1861). Sam Houston was Governor at the time, and threw all his weight in opposition to secession, but there was no staying the resolve of the people, many of whom went soon to join the armies of the Confederacy. The State was fortunate in that it was not the scene of much active fighting. Galveston was captured and held by the Federal forces for three months in the winter of 1862; but two attempts of the Union forces to enter the State from Louisiana were disastrously defeated. The last battle of the war was fought on the Lower Rio Grande, near Palo Alto, a month after Appomattox.

Following out his plan of reconstruction, June 17, 1865, President Johnson appointed as provisional Governor A. J. Hamilton, a man conspicuous in antebellum Texas politics. A convention was called which adopted the Constitution in force in the State prior to secession, with amendments recognizing the abolition of slavery, renouncing the right of secession, conferring civil rights on freedmen, repudiating the State debt incurred during the war, and assuming the tax which had been laid by the United States Government on the State during the period of secession. The people ratified this Constitution and under it J. W. Throckmorton was elected Governor. The Reconstruction Acts of 1867 placed the State under the military authority, with General Sheridan in command. The carpetbaggers followed and the new reconstruction occupied the next three years. A constitution was submitted to the people in November, 1869, when Congressmen and State officers were elected, and on March 30, 1870, Texas was readmitted to the Union. At the election in November, 1872, the Democrats secured control of the State; and in December, 1873, a Democratic victory made Richard Coke Governor. By this time the State had become involved in debt to the extent of several millions of dollars on the score of reconstruction. The memory of reconstruction and the race problem have served to keep the State consistently Democratic.

GOVERNORS OF COAHUILA AND TEXAS

José Maria Viesca, First Constitutional Governor	1827-30
Rafael Eca y Musquiz	1830-31
José Maria de Letona	1831-32
Rafael Eca y Musquiz	1832-33
Juan M. de Veramendi	1833-34
Francisco V. y Villaseñor	1834-35
José Maria Cantú	1835
Marciel Borrego	1835
Augustin Viesca	1835

PROVISIONAL GOVERNOR BEFORE THE DECLARATION OF INDEPENDENCE

Henry Smith	November 12, 1835-March 18, 1836

PRESIDENTS UNDER THE REPUBLIC

David G. Burnet	March 18, 1836-October 22, 1836
Sam Houston	October 22, 1836-December, 1838
Mirabean B. Lamar	December, 1838-December, 1840
David G. Burnet (acting)	December, 1840-December, 1841
Sam Houston	December, 1841-December, 1844
Anson Jones	December, 1844-February 19, 1846

GOVERNORS OF THE STATE

James P. Henderson	Democrat	1846-47
George T. Wood	"	1847-49
P. Hansborough Bell	"	1849-53
Elisha M. Pease	"	1853-57
Hardin G. Runnels	"	1857-59
Sam Honston	Independent and Unionist	1859-61
Edward Clark (acting)	Democrat	1861
Francis R. Lubbock	"	1861-63
Pendleton Murrah	"	1863-65
Andrew J. Hamilton, Prov.	Unionist	1865-66
James W. Throckmorton	"	1866-67
Elisha M. Pease	Republican	1867-70
Edmund J. Davis	"	1870-74
Richard Coke	Democrat	1874-77
Richard B. Hnbbard	"	1877-79
Oran M. Roberts	"	1879-83
John Ireland	"	1883-87
Lawrence S. Ross	"	1887-91
James S. Hogg	"	1891-95
Charles A. Culberson	"	1895-99
Joseph D. Sayers	"	1899-1903
S. W. Lanahan	"	1903—

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TEXAS, UNIVERSITY OF. A coeducational institution at Austin, Texas, with a medical department at Galveston, founded upon a grant of 1,000,000 acres of land by the Legislature in 1876. In 1883 an additional million acres was set apart and the university was opened. The medical building at Galveston was completed in 1890, when the department was opened and the John Sealey Hospital, presented the previous year, was occupied. The medical buildings were in great part rebuilt after the disastrous Galveston flood of 1900. Besides the medical department the university embraces the department of literature, sciences, and arts, offering the degrees of B.A., B.Lit., B.S., M.A., and M.S.; the department of engineering, conferring the degrees of civil engineer and engineer of mines; and the department of law, conferring the degrees of LL.B. and LL.M. New departments in electricity and mechanical engineering were established in 1903, when it was decided to give no degree for undergraduate work after 1906 except that of B.A. Two summer schools are conducted at Austin during June and July. In 1902 the student attendance was 1378, and the faculty numbered 109. The library had 40,000 volumes. The endowment was $1,363,000 and the income $275,303.

TEXAS FEVER (also known as Spanish splenic or acclimation fever, American cattle plague, red water, black water, yellow murrain, and bloody murrain). An epizoötic, reputed contagious or infectious fever of cattle, confined to regions south of the 37th parallel of north latitude, except when communicated by cattle brought from there. The cause is charged to Pyrosoma bigeminum, a protozoön found in the blood. Observations indicate that in the permanently infected districts cattle become accustomed to the influence of the protozoa which pass through the organism without creating much disturbance, and generally without being noticed. It is claimed, however, that native cattle in more northern regions, not being protected by previous habitual exposure, are subject to injury. One of the first symptoms is an elevation of temperature, which ranges usually from 106° to 108° F., and sometimes as high as 110°. With this rise are symptoms of languor and fatigue, as drooping of the head, and lopped ears. In advanced cases the head droops so that the nose almost reaches the ground; the hind legs are placed close under the body; the legs are weak, and the animal frequently lies down, especially in water. The pulse is frequent, sometimes soft and feeble, but often hard and wiry. The inoculation of animals attacked with the blood of animals which have recovered is believed to be the only means of curing serious cases. But since the protozoön is spread from animal to animal by the cattle tick (*Boophilus bovis*), dips which rid the animals of the ticks have been suggested as preventive measures.

TEX'EL. The southernmost and largest of the West Frisian Islands, belonging to the Dutch Province of North Holland, and situated at the entrance to the Zuider Zee (Map: Netherlands, C 1). It is separated from the mainland on the south by the Marsdiep, about 5 miles wide. Area, 67 square miles. It consists largely of good meadow land lined on the north and west by sand dunes, and protected from the sea on the other sides by dikes. The principal industry is sheep-raising, and wool and cheese of fine quality are exported. Population, in 1899, 5954.

TEXIER, tĕs'yâ', CHARLES FÉLIX MARIE (1802-71). A French archæologist, born in Versailles. He explored the antiquities of Asia Minor and taught at the Collège de France. His works include: *Description de l'Asia Mineure*, published in Paris and London (1839-48); *Description de l'Arméne, la Perse et de la Mésopotamie* (1842-45); and *Asie Mineure* (1862).

TEXTILE DESIGNING (Lat. *textilis*, relating to weaving, from *textus*, fabric, composition, text, from *texere*, to weave; connected with Gk. *τέκτων*, *tektōn*, carpenter, *τέχνη*, *technē*, art, Skt. *takṣ*, to cut, form). That branch of textile manufacturing which is devoted to the construction of fabrics, their weaves and patterns or designs for the same. Unlike the designing for printed patterns, whether for textiles, wall-paper, or other purposes, which are termed 'applied designs'—and for which the designer is only called upon to use his skill in drawing and color combination—the designing of fabrics in which the pattern is to be woven of threads colored before weaving, or in which the pattern is produced by the weaves, necessitates in addition to knowledge of combining colors and drawing a thorough knowledge of each of the various departments or processes of textile manufacturing (q.v.). The designer must be able to construct fabrics of a required weight, texture, and finish, or for a specific purpose, telling the manufacturer what size of warp and filling to use, how many threads of each to the inch, and what weave will give the required results.

The construction of various weaves is one of the most important features of textile designing, and an account of weave construction will be found in the article WEAVING. A complete design for a woven fabric must contain at least the following specifications: Number of warp threads to an inch; number of inches wide on loom; number of picks, or filling threads, to an inch; size of warp and filling yarns and materials for same; the weave and the arrangement of the warp thread on the loom—harness with full particulars relative to manipulation of materials in the process of manufacturing; the estimated weight of the fabric as woven; the finishing processes it is to be submitted to, together with its finished width, weight, and texture, that is, the count in warp and filling threads to the inch. When the pattern is to be worked out in colored threads the arrangement of these must be given; and when the pattern is drawn and possibly colored, then the weave is constructed in such a way as to produce with the woven threads the effect of the drawing as nearly as possible. See LOOM; WEAVING; TEXTILE MANUFACTURING.

TEXTILE MANUFACTURING. The industrial group of manufactures embracing the production from the various raw materials of fabrics of cotton, wool, silk, flax, hemp, and jute; hosiery and knit goods; felt goods and wool hats; cordage and twine; laces, braids, and embroideries.

TABLE I.—COMPARATIVE SUMMARY OF TEXTILE INDUSTRIES, NOT INCLUDING FLAX, HEMP, AND JUTE, 1880 TO 1900, WITH PER CENT. OF INCREASE FOR EACH DECADE

	Date of census			Per cent. of increase	
	1900	1890	1880	1890 to 1900	1880 to 1890
Number of establishments	4,171	4,114	4,018	1.4	2.4
Capital	$1,001,005,815	$739,973,661	$412,721,496	35.3	79.3
Salaried officials, clerks, etc., number	16,181	*10,179	†	59.0	......
Salaries	$22,331,972	*$11,930,750	†	87.2	......
Wage-earners, average number	640,548	501,718	‡384,251	27.7	30.6
Total wages	$202,690,706	$163,616,593	$105,050,666	23.9	55.8
Men, 16 years and over	288,871	216,345	159,382	33.5	35.7
Wages	$114,959,158	$91,038,323	†	26.3	......
Women, 16 years and over	283,638	243,589	169 806	16.4	43.5
Wages	$78,084,564	$66,644,785	†	17.2	......
Children, under 16 years	68,039	41,784	55,063	62.8	§24.1
Wages	$9,646,984	$5,933,485	†	62.6	......
Miscellaneous expenses	$60,444,630	$43,356,736	¶	39.4	......
Cost of materials used	$489.147,315	$421,398,196	$302 709,894	16.1	39.2
Value of products	$883,892,959	$721,949,262	$532,673,488	22.4	35.5

* Includes proprietors and firm members, with their salaries; number only reported in 1900, but not included in this table. † Not reported separately. ‡ Includes 2,115 officers and clerks whose salaries are not reported. § Decrease. ¶ Not reported.

TEXTILE MANUFACTURING IN THE UNITED STATES.—STATISTICS. The importance of the textile industry in the United States is seen from the accompanying table from the Twelfth Census, which shows 35.3 per cent. increase in the capital invested, during the last decade of the last century, over the decade immediately preceding; an increase of 23.9 per cent. in the annual amount of wages paid for the same period; but only 22.4 per cent. increase in the annual value of the manufactured product. This latter condition is explained by the decreased cost of production, due to the improved machinery and to a decreased cost of the several raw materials. An exact knowledge of the general growth of the industry is difficult to arrive at, in consequence of the above and other varying conditions, and probably the best idea of its growth is the increase of wage-earners as shown by decades in Table II. In spite of the fact that the improved machinery makes the productive power of one man's labor many times greater than it was a half century ago, the increase in wage-earners each decade has exceeded the general growth of the population except between 1850 and 1860.

Table II.—Per Cent. of Increase in Average Number of Wage-Earners and in Value of Products: 1850 to 1900 *

PERIODS	Per cent. of increase in—	
	Average number of wage-earners	Value of products
1850 to 1900	336.1	586.4
1890 to 1900	27.7	22.4
1880 to 1890	30.6	35.5
1870 to 1880	39.8	2.4
1860 to 1870	41.7	142.3
1850 to 1860	32.1	66.8

* Not including flax, hemp, and jute.

The importance of the industry is also shown by Table III., giving the value of textile products by decades from 1810 to 1900, and in Table IV., which shows not only the 'combined textiles,' but each individual industry classed to show conditions each decade from 1850 to 1900.

Table III.—Comparative Summary, Value of Products: 1810 to 1900

DATE OF CENSUS	Total	Cotton manufacture *	Wool manufacture †	Silk manufacture	Holsery and knit goods	Flax, hemp, and jute ‡	Dyeing and finishing textiles
1900	$931,494,556	$339,200,320	$296,990,484	$107,256,258	$95,482,566	$47,601,607	$44,963,331
1890	759,262,283	267,981,724	270,527,511	87,298,454	67,241,013	37,313,021	28,900,560
1880	532,673,488	192,090,110	238,085,686	41,093,045	29,167,227	....	32,297,420
1870	520,386,764	177,489,739	199,257,262	12,210,662	18,411,564	....	§113,017,537
1860	214,740,614	115,681,774	73,454,000	6,607,771	7,280,606	....	11,716,463
1850	128,769,971	61,869,184	48,608,779	1,809,476	1,028,102	....	15,454,430
1840	67,047,452	46,350,453	20,696,999	....	....	....	....
1830	37,062,981	22,534,815	14,528,166	....	....	....	....
1820	9,247,225	4,834,157	4,413,068	....	....	....	....
1810	51,685,785	¶26,076,997	‖25,608,788	....	....	....	....

* Includes cotton goods and cotton small wares. † Includes worsted goods; woolen goods; carpets and rugs, other than rag; felt goods, and wool hats. ‡ Includes cordage and twine; jute and jute goods; linen goods; and two establishments in 1890 classified as 'linen thread.' § At the census of 1870 the value of the fabric itself was reported, whereas in all subsequent censuses merely the value added to such fabric by the process of dyeing and finishing is given. ¶ Includes manufactures of cotton and flax in families and otherwise. ‖ Includes manufactures of wool in families and otherwise.

The increase in the amount of the various raw materials used by decades from 1840 to 1900 is shown by Table V., which also furnishes a measure of the relative growth of the several industries. It is well to notice in this connection, however, that because of the unsettled conditions in the Southern States from 1860 to 1870 there was a decrease in the amount of cotton used, while for each decade there is a large and steady increase in the amount of wool used. During the twenty-year period 1860 to 1880 the amount of cotton used did not double itself, while the use of wool increased over 300 per cent.; but the use of cotton shows a wonderful increase from 1880 to 1900, due largely to the development of the cotton-manufacturing industry in the Southern States, which bids fair to monopolize the production of the medium and coarser grades of cotton fabrics.

Table V.—Consumption of Textile Fibres: 1840 to 1900

YEARS	Cotton, pounds *	Wool, pounds †	Silk, pounds
1900	1,910,509,193	412,323,430	9,760,770
1890	1,193,374,641	372,797,413	6,376,881
1880	798,344,838	296,192,229	2,690,482
1870	430,781,937	219,970,174	684,488
1860	443,845,378	98,379,785	462,965
1850	288,558,000	70,862,829	....
1840	126,000,000	....	....

* Includes cotton consumed in establishments classed as cotton goods, cotton small wares; woolen goods, worsted goods, carpet and rugs, other than rag; felt goods; wool hats; and hosiery and knit goods. † Includes wool consumed in establishments classed as woolen goods; worsted goods, carpets and rugs, other than rag; felt goods; wool hats; and hosiery and knit goods.

It is difficult to obtain exact information about the relative importance of the United States in the manufacture of textiles, as the statistics are collected in no other country with the thoroughness which characterizes the American census. The accompanying tables give in the most comprehensive way the opinions of the most capable statisticians. One might infer from Table VI. that in 1900 the United States led the world in the manufacture of cotton goods; yet it is universally known that Great Britain is far in the lead in cotton manufacturing; but because of the fact that the greater part

Table VI.—Consumption of Cotton at Decennial Periods, 1830–1900

	Great Britain, number of thousand bales	Continent Europe, number of thousand bales	United States, number of thousand bales
Average for 5 years ending—			
1830	711	411	130
1840	1,156	629	255
1850	1,458	776	553
1860	2,265	1,490	813
1870	2,639	1,842	875
1880	2,924	2,455	1,543
Year 1890	4,140	4,277	*2,983
Year 1900	4,079	5,720	4,599

* Census figures, reduced to bales of 400 pounds. Cotton used in wool manufactures included.

Table IV.—Comparatve Summary, by Industries: 1850 to 1900

INDUSTRIES	Year	Number of establishments	Capital	Salaried officials, clerks, etc.		Wage-earners		Miscellaneous expenses	Cost of materials used	Value of products
				Number	Salaries	Average number	Total wages			
Cotton manufacture—Cotton goods	1900	973	$460,842,772	4,713	$7,123,574	297,929	$85,126,310	$21,650,144	$173,441,390	$332,806,156
Cotton small wares	1900	82	6,397,385	189	226,625	4,932	1,563,442	462,534	3,110,137	6,394,164
Wool manufacture	1900	1,414	310,179,749	4,495	6,455,495	159,108	57,933,817	17,329,932	181,159,127	296,990,484
Silk manufacture	1900	483	81,082,201	2,657	3,134,352	65,416	20,982,194	10,264,208	62,406,665	107,256,258
Hosiery and knit goods	1900	921	81,860,604	2,809	3,124,798	83,387	24,358,627	6,599,865	51,071,859	95,482,566
Flax, hemp, and jute	1900	141	41,991,762	641	957,190	20,903	6,331,741	2,678,286	32,197,885	47,601,607
Dyeing and finishing textiles	1900	298	60,643,104	1,318	2,267,128	29,776	12,726,316	4,137,947	17,958,137	44,963,331
Combined textiles	1900	4,312	$1,042,997,577	16,822	$23,289,162	661,451	$209,022,447	$63,122,916	$521,345,200	$931,494.566
Cotton manufacture	1890	905	$354,020,843	2,709	$3,464,734	218,876	$66,024,538	$16,716,524	$154,912,979	$267,981,724
Wool manufacture	1890	1,693	245,886,743	3,652	4,057,695	154,271	54,339,775	15,622,263	167,233,987	270,527,511
Silk manufacture	1890	472	51,007,537	1,531	1,917,877	49,382	17,762,441	4,259,623	51,004,425	87,298,454
Hosiery and knit goods	1890	796	50,607,738	1,621	1,685,153	59,588	16,578,119	3,627,245	35,861,585	67,241,013
Flax, hemp, and jute	1890	162	27,731,649	458	609,170	15,519	4,872,389	1,431.932	26,148,344	37,313,021
Dyeing and finishing textiles	1890	248	38,450,800	666	805,291	19,601	8,911,720	3,131,081	12,385,220	28,900,560
Combined textiles	1890	4,276	$767,705,310	10,637	$12,539,920	517,237	$168,488,982	$44,788,668	$447,546,540	$759,262,283
Cotton manufacture*	1880	756	$208,280,346	....	....	†174,659	$42,040,510	....	$102,206,347	$192,090,110
Wool manufacture	1880	2,330	143,512,278	....	....	132,672	40,687,612	....	149,160,600	238,085,686
Silk manufacture	1880	382	19,125,300	....	....	31,337	9,146,705	....	22,467,701	41,033,045
Hosiery and knit goods	1880	359	15,579,591	....	....	28,885	6,701,475	....	15.210,951	29,167,227
Dyeing and finishing textiles	1880	191	26,223,981	....	....	16,698	6,474,364	....	13,664,295	32,297,420
Combined textiles	1880	4,018	$412,721,496	....	....	†384,251	$105,050,666	....	$302,709,894	$532,673,488
Cotton manufacture	1870	956	$140,706,291	....	....	135,369	$39,044,132	....	$111,736,936	$177,489,739
Wool manufacture	1870	3,208	121,451,059	....	....	105,071	35,928,150	....	124,318,792	199,257,262
Silk manufacture	1870	86	6,231,130	....	....	6,649	1,942,286	....	7,817,559	12,210,662
Hosiery and knit goods	1870	248	10,931,260	....	....	14,788	4,429,085	....	9,835,823	18,411,564
Dyeing and finishing textiles	1870	292	18,374,503	....	....	13,066	5,221,538	....	99,539,992	‡113,017,537
Combined textiles	1870	4,790	$297,694,243	....	....	274,943	$86,565,191	....	$353,249,102	$520,386,764
Cotton manufacture	1860	1,091	$98,585,269	....	....	122,028	$23,940,108	....	$57,285,534	$115,681,774
Wool manufacture	1860	1,476	38,814,422	....	....	50,419	11,699,630	....	43,447,048	73,454,000
Silk manufacture	1860	139	2,926,980	....	....	5,435	1,050,224	....	3,901,777	6,607,771
Hosiery and knit goods	1860	197	4,035,510	....	....	9,103	1,661,972	....	3,202,317	7,280,606
Dyeing and finishing textiles	1860	124	5,718,671	....	....	7,097	2,001,528	....	5,005,435	11,716,463
Combined textiles	1860	3,027	$150,080,852	....	....	194,082	$40,353,462	....	$112,842,111	$214.740,614
Cotton manufacture	1850	1,094	$74,500,931	....	....	92,286	....	....	$34,835,056	$61,869,184
Wool manufacture	1850	1,675	31,971,631	....	....	45,438	....	....	28,831,583	48,608,779
Silk manufacture	1850	67	678,300	....	....	1,743	....	....	1,093,860	1,809,476
Hosiery and knit goods	1850	85	544,735	....	....	2,325	....	....	415,113	1,028,102
Dyeing and finishing textiles	1850	104	4,818,350	....	....	5,105	....	....	11,540,347	15,454,430
Combined textiles	1850	3,025	$112,513,947	....	....	146,877	....	....	$76,715,959	$128,769,971

* In addition to these data there were in the census of 1880 returns for 249 'special mills,' engaged in working raw cotton, waste, or cotton yarn into hosiery, webbing, tapes, and fancy fabrics, and mixed goods or other fabrics, which are not sold as specific manufactures of wool or cotton. These 249 establishments reported $11,224,448 capital, 12,928 employees, $3,573,909 wages, $2,338,385 cost of cotton consumed, $18,860,273 value of products, and should be considered in making comparisons. In 1890 this class of mills is reported under a number of different heads, although some of them may be included in the totals for textile industries presented in the figures for 1890. † Includes 2,115 officers and clerks, whose salaries were not reported. ‡ At the census of 1870 the value of the fabric itself was reported, whereas in all subsequent censuses merely the value added to such fabric by the process of deying and finishing is given.

of the spindles in the United States run on coarse or medium-sized yarns, and those of England on much finer yarns, the United States actually spins more pounds of the raw material.

TABLE VII.—COTTON SPINDLES IN THE WORLD AT VARIOUS PERIODS, IN THOUSANDS

	1900	1897	1887	1877	1861
Great Britain	46,000	44,900	43,000	39,500	30,300
Continent of Europe	33,000	30,350	23,750	19,600	10,000
United States	19,008	16,800	13,500	10,000	5,000
India	4,400	4,000	2,400	1,230	338
Japan	1,500	970	....	....	....
China	600	440	....	....	....
Canada	640	560	....	....	....
Mexico	460	450	....	....	....

None of the European countries equals the United States in spindles, so that the latter is second only to Great Britain.

The relative standing of the countries in wool manufacturing is more difficult to arrive at accurately; but the following table, compiled from a trade circular of Messrs. Helmuth, Schwartz & Co., London, who are recognized as authority on the production and consumption of wool throughout the world, and from figures made up by the National Association of Wool Manufacturers (*Bulletin* for November, 1900)—the nearest year of comparison being 1894—shows the net pounds available for home consumption in the several countries. It might be said that Great Britain, France, Germany, and Austria-Hungary produce fully five-sixths of all the woolen goods made in Europe, Great Britain being in the lead.

TABLE VIII.

COUNTRIES	Pounds
Great Britain	507,000,000
North America	458,000,000
France	457,610,000
Austria-Hungary	386,800,000
Germany	383,090,000

The statistical position of the several countries engaged in silk manufacturing is readily seen in Table IX., which gives the value of silk products in Europe and in the United States, showing that while France was first, the United States was a good second in 1900; but when we consider that the industry in this country has been developed since 1870 and note, as in Tables III. and IV., the rapid growth, we may believe that if it already does not it will soon lead in the manufacture of silks.

TABLE IX.—VALUE OF SILK PRODUCTS OF EUROPE AND THE UNITED STATES: 1900*

COUNTRIES	Value of products	Per cent. of products
France	$122,000,000	30.9
United States	92,000,000	23.3
Germany	73,000,000	18.5
Switzerland	38,000,000	9.6
Russia (in Europe)	21,000,000	5.3
Austria-Hungary	17,000,000	4.3
Great Britain	15,000,000	3.8
Italy	13,000,000	3.3
Spain and Portugal	4,000,000	1.0
Total	$395,000,000	100.0

* International Universal Exposition at Paris; Report of United States Commissioner Peck: Report on silk fabrics, contributed by Franklin Allen, Jr., of the United States, in the silk section (Class 83). Government Printing Office, Washington, D. C., 1901, page 565.

INFLUENCES CONTROLLING DEVELOPMENT. The influences controlling the establishment of the textile industry in a given country are primarily the supply of the raw material and the adaptability of the people to a manufacturing life. Among the earliest forms of machinery are the hand-loom and spinning-wheel; and as sheep may be, and usually are, raised in any country where clothing must be warm, it is not surprising to find in the world's earliest history records of the production of fabrics of *wool;* these came to be known as *homespun*, because made from yarn spun at home and woven by hand by some member of the household. That the woolen industry should spring up in primitive communities, and among people too poor to purchase material for clothing, is only natural; and as the comforts of life became more accessible and labor became diversified and specialized, owing to the increase in population, the tendency was to produce fabrics for sale and in such quantities as required the use of more improved machinery; and in order to further reduce the cost large numbers of machines were collected and there resulted the mill or factory. That the woolen industry has secured a foothold in all countries in which wool fabrics are needed for clothing, with the exception of the polar regions, is, then, not surprising.

Cotton being a sub-tropical plant and the lint being separable with ease from the seed by hand, and as the fibre can be spun and woven in as simple a way as wool was manufactured in primitive communities, it would seem that the cotton industry should have developed near the source of the raw material; but the sections of the different countries suited to raising cotton were largely inhabited by people with agricultural instincts, consequently the industry has developed in more thickly settled communities and in sections remote from the cotton field. One important feature in the early development of the cotton industry in factories was the fact that fabrics of cotton must necessarily be light in weight and of comparatively fine yarns, consequently the proportion of labor cost to the cost of production was much greater than in the production of fabrics of wool, and the tendency was to concentrate in their production; this condition also stimulated the invention of labor-saving machinery. The result is that virtually the whole manufacture is in the hands of invested capital, and the tendency is for it to expand in communities where it is already established, and, unless favored by special advantages, to languish or to be neglected in sections where it is newly introduced.

In the thickly settled centres of India the industry had its greatest growth in a semi-tropical country and in a country fully adapted to the production of the fibre, yet, strange as it may seem, the inhabitants make better laborers in the factories than they do cultivators of the crop. Those who do follow agricultural pursuits are content to do so in a small way, simply raising the product for individual use rather than farming in a commercial way. This condition was recently referred to by Sir George Watt, reporter to the Government of India on Economic Products, as follows: "Like many other countries in the East and Far East, India cannot be treated geographically, for in every instance the people on the soil must be taken into consideration. In places like, say Africa, districts may be found where the planter can settle on virgin soil and find natives who are only too willing to work for wages; but in India a more civilized, we might say more dignified, set of people are to be found, and these natives prefer to manage the soil without European intervention. This feeling is illustrated in a higher stage of the industry, where the best and largest cotton mills are owned by natives or are operated by native companies."

In China, Japan, the East Indies, and Mexico there has been of recent years a considerable introduction or development of the industry, due almost entirely to the adaptability of the people to a manufacturing life. Yet it is doubtful if the movement would have been as successful in some of these cases if there had not been encouragement in the way of Government measures.

The most wonderful growth of the cotton-manufacturing industry has been in the Southern United States. The availability of the raw material, made possible largely by the agricultural labor of the negro, and the presence of a class of the white population who, after the war, found themselves without homes or occupation and who it was found were teachable and tractable, and would make good factory hands, and were to be had in abundance, were the chief factors in this development; then there were available water-power and land which could be secured cheaper than elsewhere, and at first municipal aid in the way of exemption from taxation for a term of years. The growth of the industry in the Southern States has been remarkably steady since 1880, and ample proof of its success is evidenced by the fact that more and larger mills are now being built, together with the enlargement and development of older ones.

The sources which first gave the so-called 'civilized' nations their fine and beautiful fabrics of silk were China and Japan; there the silkworm flourished, labor was plentiful and cheap, and the nations æsthetic; they produced beautiful but costly fabrics which were to be considered luxuries as far back as the nations have a history, yet these nations now produce less in value than many others, though they still produce fabrics which the more highly civilized nations can hardly equal. It is natural to expect that the growth of the silk industry should be greatest in those countries which can produce the raw material, but this is not always the case. The introduction of the silkworm into Central and Western Europe caused a remarkable expansion of the manufacture of silks in Switzerland, Italy, Austria, and France. The Germans, producing practically no raw silk, however, have made a great success of the industry, as has the United States in recent years. England, however, with a wonderful capacity for manufacturing, having attempted the silk industry, relying on imported silk, though fairly successful for a time, has seen it decline for the last half century, while the cotton industry during the same period has had an extraordinary development. Mr. Edward Stanwood, of Boston, a textile statistician, in speaking of the development of the industry of the United States, says: "Reasons corresponding to those which caused the wool manufacture to spring up in every part of the country and which concentrated the manufacture of cotton where power is cheap, where rates of transportation are low, where labor is abundant, or in the immediate vicinity of a supply of cotton, result in a still greater localization of the silk industry. Eleven-twelfths of all the establishments in the country are in the five adjoining States of Pennsylvania, New Jersey, New York, Connecticut, and Massachusetts, and of the spindles, more than nineteen-twentieths of the whole are in the mills of those States." The most important reason for this localization is the presence of sufficient labor of requisite skill to manufacture the raw material and produce fine and costly fabrics—a labor which would be too costly to employ in the production of cotton goods except those of the very finest quality, but which may be employed in the silk industry with profit. Yet another factor has been an encouraging Government policy, which has helped to establish the industry more firmly.

These are briefly the important features in connection with the development of the most important of the world's textile industries. See COTTON; SILK; WOOL AND WORSTED MANUFACTURES; FACTORIES AND FACTORY SYSTEM; MANUFACTURES, etc., etc.

TEXTILE PRINTING. The art of producing figured designs upon textile fabrics, by dyeing or staining, can be traced back 4000 years to the early homes of textile weaving, in India and Egypt. Probably the earliest figured effects were produced by securely binding up spots all over the material so that the dye into which the fabric was afterwards dipped could not penetrate these places. Another method of producing white or uncolored spots was by applying fused wax, which, of course, was removed after the cloth had been dyed. According to Pliny, the Egyptians, from early times, were very skillful in the production of patterned cloth by applying or painting mordants on fabrics and then dyeing them. Another way of producing the same effect was the use of the stencil, on which the coloring material was applied with a brush. Painting, or making the designs directly with a brush, was a common method of producing figured textiles; most of the early figured textiles introduced into Europe were not really printed, but only painted fabrics. It is recorded that painted cloth, probably linen, was produced in London in 1410.

The printing block, in its most primitive form, was used in the Orient from the remotest times. In Europe it seems to have been applied to the printing of fabrics before its use in book-printing was thought of. For centuries it was the only means used for producing figured designs not embroidered or painted, and it is still employed for producing special patterns. Upon the face of a block of some hard wood, 9 or 10 inches long, 5 or 6 inches wide, and half as thick, the design was carved, a stout handle having previously been fastened to the block. Sometimes stout copper wire was bent into the required shape and hammered into the block along the outlines of the pattern, which had been previously traced on the wood. The table upon which the printing was performed was a smooth flag of sandstone, covered with securely fastened blanketing. Over this table the fabric was spread. The thickened color was spread on a woolen cloth, upon which the printer applied the block and then stamped it upon the cloth. It required great skill and experience on the part of the printer to dip up the color evenly and in the right amount upon the block and then to apply it over and over, in exactly the proper place upon the fabric, until the entire surface had been covered with the design. Of course a separate block, with the proper portion of the design thereon, was required for each color, and between the applications of two successive colors the cloth was thoroughly dried. The *Perrotine* (so called from the name of its inventor) is a device for producing block printing by machinery. The design is engraved in relief upon cast metal plates. It is now but little used.

The invention of the roller printing press marked an epoch in the history of textile printing. It made possible the production of patterns complicated in design and coloring, at a cost so slight as to make it practicable to use them for the most inexpensive fabrics. The first patents for roller printing were taken out in England in 1743 and 1772, and in France in 1801. The invention is usually ascribed to Thomas Bell. The roller printing press consists of a huge cylinder or bowl, revolving on its axis and carrying the cloth to be printed. While passing over this drum the material to be printed is brought into contact with another cylinder which carries the color and upon whose surface the pattern is engraved. The drum is covered or cushioned with several layers of a coarse cloth called lapping. Against this bowl is pressed the engraved copper cylinder, which receives the color from a wooden cylinder, covered with cloth and dipping into the color-trough. In order to remove the surplus color from the copper roller, the so-called *doctor* is supplied; this is simply a sharp blade which is pressed at an angle on the roller and scrapes the surplus color from it. In order to remove any loose threads or filaments, there is also a *lint-doctor*. The cloth to be printed passes between the engraved copper roller and the bowl, and in order to have an elastic underlayer it is supplied with a *blanket*, which is usually of wool. To keep the blanket clean the *back-cloth*, of unbleached cotton, is allowed to intervene between blanket and printing cloth. The three cloths (blanket, back-cloth, and cloth to be printed) go through at the same time between the bowl and the printing roller. The latter gives the color kept in the engraving over to the printing cloth next to it. This giving up is caused (1) by the pressure of the printing roller against the drum, and (2) by the action of the lapping and blanket, which, by forming a kind of elastic cushion, press the cloth into the engraved cavities of the roller and force the cloth to absorb the color, which is prevented from spreading by the pressure exerted at the same time. The copper roller is a hollow cylinder mounted on an iron mandrel. It is sometimes engraved by hand, but more often by machine. The engraving is accomplished mechanically by producing the design in a small section by hand, then reproducing it on a second piece of hardened steel, from which it is easily stamped over and over on the comparatively soft copper. By another method, known as the chemical process, the copper roller is covered with varnish through which the pattern is cut with a pantograph (q.v.). The roller is then immersed in acid, which eats out the exposed copper in the form of the design, after which the varnish is removed from the roller. The printed fabric is dried by passing it slowly over and near a series of steam-heated hollow cast-iron plates. As each roller prints but one color, there are as many rollers in a cylinder printing press as the desired number of colors. Great care has to be observed to keep the colors clear. In order that a dark shade may not soil a light one, the lighter shades are usually printed first and sometimes a plain starch roller is applied between the two.

Before it is printed the cloth is subjected to various preliminary processes, depending upon the nature of the fabric. Cotton goods are bleached and padded or treated to dressing to give them the proper body and surface. They are then run through the *lint-doctor* to remove all hairy projections. Woolen goods must be treated to a preliminary bath in a weak solution of sodium hypochlorite. The cloth is moistened before printing, and after printing is washed and dried. Silk has to be prepared for printing by suitable agents, such as tin with or without an acid. Both wool and silk require to be entirely freed from grease before they can be printed.

The preparation of the colors for printing requires great skill and knowledge of the properties of the different dyestuffs. The colors are mixed in copper pans so mounted that their contents can be boiled by steam, cooled with water, and easily emptied. Wooden paddles are provided for stirring the colors, or the agitation may be performed by mechanical appliances. As most of the colors are thickened with starch or flour, so that they will spread well, they require straining through a copper wire sieve.

The printing of cotton fabrics is a much more complicated and difficult process than that of printing silk or wool, because many of the complex methods that may be applied to the former are, from the nature of the material, inapplicable to the latter. The many different methods and combinations of methods by which the color effects are produced on cotton fabrics have been variously classified by writers on textile printing. To understand the production of these different so-called 'styles' involves a knowledge of the principles and chemistry of dyeing. (See DYEING.) The simplest classification is that adopted by Georgrievic, in his work named in the bibliography. According to his classification, the production of a pattern upon cotton cloth may be accomplished as follows: (1) Direct printing; (2) combined dyeing and printing; (3) discharge style printing; (4) reserve style printing. *Direct printing* is done by mixing the desired color with the proper fixing agents and applying the mixture directly to the fabric. In *combined dyeing and printing*, the printing is done with mordants, and then the whole fabric is dyed. In the *discharge style* the effect is produced either by using a solution that will discharge the mordant or the dye itself. In the *reserve style* various substances, printed on the fabric, are employed to prevent absorption or development of other colors subsequently applied by padding or dyeing. The last three groups belong to the general class of dyes, as opposed to simple printed colors.

Considering these four groups more carefully, we find that in direct printing three general methods are used for fixing the color upon the fabric, the method used in a given case depending upon the chemical nature of the dyestuff. These methods are: (1) *Steaming*, in which printing is followed by air drying and steaming, or by immediate steaming, drying, and again steaming; (2) *oxidizing*, in which the color is fixed by the process known as 'aging,' either by prolonged exposure to the air or by passing through a steam 'ager;' (3) *reducing*, a method applied to indigo printing. Indigo is printed upon fabrics in two ways known as the 'glucose' and 'reduced indigo' processes which are briefly described by Sadtler (see bibliography) as follows: By the first method "Indigo is finely ground and made into a paste with water, to which is added caustic soda; this is now kept in a closed vessel in order to prevent as much as possible the absorption of carbonic acid from the atmosphere. The proportioning of the ingredients depends on the desired shade of blue. When used in printing it is thickened with dextrin and starch. . . . The cloth, before being printed upon, is worked through a twenty-five per cent. solution of glucose and dried. After printing, the cloth must be again dried and passed through an atmosphere of wet steam, to effect the *reduction* of the indigo which now takes place. The cloth is now washed in water, being repeatedly, during the washing, exposed to the air, when the *reduced* indigo is oxidized and its real color appears. . . . The second process is based upon the fact that indigo, when finely ground and mixed with lime and thiosulphate of soda in suitable thickening agents, is reduced; if with this reduced indigo paste, patterns are printed upon cotton fabrics, and then exposed to the air, the indigo is oxidized with a regeneration of the blue color. The pieces are then washed and dried. Instead of using indigo in printing, one of the newer colors, *immedial blue*, is now very extensively used and printed with suitable mordants directly upon the goods."

Passing on to the second general method of textile printing, which is a combination of printing and dyeing, four operations are involved. First, the fabric is printed with the appropriate mordant; then follows the *aging* process, during which the printed mordant is decomposed and more firmly fixed to the cloth; then follows an operation known as *dunging*, which removes the thickening, no longer needed in the mordant; and finally *dyeing*, the dye, of course, remaining fixed only to that part of the fabric which was previously treated with the mordant. The aging process was formerly conducted in large chambers and consumed several weeks. It is now performed in steam 'agers,' much more rapidly; but cloth that is rapidly aged does not hold its color as well as when the operation is conducted more slowly. Dunging is a passing of the cloth through solutions of sodium phosphate, arseniate, or silicate, these chemicals being now employed in place of the somewhat offensive cow-dung. The composition of the dye-bath is described under DYEING.

For the third, or discharge style of printing, the *discharges* are simply substances printed upon the goods, the whole of which has been mordanted, so that the mordant is removed from the printed spots, and when the goods are finally dyed the printed figures will be white, while the background will be the color naturally produced by the dye and mordant.

In the fourth, or reserve, style of printing, substances are printed upon the fabric which will prevent the fixation of color in those places. Reserves are of two general kinds: chemical, such as citric acid, and mechanical, such as pipe-clay, beeswax, or other inert substance.

These four general methods of textile printing, briefly outlined above, are susceptible of endless modification and combination. Rothwell (see bibliography) gives ten possible methods which he groups under seven 'styles.' Many of them are applicable only to cotton.

STATISTICS. According to the United States Census for 1900, 1,233,191,438 yards of cotton were printed in the United States in 1900, as against 722,257,451 yards printed in 1890. During 1900, 10,239,606 yards of silk goods were also printed in this country. In the same year, 334 printing machines were in operation in factories devoted exclusively to printing and finishing textile fabrics, of which 321 were for the printing of cotton fabrics and the remainder for the printing of silk. It is evident from these figures that the printing of woolen and mixed goods, which is a flourishing industry in Europe, has not yet become established in America.

BIBLIOGRAPHY. Consult: Georgievic, *Chemical Technology of Textile Fabrics*, trans. by Salter (London, 1902); Rothwell, *Printing of Textile Fabrics* (Philadelphia, 1902); Santonè, *The Printing of Cotton Fabrics* (London, 1897); Duerr, *Bleaching and Calico Printing* (London, 1896); Sadtler, *Industrial Organic Chemistry* (Philadelphia, 1900). The last named book contains a complete bibliography chronologically arranged, from 1874 to 1900.

TEXTUAL CRITICISM (OF., Fr. *textuel*, from Lat. *textus*, text, composition, fabric, from *texere*, to weave). The criticism of existing texts of literary works with a view to the detection of errors which have crept in, and the restoration of the reading intended by the author. Such criticism may be necessary in the case of any literary production which is no longer under the control of its author, but it finds its most difficult problems in the Old and New Testaments, the Greek and Latin authors whose works are preserved to us, in the older monuments of the national literatures, and in the texts of some moderns, e.g. Chaucer and Shakespeare.

The criticism of the texts of Greek and Latin authors, to take them as examples, is based first of all on a careful study and comparison of all existing manuscripts, then on quotations and unconscious reminiscences of the writer in question, in other authors, and finally on such helps as may be obtained from ancient commentaries, *Scholia* (see SCHOLIASTS), or from early translations, such as the Latin and Arabic renderings of certain works of Aristotle. Most of our classical manuscripts belong to the period from the ninth to the fifteenth century; a few are earlier, one or two possibly as old as the fourth century, and some are later, but ordinarily the manuscripts of the fifteenth and sixteenth centuries are of little or no value. No existing manuscript is free from error. The scribes often did their work mechanically and ignorantly, so that blunders were easily made; these were then perpetuated and spread by each successive copyist. Such errors may be corrected by comparison with a manuscript which does not contain the identical blunders; but in case all existing manuscripts are descended from the same incorrect original, the same errors will probably appear in all. In such case, if the subsidiary aids named above fail, the only resort is to conjectural emendation. Or it may happen that a number of manuscripts have different readings in the same passage, all intelligible. The problem then is to determine which of the several readings is the one intended by the author.

Errors in manuscripts may be divided into: (1) Errors of Omission, (2) Errors of Insertion, (3) Errors of Substitution, (4) Errors of Transposition, (5) Errors of Emendation, (6) Errors due to the Confusion of Letters or Contractions.

(1) *Errors of Omission.* The simplest form of this class of errors is that known as *haplography*, when of two identical letters, syllables, or words only one is written; e.g. Plautus, *Miles Gloriosus* 54, *si viverent* for *sivi viverent;* Vergil, *Georgics*, 4, 311, *magis aera carpunt* for *magis magis aera carpunt*. The omission of a syllable, word, or passage may also be due to the inexcusable carelessness of the scribe, a failure to understand, a defect in the archetype, etc. Most such omissions come under the head of what is technically known as *lipography*. Examples are furnished by Vergil, *Æneid*, 4, 491, *descere* for *descendere;* 6, 708, *indunt* for *insidunt*. The omission of clauses or sentences in prose, or of whole lines in poetry, is frequently occasioned by the similar endings of clauses or verses (*homœoteleuton*), or by similar words in the same position within the lines, so that the eye of the scribe jumped from one to the other. In Plautus's *Bacchides*, the oldest manuscript lacks two entire verses, owing to the fact that v. 507 has *atque* and v. 509 *usque* in the same position. The texts of Lucretius and Vergil also furnish a number of examples of this kind of error.

(2) *Errors of Insertion.* One of the most common forms of this class of errors is that known as *dittography*, whereby a letter, syllable, or word is written twice. A case of double dittography is furnished by the Palimpsest of Cicero, *De Republica*, 2, 57, *secvtvtvsecvtvs* for *secutus*. Often an explanatory word, gloss, or passage, either interlinear or marginal, is inserted in the body of the text. Thus in Plautus's *Truculentus*, v. 79, is an unmetrical line, *Phronesium, nam phronesis est Sapientia*, which apparently was originally a marginal gloss in explanation of the proper name *Phronesium* in v. 77. Or any marginal note may be incorporated by the scribe, such as *Caput*, chapter, *nota*, take notice, *deest*, there is lacking, etc. In some cases insertions have been made with fraudulent intent. There is an ancient tradition that the mention of Athens in the *Iliad*, 2, 553ff., was interpolated to give the dignity of antiquity to the capital of Attica. Syntactical corrections, both intentional and unintentional, from a difficult to an easier construction are not uncommon; and Renaissance scholars seem often to have been more concerned with making a readable than a correct text.

(3) *Errors of Substitution.* This class of mistakes may arise from various causes. An explanatory gloss may have been substituted for the word it explains, as in Vergil, *Eclogues*, 6, 40, *rara per ignaros errent animalia montis*, where some manuscripts have *rara per ignotos*, etc., *ignotos* being evidently a gloss substituted by some copyist for the correct *ignaros*. In the case of archaic writers like Plautus, a classical word may have ousted the early form; an example is furnished by *Amphitruo*, 631, where one manuscript has the classical *simul* for the archaic *simitu*. The earlier form is correctly given by two manuscripts, while the writer of a fourth first copied correctly *simitu* and then changed it to *simul*. Not infrequently, also, a word has been substituted from the context or from a parallel passage which lingered in the copyist's mind. Further, the mediæval scribes, being monks, might corrupt a passage by substituting a word from a similar passage in the Bible. A famous example is that of Horace C., 3, 18, 11f., where the monk who was writing a manuscript which afterwards became the archetype of a considerable class had in mind Isaiah xi. 6, *habitabit lupus cum agno et pardus cum hædo accubabit*, and so substituted *pardus* for *pagus* in the passage *festus in pratis vacat otioso cum bove pagus*. The most common cause of this class of errors, however, is the confusion of similar words: *addit* and *adit*, *adesse* and *ad sese*, *hospitium* and *hostium*, *precor* and *prætor*, etc.

(4) *Errors of Transposition.* These errors, whether of letters, syllables, words, or lines, are very common in classical manuscripts. They are due most often to the carelessness of the copyist whose eye traveled faster than his pen. Transposed letters and syllables are easily detected by any one familiar with the language; transposed words are not so readily discovered in prose as in verse, where the transposition usually spoils the metre, e.g. the reading of certain manuscripts of Horace C. 3, 13, 14, *ternos ter attonitus cyathos petet vates* will not 'scan,' but the metre is perfect when the correct *cyathos attonitus* is read. The transposition of entire lines is generally due to the fact that the copyist carelessly dropped the line or lines, and later, on discovering his error, inserted the missing lines out of place, often without any indication of the misplacement. Lucretius and Vergil furnish many excellent examples. Finally, one or more entire pages may be misplaced either because the scribe carelessly omitted a page or because the sheets of the archetype had become disturbed before the copy was made. A well-known example of the last is furnished by Lucretius, where the error enabled Lachmann to determine the size of the lost archetype from which the extant manuscripts are descended.

(5) *Errors of Emendation.* This class has been touched on under Sections 2 and 3. They occur chiefly in manuscripts dating from the ninth century or later, and are especially common in manuscripts written by Renaissance scholars. These errors may arise simply from the wrong division of words, as in Seneca, *Epist.*

89, 4, where the copyist senselessly divided *quid amet* of his original into *quidam et.* Madvig, by a stroke of the pen, first restored the correct *quid amet.* While Alcuin's efforts to restore Latin orthography were for the most part beneficial, they also led to certain errors, mostly due to the substitution of a familiar for an unfamiliar word, e.g. *facile* for *facete,* etc. Renaissance scholars of the fifteenth and sixteenth centuries not only 'corrected' passages, but also filled out lacunæ, supplied missing scenes, etc.

(6) *Errors Due to the Confusion of Letters and Contractions.* These mistakes are few in capital and uncial writing, but in minuscule writing the possibilities of the confusion of letters are much greater, and the use of contractions constantly increased with the centuries. A treatment of the subject is impossible here, as it belongs to paleography (q.v.).

Bibliography. For a bibliography of the text criticism of the Bible, see articles on Biblical Criticism, New Testament, etc. On the text criticism of classical authors, consult Boeckh, *Encyklopädie und Methodologie der philologischen Wissenschaften* (2d ed., Leipzig, 1886); Madvig, *Adversaria Critica* (1870); Cobet, *Variæ Lectiones* (1873); Blass in vol. ii. of Von Mueller's *Handbuch der klassischen Altertumswissenschaft* (2d ed. 1892); Lindsay, *Introduction to Latin Textual Emendation* (1896); and the best critical editions of the separate authors. Such works as Skeat's edition of Chaucer and Furness's variorum edition of Shakespeare give an excellent idea of the textual problems presented by these two authors.

TEZCUCO, tĕs-ko͞o′kȯ, or **TEXCOCO.** A town in the State of Mexico, sixteen miles east of the city of that name, east of the Lake of Tezcuco. It is on the Interoceanic Railway, whose shops form its chief industry. It also has glass and cotton manufactures. In the plaza is a monument to Netzahualcoyotl, the most famous Tezcucan King. Previous to the Spanish conquest the place was occupied by a Chichimeca tribe, known as the Texcucans or Acolhuans, who claimed a preëminence in Nahuatl culture and civilization. Here, in 1521, Cortés built the brigantines with which he besieged Mexico. Its population is about 2500.

TEZIUTLAN, tā′sė-o͞ot-län′. A town of the State of Puebla, Mexico, seventy-six miles northeast of Puebla, and thirty-seven miles northwest of Jalapa (Map: Mexico, K 8). Its streets are steep and irregular. It has an extensive commerce with Mexico City and with the towns of Vera Cruz. Population, in 1895, 9776.

THACH′ER, John Boyd (1847—). An American manufacturer, writer, and book collector, born in Ballston, N. Y. He graduated at Williams College in 1869, and settled at Albany, N. Y., where he became a successful manufacturer of car wheels. In 1884-85 he was a Democratic member of the State Senate, taking an especial interest in tenement house reform; and in 1886, 1887, 1896, and 1897 was Mayor of Albany. He devoted much of his attention to the study of early American discovery. His publications include: *The Continent of America, Its Discovery and Its Baptism; An Essay on the Nomenclature of the Old Continents, etc.* (1896); a drama, *Charlecote; or The Trial of William Shakespeare* (1896); *The Cabotian Discovery* (1897); and *Christopher Columbus, His Life, His Works, His Remains, together with an Essay on Peter Martyr of Anghera and Bartolomé de las Casas, the First Historians of America* (2 vols., 1903), an important work, made especially valuable by the publication of many original documents and of various early accounts of the life and voyages of Columbus.

THACHER, Thomas Antony (1815-86). An American educator, born in Hartford, Conn. He graduated at Yale in 1835, was appointed tutor there in 1838, and, in 1842, professor of Latin, a position which he held during the remainder of his life. In 1843 he went to Germany and for a time gave instruction in English to the Crown Prince of Prussia and to Prince Frederick Charles. He was one of the editors of *Webster's Dictionary,* and also edited many of the Latin classics, such as Cicero's *De Officiio* (1850), and made an English version of Madvig's *Latin Grammar.*

THACKERAY, Anne Isabella. See Ritchie, Anne Isabella.

THACKERAY, William Makepeace (1811-63). A famous English novelist. He was born in Calcutta, where his father was at the time in the service of the East India Company, July 18, 1811. At the age of six the boy was sent to England, his father having meantime died, and placed in the care of an aunt; but in 1821 his mother returned with her second husband and settled near Ottery Saint Mary in Devonshire. The boy regarded her as 'a daughter of the gods,' and his stepfather, it is asserted, was the original of Colonel Newcome. After attending two small schools, Thackeray entered Charterhouse, of which also he has given a vivid description in *The Newcomes,* and remained there six years (1822-28). Then he spent a little over a year at Cambridge, as a member of Trinity College and of the brilliant society of which Tennyson (q.v.) was another ornament. After this he spent two years abroad, staying some time at Weimar, where he met Goethe. On his return to England he studied law for a while at the Middle Temple, which furnished some of the material for *Pendennis.* On his coming of age, he inherited a fortune estimated at £20,000, but much of it was lost by the failure of an Indian bank, and he had to depend on his own exertions for a living. In 1833 he became editor and proprietor of the *National Standard,* a periodical devoted to art and literature, but it lived only about a year, after which he spent some time in Paris studying art. He offered to illustrate *Pickwick,* but his services were declined by Dickens. In 1836 he became Paris correspondent for the *Constitutional,* and married Isabella, daughter of Colonel Shawe of the Indian army.

After his marriage he settled in London, and contributed regularly to *Fraser's Magazine.* His first book was *Flore et Zéphyre by Théophile Wagstaff* (1836), with nine comic plates from his own drawings. Some of the satirical character sketches and humorous tales which he wrote for *Fraser's* were collected, as in *The Yellowplush Papers* (1838), *The Paris Sketch-Book* (1840), and *The Irish Sketch-Book* (1843). In 1842 he began writing for *Punch,* to which he contributed nearly four hundred sketches. The most successful were *Jeames's*

Diary (1845-46), the *Prize Novelists* (1847), and the *Snob Papers* (1846-47). Thackeray had now proved himself a master of burlesque, and an acute critic of contemporary manners. In their kind nothing could be better than the *Prize Novelists* and *Rebecca and Rowena*, in which he exaggerates the weaknesses of Bulwer, Disraeli, Lever, Cooper, and Scott. *Barry Lyndon*, a mock defense of gambling (1844), is superb. He had also begun, as he continued throughout life, to write occasional verse, commonly in the ballad measure, at will grave and pathetic or richly humorous.

In 1846-48 *Vanity Fair* appeared in monthly parts, and Thackeray assumed his place in English literature by the side of Fielding. This, with his other great novels, *Pendennis* (1849-50), *Henry Esmond* (1852), and *The Newcomes* (1854-55), shows him at the height of his power. Somewhat inferior, but still to be mentioned in this context, are *The Virginians* (1858) and *The Adventures of Philip* (1862). *Henry Esmond*, especially, has taken rank by universal consent at the very head of English historical fiction. To say nothing of its other merits, it is an absolute faithful reproduction, not only of the language, but of the thought and the manners of the early eighteenth century. This was a period by which Thackeray was always strongly attracted; Addison, Swift, Steele, and the eighteenth-century novelists were his masters in literature. He even thought of writing a history of the century; and his studies took shape in the delightful lectures on *The English Humorists*. These he delivered in America in 1852 and 1853, with such success that he came again in 1855 with *The Four Georges*. In 1857 he tried for Parliament, standing for Oxford in the Liberal interests, but was fortunately defeated. In 1860 he became the first editor of the *Cornhill Magazine*, for which he wrote his last novels and the *Roundabout Papers* (1860-63), a series of essays and sketches which are the best revelation of the man and of his large heart.

Though not far beyond middle life, Thackeray felt the burden of years, and resigned the editorship of the *Cornhill* in April, 1862. On the morning of December 24, 1863, he was found dead in his bed. He was admirable both as a man and as a novelist. Tennyson called him 'lovable' and 'noble-hearted.' So said Carlyle, and all who knew him well. He has been often called a cynic; and indeed he was unsparing in the fierceness with which he plied the lash on anything which savored of sham or pretense, and his keen vision detected alloy in the finest natures. Yet there is a tremendous contrast between his satire and that of Swift, a truer type of the cynic, who hated and despised human nature and rejoiced in laying bare its weaknesses. Thackeray wrote always with a noble tenderness and an utter reverence for all that was good and true. Yet it must be admitted that, almost without exception, the strongest characters in his novels are the bad ones, and that he has drawn scarcely a woman whom we can love and admire without qualification.

This probably comes, however, less from what has been called his cynicism than from a more indisputable defect—his lack of poetic imagination. Thackeray was a realist; in some ways he pointed out the path to the modern English realistic school. "I have no brains above my eyes," he said himself; "I describe what I see." He describes the life of the upper classes, as Dickens that of the lower; and between them they give an unrivaled picture of English life in the middle of the nineteenth century, with its characteristic notes—one may say, for the first time in the history of literature, a picture of a society whose chief concern is the making or the spending of money. The interest in social questions which he was among the first to import into fiction has never died out; though Charlotte Brontë's enthusiastic picture of him (in the preface to the second edition of *Jane Eyre*) as a prophet "who comes before the great ones of society much as the son of Imlah came before the throned kings of Judah and Israel, and who speaks truth as deep, with a power as prophet-like and as vital, a mien as dauntless and as daring," may seem to us overdrawn. The most indisputable of his qualities is his unfailing mastery of a singularly pure, perfect, and simple style—the natural unstrained expression of his thoughts, however lofty or however homely they may have been. "He blew on his pipe, and words came tripping round him, like children, like pretty little children who are perfectly drilled for the dance; or came, did he will it, treading in their precedence, like kings, gloomily." His style, like the vividly realized world of his characters, is the direct outgrowth of what has been called "perhaps the most interesting personality that has expressed itself in prose."

Bibliography. Out of respect for Thackeray's request, no authorized biography of him has ever been written. His daughter, Mrs. Richmond Ritchie, however, has written sketches for each volume of the Biographical Edition of his works (London, 1898-99), and his son-in-law, Sir Leslie Stephen, wrote the article on him in the *Dictionary of National Biography*. Another good edition of the *Works* is that with introduction by Walter Jerrold (New York, 1902). Anthony Trollope's *Thackeray*, in the "English Men of Letters" series (London, 1879), is valuable for personal impressions. One of the latest biographies and certainly the most complete one is by Lewis Melville (London, 1899). For early work, not found in the Biographical Edition, see *Unidentified Contributions of Thackeray to Punch*, ed. by Spielmann (ib., 1899), and *Thackeray's Stray Papers*, 1821 to 1847, ed. by Melville (ib., 1901). Consult also Hunter, *The Thackerays in India* (ib., 1897); the biography by Merivale and Marzials in the "Great Writers" series (ib., 1891); Whibley (ib., 1903); Crowe, *Homes and Haunts of Thackeray* (ib., 1897); id., *With Thackeray in America* (ib., 1893); Wilson, *Thackeray in the United States* (New York, 1904). For criticism, consult especially the essays by Harrison, in *Early Victorian Literature* (London, 1895); Brownell, in *Victorian Prose Masters* (New York, 1901); Scudder, *Social Ideals in English Letters* (Boston, 1898); Lilly, in *Four English Humorists of the Nineteenth Century* (London, 1895); Skelton, *Table Talk of Shirley* (ib., 1895).

THADDÆ'US (Lat., from Gk. θαδδαῖος, *Thaddaios*). The name assigned to one of the twelve Apostles in the list given in Mark iii. 16-19. In the corresponding list in Matt. x. 2-4 the name is Lebbæus, while in Luke vi. 14-16, Acts i. 14 it is given as Judas [son] of James. Some of these readings are not above suspicion, as the manuscripts differ considerably. It is possible that the original name was Judas Thaddæus, for which Judas Lebbæus was often used, Lebbæus being a euphemism for Thaddæus. Eusebius makes Thaddæus one of the seventy, and sent by Thomas the Apostle to Abgar, King of Edessa, to heal him and to evangelize his people. Eusebius claims to have taken this story direct from Syrian sources. The Syrian tradition embodied in the "Doctrine of Addai" makes Addai, one of the seventy, the apostle of the Syrian Church.

THAD'DEUS OF WAR'SAW. A romance by Jane Porter (1803). The chief character is Count Thaddeus Sobieski, who devotes himself to the liberation of Poland and becomes a refugee teacher of languages in London.

THAER, târ, ALBRECHT DANIEL (1752-1828). A noted German agriculturist, whose work revolutionized certain forms of farm management and animal production of his day. Born at Celle, Hanover, he studied medicine and philosophy at Göttingen, and succeeded his father as Court physician, but early turned his attention to agriculture. He worked out a new system of farm management on his small farm in Celle, where he demonstrated the value of more intensive farming, stall feeding of soiling crops, and the rotation of crops in connection with potato culture. He was especially active in applying scientific principles to agriculture, systematizing agricultural accounts, introducing agricultural implements and appliances, and improving sheep for the production of fine wool. The fame of his system of farm management attracted large numbers of young agriculturists, to whom he began delivering lectures in 1802, out of which grew the Agricultural Institute of Celle. In 1804 he bought the Möglin Manor, near Berlin, for the purpose of demonstrating how under his system an exhausted farm could be brought to a high state of production, and in 1806 founded there an agricultural institute, which became celebrated. He was appointed professor at the University of Berlin and councilor in the Ministry of the Interior in 1810, started his famous sheep-breeding farm at Möglin in 1811, and from 1815 on had charge of the royal sheep-breeding farms, which he greatly improved. Resigning his professorship in 1818, he devoted himself to his institute at Möglin, which was raised to a Royal Academy of Agriculture in 1824. Thaer founded and edited the *Annalen der niedersächsischen Landwirtschaft* (1798-1804), and was the author of a large number of treatises on agriculture, several of which are characterized as epoch-making. The *Einleitung zur Kenntnis der englischen Landwirtschaft* (1798; 3d ed. 1816) made his name first more widely known, and his great work *Grundsätze der rationellen Landwirtschaft* (1809-10; new ed., 1880) was translated into most of the European languages. Monuments to his memory were erected at Leipzig, Berlin, and Celle. For his biography, consult Körte (Leipzig, 1839).

THAI, tä'ê (free). A group of peoples of Farther India, including the Thos (q.v.) and Muongs (q.v.) in the northeast (Tongking and China), the Shans (q.v.) in the northwest (Burma, Siam, China), the Laotians (see LAOS) in the south (the Laos States, French Siam), and the Siamese in the southwest (Siam). The term Thai is applied by certain writers to the Siamese in particular, but their proper appellation is rather Little Thai, their ancestors, the Shans, being called the Great Thai. The Thai peoples speak languages belonging to the same linguistic stock. The Siamese present the Thai type, much changed by intermixture with Khmers, Hindus, Kuis, Malays, and other stocks. They are of medium stature and brachycephalic, while the Laotians are shorter and less broad-headed. Among some of the Shan tribes the primitive Thai type is best preserved. The Thai peoples have shown much political capacity. Consult: Pellegoix, *Description du royaume Thai ou Siam* (Paris, 1854); Bastian, *Die Völker des östlichen Asiens* (Leipzig, 1866); Hellwald, *Hinterindische Länder und Völker* (ib., 1880); Forbes, *Comparative Grammar of the Languages of Further India* (London, 1881); Colquhoun, *Across Chrysé* (ib., 1883); Diguet, *Etude de la langue Tai* (Paris, 1896).

THA'IS (Lat., from Gk. Θαίς). An Athenian courtesan, famous for her wit and beauty. She accompanied Alexander the Great on his expedition into Asia, and, according to Cleitarchus, induced him, during a festival, to set fire to the palace of the Persian kings at Persepolis. After the death of Alexander she lived with Ptolemy Lagi, King of Egypt, who is said (by Athenæus) to have married her, and by whom she had two sons, Leontiscus and Lagus, and a daughter, Irene.

THALBERG, täl'bĕrk, SIGISMUND (1812-71). A distinguished German pianist, born at Geneva, Switzerland. He was the natural son of Prince Moritz Dietrichstein and received his musical education from 1822 on at Vienna, where he studied under Hummel and composition under Sechter. Making his appearance in public in 1830 with brilliant success, he was appointed chamber virtuoso to the Emperor of Austria in 1834, and the following year appeared in Paris, as a rival of Liszt. After a succession of triumphs in England, Russia, and Italy, in Brazil (1855-56), and in the United States (1856-58), he retired to his home at Posilippo, near Naples, whence he only once more undertook a concert tour to Paris and London in 1862 and to Brazil in 1863. Perhaps his strongest point as a pianist was his mastery of the legato singing tone. In every other respect his style, though brilliant, was shallow.

THALER, tä'lĕr. A German coin, first struck at Joachimsthal, Bohemia, in 1519 and hence called Joachimsthaler, whence the modern name. The thaler, divided into thirty silbergroschen of 12 pfennigs, was the German unit of value until 1873, when the mark was adopted. The thaler is still in circulation with the value of 3 marks, about 69 cents.

THALES, thā'lēz (Lat., from Gk. Θαλῆς) The earliest of the Greek philosophers, and the founder of the Ionic or Physical school. He flourished in the first half of the sixth century B.C. He was a native of Miletus, in Asia Minor, and is said to have been of Phœnician descent. He was reckoned one of the Seven Wise Men, possessed sufficient astronomical knowledge to enable him to predict the eclipse of the sun in the reign of the Lydian King Alyattes, and was an excellent mathematician. He was famed also for his practical and political wisdom, but his chief renown is due to the fact that he was the first man among the Greeks to set aside the current explanations of the universe and to look for a first principle which might be grasped through reason. This first principle (ἀρχή) he regarded as water, which was the source of all things, and that into which all things were resolved. The importance of his speculation lies in the fact that he turned men to reasoning about the world and to an effort to find the significant principle which lay behind the varied phenomena. Thales left no writings, and even among the Greeks considerable doubt prevailed as to his exact teachings. Consult: Ritter and Preller, *Historia Philosophiæ Græcæ* (7th ed., Gotha, 1888); Zeller, *Philosophie der Griechen*, vol. i. (4th ed., Berlin, 1900); Ueberweg, *History of Philosophy*, Eng. trans., vol. i. (New York, 1887).

THALI′A (Lat., from Gk. Θάλεια, *Thaleia*, from θάλεια, *thaleia*, luxuriant, blooming, from θάλλειν, *thallein*, to bloom; connected with Alb. *dal*, I bloom). One of the nine Muses (q.v.). In the late assignment of specific functions to the Muses, she became the Muse of Comedy, and was represented as holding the comic mask.

THALLIUM (Neo-Lat., from Gk. θαλλός, *thallos*, green shoot). A metallic element discovered by Crookes in 1861, and independently by Lamy in 1862. It was originally found by the bright green line which its compounds give when examined by the spectroscope. It occurs as the selenide in combination with copper and silver, in the rare mineral *crookesite*, in small quantities in copper and iron pyrites, and in the seleniferous deposits from sulphuric acid; also in minute quantities in other minerals, and in certain mineral waters. It may be prepared from the flue-dust of sulphuric acid works in which pyrites containing thallium are burned, by treating the dust with water acidulated with sulphuric acid, concentrating the resulting solution, and precipitating the thallium by zinc. Thallium (symbol, Tl; atomic weight, 204.15) is a soft, crystalline, lead-like metal, with a specific gravity of 11.8, and a melting point of 290° C. (554° F.). When exposed to the air it tarnishes rapidly, becoming coated with a thin layer of oxide, which preserves the rest of the metal. It combines with oxygen to form a monoxide and a trioxide, which yield corresponding series of salts, known as the *thallous* and *thallic* compounds. The compounds of thallium are very poisonous, producing symptoms like those of lead poisoning. Their presence in a given substance may be readily detected by the beautiful green color which they impart to a non-luminous gas flame.

THALLOPHYTES (from Gk. θαλλός, *thallos*, green shoot, from θάλλειν, *thallein*, to bloom + φυτόν, *phyton*, plant). One of the four great divisions of the plant kingdom, containing the algæ and fungi (qq.v.). In theory the thallophytes are distinguished from the other groups by having a thallus body. As a matter of fact, there are many thallophytes with upright stem-like axes, root-like regions of attachment, and lateral members which function as and resemble leaves, although not at all homologous with the leaves of higher plants. The best examples of these are found among the Phæophyceæ, Rhodophyceæ, and Charales (qq.v.). The thallophytes are readily distinguished from the bryophytes above them by the absence of the peculiar female sexual organ (archegonium, q.v.), and the sexless phase or plant (sporophyte, q.v.) characteristic of the bryophytes and pteridophytes. They are, therefore, defined more through the absence of structures found in the higher plants than by any agreement among themselves.

THALLUS (Lat., from Gk. θαλλός, green shoot). A plant body whose vegetative structure is not differentiated into such organs as stem, leaf, etc. Most of the algæ and fungi (thallophytes, q.v.) have thallus bodies. Many liverworts, the sexual phase (gametophyte) of ferns, and even certain reduced and simplified flowering plants such as the duckweed (Lemna), present a thalloid structure. On the other hand, certain thallophytes, especially among the brown and red algæ, have bodies differentiated far beyond the limits of the definition of a thallus.

THAMES, tĕmz. The most important river in Great Britain, flowing with a southeastern trend through the southern portion of the Kingdom and passing through London (Map: England, G 5). Its remotest source, the Churn, rises on the southeast slope of the Cotswold Hills, in Gloucester, five miles south of Cheltenham, and after flowing southeast for 20 miles receives the Thames, or Isis, from the west. The Thames then flows east-northeast for about 35 miles, and curving southeast, passes Oxford and flows on to Reading, where it again changes its course to a generally eastward trend. A few miles below Gravesend it expands into a wide estuary, and enters the North Sea. The length of the Thames is about 250 miles. At London Bridge the width of the river is about 290 yards; at Woolwich, 490 yards; at Gravesend pier, 800 yards; 3 miles below Gravesend, 1290 yards; at Nore Light, 6 miles; and at its mouth, between Whitstable and Foulness Point, about 8 miles below the Nore, the estuary is 18 miles across. The river is navigable for barges to Lechlade, upward of 200 miles above its mouth, and it is connected with several important canals, affording communication with the west and south coasts, and with the interior of the country. Its upper reaches and islands are much resorted to for their sylvan beauty, and pleasure steamers ply daily between Kingston, Henley, and Oxford. Vessels of 800 tons can reach Saint Katharine's docks, London, those of 4000 tons can ascend to Blackwall, while by the dredging operations that have been carried out, vessels of 22 feet draught are now accommodated in the Albert and Victoria docks. The volume of traffic on the river was estimated in 1900 at 30,000,000 tons. The Thames is also the main source of the water supply of London, as much as 130,000,000 gallons a day being withdrawn near Hampton for this purpose. The part of the river immediately below London Bridge is called the *Pool*, and the part between the bridge and Blackwall is called the *Port*. Two embankments have been formed, one on the north shore from Blackfriars Bridge to Westminster, and one on the south shore from Westminster Bridge to Vauxhall. Among the places on the Thames besides those above mentioned are Windsor, Eton, and Richmond. An extensive bibliography includes: *The River Thames from Oxford to the Sea* (London, 1859); Cassell, *Royal River*, illustrated (ib., 1885); and annual *Reports* of the Conservators of the River Thames (ib.). See LONDON.

THAMES, tĕmz, or **GRA′HAMSTOWN.** A gold-mining township on the east coast of an inlet in the Hauraki Gulf, North Island, New Zealand, 46 miles east-southeast of Auckland (Map: New Zealand, E 2). Population, in 1901, 4009.

THAMES, *local pron.* thāmz. A river of eastern Connecticut (Map: Connecticut, G 4). It is a broad and navigable tidal estuary, 15 miles long, receiving the Shetucket, and entering Long Island Sound at its eastern end. At its mouth stands New London, and at its head Norwich. The Shetucket and its branches supply power for considerable manufactures.

THAMES, BATTLE OF THE. A battle fought at the Moravian settlement on the Thames River in the township of Oxford, Ontario, Canada, on October 5, 1813, during the War of 1812, between an American force of about 3000 (largely Kentucky volunteers) under Gen. William H. Harrison and a British force of about 650 under General Proctor, aided by a force of Indians, whose number has been variously estimated at from 800 to 2000, under Tecumseh. For several days Proctor had retreated before Harrison, but had at last decided to give battle and had drawn up his troops in readiness to receive the advancing Americans. The battle was begun and virtually decided by a cavalry charge under Col. Richard M. Johnson, who has been credited with having personally killed Tecumseh. The British soon broke, and fled wildly from the field, with Proctor at their head, and the only serious resistance was that offered by the Indians. The loss of the Americans in killed and wounded was reported by Harrison as 29; that of the British was about 35, while a large number were taken prisoners. The loss of the Indians is not definitely known. Proctor was soon afterwards disgraced for his conduct during the battle. By this battle the right division of the British army in Upper Canada was greatly weakened, and as the result of Tecumseh's death the powerful Indian confederacy in the Northwest against the United States was broken up.

THAMES EMBANKMENT. An important public work in London consisting of broad roads along the Thames, protected on the river side by massive granite walls. The finest portion, the Victoria Embankment, on the north bank of the river, between Blackfriars Bridge and Westminster, was constructed in 1864-1870. It has a carriageway 64 feet wide, flanked by broad foot-walks, and is planted with trees and adorned with gardens containing statues of notable men. The obelisk known as Cleopatra's Needle stands near the Adelphi Steps. The Albert Embankment, on the right bank of the river, between Westminster Bridge and Vauxhall Bridge, with a 60-foot roadway, was completed in 1869, and the Chelsea Embankment, on the left bank, in 1873.

THAM′YRIS (Lat., from Gk. Θάμυρις). A Thracian bard who challenged the Muses to a contest of singing. He was overcome by them and as a punishment was blinded and deprived of his gift of song.

THAN′ATOP′SIS (Neo-Lat., from Gk. θάνατος, *thanatos*, death + ὄψις, *opsis*, sight, view). A well-known poem by William Cullen Bryant, written in 1811, and published in 1817.

THAN′ATOS (Lat., from Gk. θάνατος, Death). The Greek god of death, called by the Romans Mors, and twin brother of Sleep (see SOMNUS), with whom he is usually represented.

THANE (AS. *þegen*, *þegn*, OHG. *degan*, attendant, servant, soldier, Ger. *Degen*, heroic warrior; connected with Gk. τέκνον, *teknon*, Skt. *tōka*, child), or THEGN. The name by which the class of minor nobles was known in Anglo-Saxon times. Any freeman who had acquired five hides of land and a special appointment in the King's hall became a thane. He was bound to service in war, but was protected by a higher wergild (q.v.) than the ordinary freeman. Like the gesith, who was the noble living with the King, the thane was a development from the Germanic *comitatus* or noble follower of some chief, described by Tacitus. After the Norman Conquest the thanes were merged in the class of knights. Consult Stubbs, *Constitutional History of England*, vol. i. (6th ed., Oxford, 1897).

THAN′ET, ISLE OF. The northeast corner of Kent (q.v.), England, separated by the river Stour and its branches, and bounded on the north and east by the sea (Map: England, H 5). It is 10 miles in length and from 4 to 8 in breadth. Agriculture is successfully pursued. It contains the well-known watering places, Ramsgate, Margate, and Broadstairs. Population, in 1891, 57,800; in 1901, 68,350. Consult: Simson, *Historic Thanet* (London, 1891).

THANET, OCTAVE. The pseudonym of the American novelist Alice French (q.v.).

THANKSGIVING DAY. A day specially set apart for the giving of thanks. After the first harvest of the New England colonists in 1621 Governor Bradford made provision for their rejoicing specially together with praise and prayer. In 1623 a day of fasting and prayer in the midst of drought was changed into thanksgiving by the coming of rain during the prayers; gradually the custom prevailed of appointing thanksgiving annually after harvest. These appointments were by proclamation of the Governors of the several New England colonies. During the Revolution a day of national thanksgiving was annually recommended by Congress. Since 1864 the President has appointed a day of Thanksgiving (usually the last Thursday of November), and his proclamation has generally been followed by similar proclamations from the Governors of several States. The credit of this change belongs to Mrs. Sarah Josepha Hale, editress of *Godey's Lady Book* (Philadelphia), and the first President to adopt it was Abraham Lincoln. Consult Love, *The Fast and Thanksgiving Days of New England* (New York, 1895).

THAR, thär (East Indian name), or TAHR. A goat-antelope (*Hemitragus Jemlaieus*) allied to the Nilghiri goat (q.v.), which inhabits the higher forest regions of the southwestern Himalayas. It is about 3⅓ feet tall. It is usually dark brown, but variable, and lighter in winter. The female is singular in having four teats. The horns are black and bend backward. This species is known in Kashmir as 'kras,' and in Nipal as 'jharal.' See Plate of Goat-Antelopes.

THA'SOS (Lat., from Gk. Θάσος). The most northerly island in the Ægean Sea, a few miles off the coast of Macedonia. Circumference, about 40 miles; population, about 12,000, scattered over a dozen villages. Thasos is mountainous, the chief summit, Hypsarion, being about 3400 feet in height, and is, on the whole, barren. It exports some oil, honey, and timber. The island seems to have been the seat of a Phœnician trading-post in very early times, but near the end of the eighth century B.C. it was colonized by Parians. The settlers had a severe struggle with the natives before they finally secured possession of the island and its rich gold mines. They later secured a footing on the neighboring coast, where gold was also found, and in consequence became very wealthy. Thasos submitted to the Persians, but after the defeat of Xerxes joined the Delian League. In consequence of an attempt to revolt, it was reduced by the Athenians, who retained possession of it for the greater part of the time until the end of the third century B.C., when it passed into the hands of Macedon. After the battle of Cynoscephalæ (B.C. 197) Thasos long enjoyed autonomy under the Romans. Consult: Perrot, *Mémoire sur l'île de Thasos* (Paris, 1864); Conze, *Reisen auf den Inseln des Thrakischen Meeres* (Hannover, 1860); Tozer, *Islands of the Ægean* (Oxford, 1890); Jacobs, *Thasiaca* (Göttingen, 1893).

THATCH'ER, Henry Knox (1806-80). An American naval officer, born at Montpelier, near Thomaston, Me. He entered the navy as a midshipman in 1823; rose through successive grades to the rank of commodore in 1862 and to that of rear-admiral in 1866. In 1862 he was placed in command of the steam frigate *Colorado*, with which he joined the North Atlantic Squadron. In December, 1864, and January, 1865, he commanded the first division of Admiral David D. Porter's fleet in the attacks upon Fort Fisher, and showed so much ability that he was soon afterwards appointed acting rear-admiral and assigned to succeed Farragut in command of the West Gulf Squadron. In coöperation with Major-General Canby he then besieged and captured the city of Mobile with its remaining fortifications and the fleet of Confederate ironclads. Soon afterwards he occupied Galveston without opposition, and so completed the conquest of the Gulf coast. In 1866 he was given command of the North Pacific Squadron, a position which he held until 1868, when he was placed upon the retired list.

THAULOW, tou'lôv, Frits (1847—). A Norwegian landscape painter, born in Christiania. He was a pupil of Sörensen at Copenhagen and of Gude at Karlsruhe. He became known in France by his snow scenes, his night scenes, his moonlights, and his depiction of water. Examples of his work are "A November Day in Normandy" (National Gallery, Berlin), and "A Steamer on the Seine," besides others in the Luxembourg, the Pinakothek, Munich, and the museums of Stockholm and Christiania.

THAU'MATUR'GUS. See Gregory Thaumataurgus, Saint.

THAÜN, tä'ŏn', Philippe de (fl.c.1100-c.1135). The earliest Anglo-Norman poet whose work has come down to us. Little is known of him. He probably belonged to a family near Caen, France, whence he went to England. He wrote "Li Cumpoz," or "Computus," the so-called "Livre des Créatures," about 1115. It is a poetical treatise in six-syllabled lines on the ecclesiastical calendar. Of its seven manuscripts three are in the British Museum and three in the Vatican. More important is "Li Bestiare," or "Physiologus," which the poet probably composed about ten years later. It was dedicated to Adelaide, Queen of Henry I. But one manuscript has survived, viz., Cotton, Vespasian, E. x. It contains 3194 verses, consists of lines of six and eight syllables, and rhymes in couplets. It is the first French bestiary based on the Latin Physiologus, one of the most noteworthy of the bestiaries (q.v.). Philippe groups his creatures as beasts, birds, and stones, and treats each creature as a symbol. His allegories are in general naïve; those of the dove and the pelican are not without beauty. He is more valuable for his linguistic legacy in connection with the *langue d'oïl* than for his poetic talents, which were in fact poor. Consult: Mall, *Li Cumpoz de Philippe de Thaün* (Strassburg, 1873); and Walberg, *Le bestiaire de Philippe du Thaün* (Lund and Paris, 1900).

THAUSING, tou'sing, Moritz (1838-84). An Austrian art critic, born near Leitmeritz, Bohemia. He studied at Prague, Vienna, and Munich, and in 1868 became curator of the Archduke Albert's collection of drawings and engravings (*Albertina*, Vienna). In 1873 he was called to the University of Vienna as professor of art history. His publications include: *Dürers Briefe, Tagebücher und Reime* (1872); *Dürer: Geschichte seines Lebens und seiner Kunst* (2d ed. 1884).

THAX'TER, Celia [Laighton] (1836-94). An American poet, born at Portsmouth, N. H. Her father was keeper of the United States Government lighthouse on the Isles of Shoals, where her girlhood and much of her after life were passed. In 1851 she married Levi Lincoln Thaxter, a Browning scholar. Mrs. Thaxter's poetry was reflective of her quiet life on the islands. It expressed with simplicity and delicacy her feeling for the sea and its perils, and also for the gentler aspects of nature. Her works include: *Poems* (1872); *Among the Isles of Shoals* (1873), a series of papers begun in the *Atlantic Monthly* in 1867; *Poems* (1874); *Drift-Weed* (1879); *Poems for Children* (1884); *The Cruise of the Mystery, and Other Poems* (1886); *Idyls and Pastorals* (1886); *The Yule Log* (1889); *An Island Garden* (1894); *Stories and Poems for Children* (1895).—Her son Roland (1858—), botanist, born at Newton, Mass., professor at Harvard since 1891, wrote numerous monographs and contributions to scientific periodicals in cryptogamic botany.

THAYER, thâr *or* thā'ẽr, Abbott Henderson (1849—). An American figure, landscape, and portrait painter, born in Boston, Mass. His chief artistic training was derived at the Ecole des Beaux-Arts in 1875-79, mainly under Gérôme. Until 1891 he painted portraits and occasional landscapes, but afterwards produced mainly ideal figure pieces. As a landscape painter he achieved considerable success, but his chief strength is figure painting, especially in ideal subjects. One of his earliest successful pictures was "Sleep," the subject of which is a beautiful infant. "Crossing the Ferry" is noteworthy as being one of his few pictures containing many figures. Among the pictures for which his family posed are "Mother and Child" and the "Angel," which obtained a bronze medal at the Paris Exposition of 1889, and is perhaps the most widely known of his pictures, excepting the more ambitious "Virgin Enthroned" (1892). Among his later works are "Florence," a fine mural decoration in Bowdoin College, and "Caritas." Thayer was one of the original members of the Society of American Artists, of which he was for two years president, and is perhaps one of the most personal and original painters in American art. His style seems thoroughly his own, and does not bear the slightest impression of the school in which he studied. His preference seems to be for single female figures, which he invests with great dignity and charm of expression, and treats with great breadth of modeling, both in head and drapery, and with a touch and application of pigment peculiarly his own.

THAYER, Arthur Wilder (1857—). An American composer, born in Dedham, Mass. He studied singing under Charles R. Adams, harmony, counterpoint, and instrumentation under George W. Chadwick, and conducting under Karl Zerrahn. After conducting choral societies in Lowell, Salem, Worcester, Providence, and other towns, he was superintendent of music in the public schools of Dedham and Milton. He was afterwards director of music at Eliot Church, Newton, and a member of the Harvard Musical Association. His works are chiefly songs and part-songs, many of which were written for the Apollo Club of Boston. They include "Rosalind's Madrigal," "Bugle Song," "Sea-Greeting," and "The Quiet Moon upon the Clouds."

THAYER, Eli (1819-99). An American educator, inventor, and anti-slavery agitator, born at Mendon, Mass. He graduated at Brown University in 1845, and in 1848 founded Oread Institute. He is chiefly remembered for his connection with the 'Kansas Crusade,' the purpose of which was to secure the admission of Kansas as a free State. With this aim in view he early in 1854 organized the Massachusetts Emigrant Aid Company; soon afterwards affiliated it with the Emigrant Aid Company of New York; and a year later reorganized the two under the name of the New England Emigrant Aid Company. Local leagues were established whose members emigrated to Kansas and settled in localities where the company had erected hotels for their temporary accommodation and had provided saw-mills and other improvements. The company proved a financial failure, but its main purpose was successful. Under its auspices the towns of Lawrence, Topeka, Manhattan, Osawatomie, and other places were settled, and in this way contributed greatly to the saving of Kansas for freedom. (See Kansas.) In 1856 Thayer began a somewhat similar but unsuccessful work in Virginia, and founded the town of Ceredo, containing about 500 inhabitants from New England. From 1857 till 1861 he was a member of the National House of Representatives. He was also an inventor, and he patented, among other things, a hydraulic elevator, a sectional safety steam boiler, and an automatic boiler-cleaner. He published a volume of Congressional speeches (1860), a collection of lectures (1886), and *History of the Kansas Crusade* (1889).

THAYER, James Bradley (1831-1902). An American lawyer and author, born at Haverhill, Mass. He graduated at Harvard in 1852 and at the Harvard Law School in 1856. From that time until 1874 he engaged in the practice of law, and from the latter year until his death he was a professor in the Harvard Law School. His publications include: *Letters of Chauncey Wright* (1877); *A Western Journey with Mr. Emerson* (1884); *The Origin and Scope of the American Doctrine of Constitutional Law* (1893); *The Teaching of English Law in Universities* (1892); *Cases on Evidence* (1892); *Cases on Constitutional Law* (1895); *The Development of Trial by Jury* (1896); *A Preliminary Treatise on Evidence at the Common Law* (1898); and *John Marshall* (1901). Consult. *The Harvard Graduates Magazine*, vol. x. (1901-02); and *The Harvard Law Review* (April, 1902).

THAYER, John Milton (1820—). An American soldier and politician. He was born at Bellingham, Mass., was educated at Brown University, and was admitted to the Massachusetts bar. In 1853 he went West and in the following year settled at Omaha, Neb., which he made his permanent home. In 1855 he was elected major-general of the Territorial forces, and until 1861 conducted the campaigns against the Indians, in 1859 capturing the Pawnees and placing them on a reservation. At the outbreak of the Civil War he became colonel of volunteers and served with distinction till 1865. His bravery at Fort Donelson and Shiloh brought him the appointment as brigadier-general, in which position he assisted Sherman in the siege of Vicksburg. In 1867-71 he was United States Senator from Nebraska, and in 1875-79 Governor of Wyoming Territory. From 1887 to 1893 he was Governor of Nebraska.

THAYER, Joseph Henry (1828-1901). An American biblical scholar, born in Boston. He graduated at Harvard in 1850, and at Andover Theological Seminary in 1857. In 1864 he became associate professor of sacred literature in Andover Theological Seminary, and in 1884 professor of New Testament criticism in Harvard Divinity School. He translated the New Testament grammars of Winer (1869) and of Buttmann (1873), and published *A Greek-English Lexicon of the New Testament* (1886). He was a member of the American New Testament Company of Revisers of the Authorized Version.

THAYER, Sylvanus (1785-1872). An American soldier, known as 'the father of the United States Military Academy.' He was born at Braintree, Mass., graduated at Dartmouth in 1807 and at West Point in 1808, and entered the corps of engineers. During the War of 1812 he served under General Dearborn as chief engineer of the Northern Army (1812); under General Hampton as aide-de-camp and chief engineer of the Right Division of the Northern Army (1813); and under General Porter at Norfolk, Va., as chief engineer and brigade-major (1814-15). The two following years he spent in Europe studying fortifications and military schools, and observing the operations of the Allies. From 1819 to 1833 he was superintendent of the Military Academy at West Point, and during this time thoroughly reorganized the institution, and made it one of the best of its kind in the world. During the following years he was employed in constructing fortifications and harbor improvements around Boston and as a member of various boards until 1858, when he was granted sick leave. In March, 1863, he was commissioned colonel of engineers and shortly afterwards was brevetted brigadier-general in the Regular Army. On June 1, 1863, he was retired from active service. He gave liberally to the cause of education. He founded a free library and endowed an academy at Braintree, and founded (1867) the Thayer Engineering School at Dartmouth College.

THAYER, Whitney Eugene (1838-99). An American organist and composer, born in Mendon, Mass. He was favorably known, in Europe as well as America, for his musical attainments. He was for a time editor of the *Organist's Journal* and the *Choir Journal*, and served as the conductor of the Boston Choral Union and New England Church Musical Association. In 1881 he came to New York and was until 1888 organist of the Fifth Avenue Presbyterian Church. He was the composer of many organ pieces, part songs, and songs, but his greatest work was the *Festival Cantata* for soli, an 8-part chorus, and orchestra.

THAYER, William Roscoe (1859—). An American author and editor. He graduated at Harvard College in 1881, and was editor of the *Harvard Graduate's Magazine* from its beginning (1892). His verse writing is comprised in *The Confessions of Hermes* (1884); *Hesper, an American Drama* (1888); and *Poems, New and Old* (1894). His most noted historical study is *The Dawn of Italian Independence* (1893), an excellent and useful work. He also wrote *History and Customs of Harvard University* (1898) and *Throne-Makers* (1899), and edited *The Best Elizabethan Plays* (1890).

THE′ÆTE′TUS (Lat., from Gk. Θεαίτητος, *Theaitētos*). An important dialogue of Plato, discussing all the answers to the question: What is knowledge? The speakers are Socrates and the Athenian youth Theætetus.

THE′ATINES. A Roman Catholic religious community, which played, next to the Jesuits, the most important part in the movement for reform from within the Church in the sixteenth century. Its founders were Saint Cajetan (Gaetano da Tiene) and Giovanni Pietro Caraffa, at that time Bishop of Chieti, from the Latin title of whose see, Theate, the order took its name. With two other friends, they obtained a brief of Clement VII., dated June 24, 1524, formally constituting the new brotherhood, with the three usual vows, and with the privilege of electing their superior, who was to hold office for three years. They were all to be priests. Their first convent was opened in Rome, and Caraffa was chosen as superior. He was succeeded in 1527 by Cajetan, and the congregation began to extend to the provinces. After a time, however, it was thought advisable to unite it with the somewhat analogous Order of the Somaschians (q.v.); but this union was not of long continuance, Caraffa, who was elected Pope, under the name of Paul IV., having restored the original constitution in 1555. By degrees, the Theatines extended themselves, first over Italy, and afterwards into Spain, Poland, and Germany, especially Bavaria. They did not find an entrance into France till the following century, when a house was founded in Paris under Cardinal Mazarin in 1644. To their activity and zeal Ranke ascribes much of the success of the Counter-Reformation in the south of Europe. At the present time the Order numbers not more than one hundred members.

There is an Order of nuns bearing this name. It was founded in Naples, in 1583, by Ursula Benincasa. It never spread out of Italy and has now only a few nunneries.

THEATRE (OF. *theatre*, Fr. *théâtre*, from Lat. *theatrum*, from Gk. θέατρον, *theatre*, place to view shows or plays, from θεᾶσθαι, *theasthai*, to view, behold, from θέα, *thea*, view, sight). A building used for the presentation of dramatic and similar spectacles.

Ancient Theatre. The theatre as a form of architecture was originated by the Greeks and naturally developed with the drama. At first it was simply the open space near the Temple of Dionysus, where the chorus danced about the altar of the god while the solitary actor, perhaps standing on the steps of the altar, carried on a dialogue with their leader. It is probable that at times the chorus of satyrs actually drew a wagon containing the actor who impersonated the god, and who naturally addressed his companions from this vantage ground, and it is quite possible to see in such a scene the 'car of Thespis,' with which the founder of tragedy is said to have traversed Attica. When tragedy became a State institution at Athens, set places for its performance were naturally provided; one of these was the 'Orchestra' near the Agora, a circular dancing place which was surrounded by raised seats for the spectators. The other theatre was in the precinct of Dionysus Eleuthereus at the eastern end of the southern slope of the Acropolis, afterwards occupied by the stone theatre.

The earliest Athenian theatre was simply a large circular place (ὀρχήστρα, *orchēstra*, from ρὀχέομαι, *orcheomai*, 'dance') about 75 feet in diameter near the temple. On the hill rose the seats for the spectators (θέατρον, *theatron*, in the strict sense), and these were further enlarged by artificial mounds of earth, so as to form rather more than a semicircle. The orchestra was entered by two passages (πάροδοι, *parodoi*) from the sides. The nature of the ground was such that at the rear it was raised some distance above the level of the sacred precinct, thus affording an opportunity for an underground passage, Charon's steps, by which actors could rise from the ground in the centre of the orchestra. There was at first no scenery or background, and some neighboring house was used as dressing-room. In the centre of the orchestra might be an altar or tomb or other structure, probably of no great height. Such simple settings are all that seem required for the earlier plays of Æschylus, such as the *Suppliants*, *Seven Against Thebes*, and *Persians*. Soon, however, an innovation was made. A tent (σκηνή, *skēnē*) was introduced to serve as a dressing-room, and this speedily became a building, apparently erected just outside the circle of the orchestra, and provided with three doors. It might represent a palace or temple or any other building called for by the play; or the front might be covered with a painted scene, as in the *Birds* of Aristophanes. During all this time actors and chorus were on the same level in the orchestra, except that gods and occasionally other characters seem to have appeared on the roof of the *skene.* Our knowledge of this theatre of the fifth century is partly based on the very scanty ruins of the earliest structure, and partly on the internal evidence of the plays themselves, in which there are many passages which imply that actors and chorus are on the same level, and none, with the exception above noted, that clearly imply any raised stage for the actors. In the fourth century, probably, the theatre at Athens was rebuilt in stone, the orchestra being moved farther back into the hill, and reduced to about sixty feet in diameter, stone seats were provided for the spectators, and outside the circle of the orchestra was erected a long stone *skene,* with projecting wings (*παρασκήνια, paraskēnia*). It seems probable that between these wings the scenery was now displayed, but there is no evidence, in the remains, of any raised stage. The old view, still held in modified form by many, is that in the fifth and fourth centuries there was a stage for the actors, probably low, in front of the *skene,* and that when the chorus was discontinued this was replaced by the high platform of the Hellenistic theatre. Somewhat later there was erected, a short distance in front of the *skene,* a low wall (*προσκήνιον, proskēnion*) about twelve feet high, composed of columns, or half-columns, supporting an entablature, and with the intercolumniations filled with wooden panels. There was a door in the centre, with possibly two more near the sides. In front of this structure the *paraskenia* projected but a little. The space between the *skene* and *proskenion* was roofed over, forming a platform, which varies in different theatres, but is from 10 to 12 feet in height and from about 7 to 9 feet in width. It is maintained by some that in the plays of the Hellenistic time the actors appeared on this level, as there was no chorus. On this point the evidence is far from clear, but it seems not improbable that actors in the drama proper occupied the lower level, and that this platform was for gods. In Asia Minor, under the influence of modified conditions, another type was developed by diminishing the height and increasing the width of the stage, reducing the orchestra to less than a semicircle. This operation might be described as sinking a part of the orchestra, for the lowest row of seats is frequently (as at Aspendus) on a level with the stage, and not, as in earlier Greek theatres, at the level of the orchestra. It is to be noted that this is not really a lowering and extension of the *proskenion,* for at the rear of the new stage appears a decorated front of columns or half-columns and cornices, which forms a background to the actor, similar to that formed by the old *proskenion.* There was no curtain in the Greek theatre.

In the *Roman theatre* the plan is very similar in outline, but the details differ widely. The orchestra was only a semicircle, and was used commonly for seats of honor. The other half of the circle was covered by a low stage (*pulpitum*), whose depth was somewhat less than a radius of the orchestra, and its width not over two diameters. In the rear wall were three or five doors, and in the side walls two, replacing the old *paradoi.* A new entrance into the orchestra was provided by an arched passage under the seats at the side. In the Roman theatre there was a curtain which disappeared below the stage when the performance began.

In Greece, outside of Athens, the chief theatres are at Epidaurus, Eretria, Sicyon, Megalopolis, Mantinea, Delphi, Oropus, and Delos. In Asia Minor Greek theatres have been studied at Pergamum, Magnesia on the Mæander, and Priene, while fine examples not fully excavated are at Aspendus, Telmessus, and other sites. In Sicily and Lower Italy the Greek theatres have been altered in Roman times. Fine ruins remain at Taormina, Syracuse, Segesta, Pompeii, and Fiesole.

In Athens plays were performed only in connection with the festivals of Dionysus (see GREEK FESTIVALS), i.e. the Country Dionysia, the Lenæa, and the Greater or City Dionysia. It was at the latter that tragedy developed, and here the great tragedies were first produced. Comedy was at first confined to the Lenæa, but after about B.C. 465 was also part of the Greater Dionysia. At this festival three tragic poets competed, each producing a tetralogy, i.e. three tragedies and a satyr play. One tetralogy seems to have been performed on each of the three days. The three comedians produced only one comedy each, which seems to have followed on each day the group of tragedies. The arrangements were in charge of the Archon Eponymus, who chose the three poets from among those submitting works, and assigned to each a *choregus,* i.e. a wealthy citizen upon whom devolved the expense of the production. The production was a competition between the choruses, and the victorious choregus dedicated a tablet to Dionysus. The poets received a crown of ivy and a sum of money. Only three actors were allowed, and at first it seems to have been usual for the poet to play the leading rôle. Later, acting became a regular profession, and troupes of three actors were organized. After the fifth century B.C., and perhaps earlier, the leading actors also competed for a prize. The profession was not dishonorable, and the actors seem to have been always free citizens, as were the chorus. Women did not appear on the stage, unless possibly as flute-girls. The costume of the tragic actor was a long tunic, with close-fitting sleeves often richly embroidered, and a cloak or mantle, with sometimes a shorter tunic under the cloak. Masks were also worn, and the stature was somewhat increased by padding, a high top to the mask, and thick-soled shoes (*cothurni*), which also served to raise the actor somewhat above the level of the chorus. The dress of the chorus seems to have resembled that of daily life, except of course in such cases as the *Eumenides* of Æschylus, where the Furies produced a great impression by their awe-inspiring appearance. The satyr chorus wore masks reproducing the typical satyr countenance, a goatskin around the loins, and *phalloi.* The comic actors wore tights, apparently often of gay colors, a short tunic and cloak, a phallus, and comic mask; the costume of the chorus varied with its character, and the poets allowed free scope to the imagination, as in the *Birds* and *Clouds* of Aristophanes. In the new comedy the dress was modified and more nearly approached that of daily life, from which the characters were taken. At the same time there was introduced a typical series of masks, so designed that the mask at once indicated the character.

At Rome the drama, like the theatre, was largely borrowed from the Greek, but it was not a state performance by citizens, at least in its developed form. The actors were troupes (*greges*) of freedmen or slaves, and the plays were in general adapted from the Greek, especially in tragedy, though the *prœtextœ*, in which the hero wore the *toga prœtexta* and not the Greek costume, were an attempt to treat national subjects in the Greek tragic style. In the comedy were distinguished the *palliata*, based on the Greek new comedy in which the Greek cloak (*pallium*) was worn, and the *togata*, treating of native life and character, and appropriately costumed. The plays were produced at public games, and also at the games or shows given on special occasions by private individuals. The magistrate or giver of the games paid the leader of a troupe (*dominus gregis*), who owned plays and produced them. The theatre thus never entered into or reproduced the national life in Rome as in Greece, and in later times the favorite Roman shows were the *Mimes* and *Attellanœ*, both of which seem to have been marked by buffoonery and indecency.

Mediæval and Modern. During the Middle Ages theatrical performances consisted almost wholly of religious or semi-religious allegories, known as Mysteries and Miracle Plays, which were given in churches, convents, or castle halls and without any elaborate staging. When performed out of doors at fairs, a rude booth of boards sufficed. No seats were provided for the spectators. In 1548 the Paris Confraternity of the Trinity built a theatre which was licensed to perform "profane pieces of a lawful and honest character." There were no seats or scenery. Until the end of the sixteenth century theatrical performances were given in England by bands of strolling players who had no permanent theatres, but performed chiefly at fairs and in the courtyards of inns, the most honored guests watching the performance from the second or third story windows and balconies, an arrangement that may have suggested the different tiers of balconies in the modern theatre. The first permanent playhouse in London was the theatre built by James Burbage about 1576. The Globe Theatre, built in 1598, also by Burbage, in which Shakespeare's plays were produced, was an hexagonal wooden structure partly open at the top. In the central court, or pit, the people stood, while the gentry sat in galleries running around three sides of the building, and a number of wits and gallants sat upon the stage, which was concealed between the acts by a curtain running upon an iron rod. Shakespeare had no scenery beyond hangings and curtains, a placard inscribed "This is a Forest," or "This is a Prison," sufficing. Movable scenery first made its appearance about 1650. Performances were given in the afternoon, except upon special occasions, when candles were used and kept snuffed by men who were duly applauded for their dexterity in keeping the lights properly trimmed. The first French theatres were modeled after those of Italy, where theatres were built about 1680 in Florence and Vicenza. The first ballets performed under Louis XIV. were organized by Italians, who introduced movable scenery, footlights, and sidelights. For Italian ballets introduced into France in 1680, scenery painted in proper perspective was first used, and women were admitted among the dancers, the female parts having been taken before that by boys. In 1759 the chief Paris theatres abolished the privilege of the gallants to sit upon the stage, and the London theatres followed their example. In Paris the custom had been so abused that the actors in popular plays had no room; in a play by Favart at the Théâtre Français in 1740, such was the crowd that there was only room on the stage for one actor to appear at a time. About 1660 women first appeared upon the English stage, where their parts had until then been played by boys or young men. In 1700 scenery began to be painted upon different flats running upon grooves in the stage, France leading the way in stage decoration, with such famous artists as Watteau and Boucher as scene painters. During the nineteenth century the pit, which formerly contained no seats and was used by the common people and by lackeys waiting for their masters, changed its name and character. Both in Europe and America the former pit, now known as the orchestra, is filled with seats which are, with a few exceptions, the most expensive in the theatre, while the cheapest places are now in the top galleries.

According to Dunlap the first American theatre was built in Williamsburg, Va., in 1752 by the English actor William Hallam, who brought a company from England and was for years the chief spirit in theatrical enterprises in the New World. The first play produced was *The Merchant of Venice*. About the same time a brick theatre, with seats for about 600 persons, is said to have been built in Annapolis. The first New York theatre was opened by Hallam in September, 1753, in Nassau Street, upon the site of an old Dutch church. Plays were given three times a week. At the end of the season Hallam moved to Philadelphia, where in April, 1754, he fitted up a building near Pine Street and gave dramatic performances. An actor named Douglass built a theatre in 1754 near Old Slip, in New York, which he called the Histrionic Academy, opening with *Jane Shore*, and five years later he was also the proprietor of a Philadelphia house. In 1759 Newport had its theatre and in the following year one was built in Perth Amboy, then the capital of the Province of New Jersey; the same company played engagements in New York, Philadelphia, Newport, and Perth Amboy. In 1757 another theatre was built in John Street, New York. In 1773 Charleston and Boston had their own theatres, and by the end of the century there were others in Albany, Baltimore, and Richmond.

The modern theatre consists, roughly speaking, of two parts, the auditorium and the stage. The first consists of suitable entrances, lobbies, reception rooms, staircases, and means of approach to the auditorium proper, which is commonly of semicircular or horseshoe form, the floor sloping down to the stage. According to the size of the house there are from one to four balconies, which follow the curve of the horseshoe; in some of the opera houses one or two of these balconies are divided into boxes, each containing four or more seats. The stage, which in houses intended for opera or spectacular pieces is as large as the auditorium, consists of the stage proper, a floor with an upward incline from the footlights to the rear wall of the theatre of about half an inch to the foot; and on either side of the stage and at the rear, there are spaces for the proper manipulation of scenery and for dressing-rooms. Above the stage are the flies, where hang the pieces of scenery to be lowered into place by ropes, and below it corresponding depths into which the scenery may be dropped. Gas, which replaced candles for lighting purposes in Europe in 1823 and in this country about 1830, has within the last few years given place to electric lights, making possible better effects of lighting, and doing away with much heat and foul air. One or two men now control from a table at the side of the stage the whole lighting of the house, raising or lowering the lights in any part of it at will. Lights are used upon the stage as footlights, in the flies at the top, and in the wings at the side. Calcium lights are used where great brilliancy is desired. Scene-painters and stage carpenters now succeed in doing with ease what would have been considered impossibilities fifty years ago. Moving scenery running upon vertical rollers at either side of the stage makes possible the illusion of horse-racing, while chariot races, railroad trains, and steamboats in motion are represented with much skill. The effect of lightning is produced by burning lycopodium powder or by electric sparks; the sound of wind by a metal cylinder revolving against a piece of cloth or wood, the sound of rain by shaking peas in a pan, of thunder by the rolling of cannon balls, of church chimes by bars of steel, and the illusion of snow by small pieces of paper dropped through coarse sieves. The magic lantern is also successfully used. In the theatre which Richard Wagner built at Bayreuth it is used to portray cloud effects, the ride of the Valkyrs who fly through the air, etc. At the Dresden Opera House, long famous for its scenic devices, the remarkable use of the magic lantern was first made in *The Rat Catcher of Hameln* to simulate the army of rats that came at the call of the Pied Piper and drowned themselves in the river Weser. Steam clouds were first used at Bayreuth to hide the stage from the spectators while the scenery was changed so as not to interrupt the poem by dropping the curtain. Wagner also used curtains of gauze with similar effects. The stage itself is now made in movable sections, which allow scenery to be raised from below as well as lowered from above. Twenty years ago a double stage was constructed at the Madison Square Theatre, New York, a small house with insufficient stage room for the manipulation of scenery; while the performance is going on upon one stage, the scene-shifters and decorators may work upon the other, which when the curtains falls is lowered or raised into place for the next act. Another innovation first tried at this house was to place the musicians above the proscenium arch instead of in front of the footlights; the object was to save space for seats. As a protection against fire spreading from stage to auditorium or vice versa, an asbestos curtain or one of sheet iron in sections is now used in many theatres.

The prices for theatre seats in England in Shakespeare's time varied from one penny to one shilling. In the early American theatres the prices were high—from three shillings for gallery seats to six shillings for seats in the boxes. Prices fell after the Revolution to 25 cents for gallery seats and $1 for box seats. This remained about the scale of prices until after the Civil War, when there was a steady increase. In 1870 first-class theatres in New York charged $1.50 for orchestra seats and from 35 cents to 50 cents for the top gallery. About 1886 a few New York theatres began charging $2 for the best seats in the orchestra and the first row in the first balcony, and gradually all first-class theatres made $2 the price of orchestra seats, with $1.50 and $1 for the balconies, and 50 cents for the gallery. For operatic performances $2 and $2.50 were the prices for orchestra seats in the New York Academy of Music until 1878, when the price was advanced by the English manager, Mapleson, to $3. A few years later, with the advent of Madame Patti, the price rose to $5 for orchestra seats, at which it has since remained. In other large cities such as Boston, Philadelphia, and Chicago, the prices for theatre and operatic performances are about one-third less. In London the best theatres charge $2.50 for good seats, and in Paris the price is but little less. In Germany, with the exception of Berlin, the price of the best seats for either opera or drama seldom exceeds $1.50.

Although the Paris Grand Opéra, built in 1866-72 from the designs of Charles Garnier, at a cost of about $4,000,000, is the most luxurious theatre in the world, the chief opera houses in Munich, Dresden, and Vienna are quite as perfect in their way and superior to the Paris house acoustically. The Metropolitan Opera House of New York is the only American theatre that corresponds with those mentioned in size and appointments. The famous Bayreuth Opera House, built by Richard Wagner in 1876 for the first performance of his Nibelungen trilogy, contained many novelties, of which the chief was an orchestra-pit so depressed below the level of the auditorium as to render the musicians invisible to the audience. The new Prince Regent Theatre at Munich, built in 1902, and devoted chiefly to Wagnerian performances, far surpasses the Bayreuth house in most respects, and is now considered the model opera house of Europe. In France and Germany the State subsidizes its chief theatres. In Paris four theatres—the Grand Opéra, the Opéra Comique, the Théâtre Français, and the Odéon—are allowed a yearly subsidy, in return for which they agree to produce a certain number of new works by native authors and composers and to give a certain number of free performances. In Berlin, Dresden, Munich, and Vienna the chief opera house and the chief theatre are under control of the State. The actors, singers, musicians, and other employees are entitled to pensions.

Law of Theatres. For legal purposes, a theatre is a house or building adapted and used for the purpose of dramatic performances. The courts differ in the various States as to what may be considered a dramatic performance, but generally almost any exhibition on the stage is included in this term. Thus, negro minstrel shows and 'comic operas' have been held to be theatrical performances within a law governing theatres. Laws regulating theatres are a constitutional exercise of the police power. Because of the necessity for such regulation, in some States theatres are considered as enterprises of such a public character that they come within the State laws prohibiting the discrimination against persons because of race or color, thus making their obligations in this particular similar to that of hotels and common carriers. However, by the weight of authority a theatre ticket is always a revocable license as to any person, and probably even in the States prohibiting such discrimination, theatrical managers could refuse to sell a ticket, or refuse to admit a person with a ticket without assigning any reason, and thus evade the statutes. Where proper notice is given to purchasers of tickets, the management may make it a condition that tickets shall not be transferable. This may be done by printing such conditions on the back of the tickets themselves and by notices posted at the theatre, or by giving actual notice to purhasers. Under such circumstances theatrical managers may refuse to honor tickets bought from speculators. The spectators may applaud or hiss the players in moderation, but must do so to express their spontaneous emotions, and not come with the intention of stopping or interfering with the performance, as in the latter case they may be ordered to leave the theatre and be forcibly removed if they refuse.

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THÉÂTRE DES ITALIENS, tȧ'ä'tr' dȧ zĕ'tȧ'lyäN' (Fr., theatre of the Italians). A former theatre of Paris from which the Boulevard des Italiens derives its name.

THÉÂTRE FRANÇAIS, fräN'sȧ'. The French national theatre. See COMÉDIE FRANÇAISE.

THÉÂTRE LIBRE, lē'br' (Fr., free theatre). The name of a dramatic enterprise founded in 1887 by André Antoine, then a young Parisian clerk. With some fellow amateurs of the Gaulois Club he arranged the production (March 30, 1887) of four new one-act plays at the Elysée des Beaux-Arts at Montmartre, and in the course of the year formed the association of the Théâtre Libre, to be conducted upon the following principles: the season to consist of eight different representations, one each month from October to June; no tickets to be sold to the public; the enterprise to be supported by subscribers who with invited guests should form the only audience. The design was to give young authors a chance to try their strength; and also, for art's sake, to produce plays which for any reason, political or moral, might be forbidden by the censorship if undertaken at a public theatre. In an artistic way the Théâtre Libre won success, though it excited much debate from the first. Its founder aimed to do away with all conventionality and to attain a degree of realism often thought out of the question upon the stage. In its first eight years, about 150 writers contributed works for its performances, and a considerable proportion of these previously unknown pieces were afterwards accepted and brought out by other theatres. At the same time such famous writers as Zola, the Goncourts, Mendès, Bergerat, Ibsen, and Tolstoy also found presentation here. Financially, however, M. Antoine found his difficulties accumulating, and in 1894 he accepted a position as an actor at the Gymnase Theatre. For a short time he was a director of the Odéon (1896); then he resumed the direction of the Théâtre Libre, for several years located in the Salle des Menus-Plaisirs and known since 1897 as the Théâtre Antoine. To this the general public is admitted in the usual way, though subscribers still retain their special privilege at eight representations a year. The idea of the Théâtre Libre has been copied in the Freie Bühne of Berlin, and in similar more or less ephemeral institutions in London and other cities.

THEATRUM EUROPÆUM (Lat., survey of Europe). A chronicle of events which appeared in volumes at Frankfort-on-the-Main between 1616 and 1718. During one portion of its existence it was illustrated with copper-plate engravings. In all 21 volumes were issued. The work was in part the forerunner of political journals.

THEBAÏS, thē'bȧ-ĭs *or* thē-bā'ĭs (Lat., from Gk. Θηβαίς). (1) The territory of Thebes, in Egypt. In later times the name was applied by the ancients to Upper Egypt. (2) An ancient Greek epic giving in 7000 verses the story of the house of Labdacus, and the attack of the seven chieftains on Thebes. (3) A dull and long-drawn work by P. Papinius Statius, dedicated to Domitian. It contains in 12 books the story of the contests of Eteocles and Polynices.

THEBAN CYCLE. The name given to a series of ancient Greek epics treating the legends of Thebes. It includes the *Thebaïs* (q.v.); the *Epigoni*, a poem of about 7000 lines, telling of the capture of the city by the descendants of the heroes of the *Thebaïs;* and the *Œdipodeia*, attributed to Cinæthon, a Lacedæmonian, containing about 6000 lines and giving the story of Œdipus.

THEBES, thēbz (Lat. *Thebæ*, from Gk. Θῆβαι). A celebrated city of ancient Egypt, situated on both sides of the Nile in about latitude 25° 50′ N. Its old Egyptian name was *Wēset*, but in later times it was also called *Nu*(*t*) *Amen*, 'the city of Ammon,' *Nu*(*t*) 'o, 'the great city,' or simply *Nu*(*t*), 'the city' (*urbs*); in the Old Testament it is called *No* or *No Amon*, and in the Assyrian inscriptions its name appears as *Ni'*. By the Greeks, who identified the god Ammon with Zeus, it was sometimes called 'Diospolis, 'the city of Zeus,' and it was specially designated as 'Great Diospolis' to distinguish it from 'Lesser Diospolis,' the modern Hon. The origin of the more usual Greek name Θῆβαι is obscure. Thebes was the capital of the fourth nome of Upper Egypt, and was a very ancient city, but did not rise to importance until the time of the Eleventh Dynasty, which was of Theban origin. Under this and the following dynasty the city was the capital of Egypt, and some of its oldest temple buildings date from this period.

Its real greatness, however, begins with the expulsion of the Hyksos invaders by the Theban princes, who united the whole land under their sway (Eighteenth Dynasty), and adorned their city with temples and palaces of unprecedented magnificence. The kings of the Nineteenth and Twentieth Dynasties added to the work of their predecessors, and for centuries Thebes was the chief residence of the Egyptian Pharaohs and far surpassed all other cities of the land in wealth and splendor. The persecution of the worship of Ammon by the heretic King Amenophis IV. (q.v.), and the temporary removal of the seat of government to Tel el-Amarna, affected Thebes but little. Seti I. and especially Rameses II. (c.1340-1273 B.C.) restored the desecrated sanctuaries and lavished enormous wealth upon the Theban temples. Under the Twenty-first Dynasty, however, Thebes ceased to be the capital of Egypt, and from this time gradually declined in importance. In the seventh century B.C. it was again the seat of government, for a time, under the Twenty-fifth or Ethiopian Dynasty, but when the capital was removed to Sais (q.v.) by the following dynasty (Twenty-sixth), it began a new period of decline. Its temples were repaired and new buildings were erected by later monarchs, especially by the Ptolemies, but, overshadowed by the rise of new cities, it gradually sank to the position of an insignificant provincial town. Its great temples sustained serious injuries in the course of various revolts against the Ptolemies, and were further ruined by an earthquake in B.C. 27. In the time of the geographer Strabo (B.C. 24) Thebes was a ruined city as at present, its site being occupied merely by a few scattered villages.

The city proper lay upon the east bank of the river between the great temples now represented by the ruins of Luxor (q.v.) and Karnak (q.v.); a little to the north was the suburb Ma'du, the modern Medamut, with a temple built by Amenophis II. (Eighteenth Dynasty) and dedicated to the Theban war god Mont (q.v.). Additions were made to this temple by Seti I., Rameses II., and several of the Ptolemies, but it is now almost entirely destroyed. On the west side of the river were suburbs of considerable size, and Rameses III. seems to have built his palace in the neighborhood of his memorial temple at Medinet Habu (q.v.), but in general this side of the river was occupied by the Theban necropolis, which extended to the Libyan range. It contained numerous temples, erected as memorials of the Egyptian kings, and to these temples were attached dwellings for the priests, schools, granaries, stables, barracks, and other buildings. Nearer the hills were the dwellings of the artisans whose employment was in the necropolis: stone-masons, builders, painters, sculptors, and especially the embalmers. There were also inns for the entertainment of visitors, and many shops for the sale of funeral offerings and other objects. The necropolis, in fact, formed a great city, and under the New Empire was under the direction of a high official entitled the 'Prince of the Western City.' The principal memorial temples of the Theban necropolis, beginning at the north, were those of Kurnah (q.v.) and Deir el-Bahri (q.v.), the Ramesseum (q.v.), and that of Medinet Habu (q.v.). The Temple of Deir el-Medineh, dedicated to the goddess Hathor, lies a little to the west of the Medinet Habu. It was founded by Ptolemy IV. Philopator, was completed under Ptolemy Philometor and Ptolemy Euergetes II., and in Christian times was converted into a monastery. Between the line of memorial temples and the hills are the cemeteries of Drah Abu'l Negga, Asasif, Abd el-Kurnah, and Kurnet Murraï. The rocky hills bordering on the plain of the necropolis are honeycombed with tombs. In a narrow valley to the north of Kurnah are the tombs of the kings, in which were buried the monarchs of dynasties XVIII.-XX. Each of these tombs contains a number of galleries and chambers whose walls are covered with paintings and religious texts. Strabo states that forty of these tombs were worthy of special attention; twenty-five of these are now accessible. The tombs of the queens, to the west of Medinet Habu, are for the most part in an unfinished state. A few of them, however, dating from the Eighteenth Dynasty, are elaborately constructed and are richly adorned with sculptures and paintings. Near Kom el-Hetan, between Medinet Habu and the Ramesseum, are two colossal statues of King Amenophis III.; they originally stood before a temple erected by the King, but only traces of the building now remain. The more northerly of these colossi, the famous 'vocal Memnon' (see Memnon), was in no way distinguished from other colossi. The chief deities worshiped at Thebes were the great god Ammon (q.v.), his spouse Mut (q.v.), and their child Chons (q.v.). See Luxor and Karnak.

Consult: *Description de l'Egypte* (Paris, 1809-29); Lepsius, *Denkmäler* (Berlin, 1849-58); Wilkinson, *Topography of Thebes* (London, 1835); Mariette, *Monuments of Upper Egypt* (ib., 1877); Wiedemann, *Geschichte des alten Aegyptens* (Berlin, 1878).

THEBES (Gk. Θῆβαι, *Thebai*). The principal city of Bœotia, in ancient Greece, situated in the southeastern part of the country, on the northern slope of a ridge which separates the valley of the Asopus from the plain to the north. The Acropolis or Cadmea, now occupied by the little town of Thiva or Phiva, lay on the high ground between the Ismenus and Dirce. At its greatest extent the ancient city seems to have extended beyond both streams. According to legend, Cadmus (q.v.) was the founder of the city—hence Cadmea as the name of the Acropolis. The city played a prominent part in the stories of the heroic age, the series of epics (see Theban Cycle) vying in interest with those which gathered about Troy. For these stories, see Œdipus; Antigone; Eteocles and Polynices; Creon; Amphion; Dirce. After the Bœotian invasion Thebes seems gradually to have secured the leading place in the Bœotian league, reducing finally the rival city of Orchomenus. Tradition told of the code of laws drawn up for the city in the eighth century B.C. by the Corinthian Philolaus. It is not till near the end of the sixth century B.C. that we reach a purely historical period—the earliest well-attested event being the dispute between Thebes and Platæa, which resulted in the latter placing itself under Athenian protection, and the former becoming involved in an unsuccessful war. During the Persian invasion under Xerxes Thebes sided with the invaders, and fought against the confederated Greeks at Platæa B.C. 479. This conduct greatly weakened for a time the prestige of Thebes, and almost cost her the headship of the Bœotian league. After the battle of Coronea (B.C. 447), however, the tendency to revolt was checked, and from this time Thebes was almost continuously the recognized leader in Bœotia. When the Peloponnesian war broke out, Thebes took part with Sparta, and at its close was eager for the destruction of Athens. But the policy of victorious Sparta soon aroused distrust, and Thebes gave a friendly welcome and shelter to those Athenians whom the oppression of the Thirty Tyrants (q.v.) compelled to abandon their city. It was from Thebes that Thrasybulus and his band started on their famous expedition for the deliverance of Athens, accompanied by a body of Theban citizens. During the following years the Thebans completely changed their policy toward Sparta, and in the Corinthian War were among the bitterest enemies of their old ally. The Peace of Antalcidas (B.C. 387), as interpreted by Sparta, broke up the Bœotian league, and led to new disputes, culminating in the treacherous seizure of the Cadmea by the Spartans (B.C. 382). The expulsion of this garrison by Pelopidas and his associates (B.C. 379) led to renewed hostilities, which culminated in the battle of Leuctra (B.C. 371), where Epaminondas (q.v.) crushed the power of Sparta outside the Peloponnesus. Before his death at Mantinea in B.C. 362, Epaminondas had secured for Thebes the supremacy in Greece, though Athens was estranged and even openly hostile. Thebes did not long hold the position thus gained. The quarrel with Athens prevented any union against the growing power of Macedon, until the seizure of Elatea (B.C. 338) furnished an opportunity for Demosthenes to secure by his eloquence a union for which he had long striven. The effort came too late, and in the same year the battle of Chæronea crushed the liberties of Greece.

After Philip's death the Thebans made a fierce but unsuccessful effort to regain their freedom. Their city was taken by Alexander, who leveled it to the ground, sparing, it is said, only the house of the poet Pindar, and sold the entire surviving population into slavery (B.C. 335). For twenty years it remained in utter desolation, but in B.C. 315 it was rebuilt by Cassander, who gathered into it all the Thebans he could find in Greece. It now had a circuit of about five miles, and seems to have prospered. It suffered at the hands of Mummius (B.C. 146) and was severely punished by Sulla for siding with Mithridates. After this it steadily declined, and Pausanias found only the Cadmea inhabited, and the lower city in ruins. It revived under the later Roman Empire, as it was a safer residence than the exposed coast cities. During the eleventh and twelfth centuries it was the seat of a considerable population engaged in the manufacture of silk, and yielded a rich booty to Norman plunderers in A.D. 1146. Under the Turks it again declined, and even now is only a country town with a population of about 3500. The course of the town walls can be traced in some places, and deep digging has brought to light some remains, but in general there are but few vestiges of the ancient city left. Consult Fabricius, *Theben* (Freiburg, 1890).

THÉDENAT, tā′de-nä′, Henri (1844—). A French archæologist, born in Paris. He studied in the Ecole Pratique des Hautes-Etudes at the Sorbonne, devoting himself especially to epigraphy. His publications, in collaboration with Héron de Villefosse, include *Les cachets d'oculistes romains* (1882) and *Inscriptions romaines de Fréjus* (1885). He also wrote *Le Forum romain et les Forums impérieux* (1898), and *Une carrière universitaire, Jean-Félix Nourrisson* (1901).

THEFT. See Larceny.

THEINE. See Caffeine.

THEINER, tī′nēr, Augustin (1804-74). A German Roman Catholic historian and canonist. He was born at Breslau and educated there and at Halle, where he took his degree as doctor of law in 1829. His intercourse in Paris with Lamennais (q.v.) seems to have disturbed his religious views, but he was reconciled with the Church at Rome in 1833, and became a teacher in the College of the Propaganda. After his ordination to the priesthood, he entered the Congregation of the Oratory, and published several historical and critical works. In 1850 he was placed in charge of the Vatican archives. In 1870 he was removed from the position of archivist, apparently in consequence of the charge that he had supplied documents with which to combat the theory of the infallibility of the Pope. His most important work was the new edition of the *Annals* of Baronius and his continuators, with three supplementary volumes. Important also are the collections of documents on the ecclesiastical history of various countries and of the Council of Trent. In his *Geschichte des Pontificates Clemens XIV.* (1853), he attacked the Jesuits and roused fresh suspicions of his loyalty to the Church, which were confirmed by his *Histoire des deux concordats de la république* *française en 1801 et 1803* (1868), and by his friendly intercourse with the German Old Catholic leaders. He died of apoplexy at Cività Vecchia. Consult Brück, *Geschichte der katholischen Kirche in Deutschland* (Mainz, 1896).

THEISM (from Gk. *θεός*, *theos*, god). The theory which assumes a living relation between God and His creatures, though it does not necessarily define it. It also carries with it, in many theories, the personal implication, and explains the universe in terms of divine reason and will. The intellectual genealogy of this conception, in its historical aspect, is very ancient, dating back to the early thought of the Greeks. In the philosophic theism of Socrates, which was a reply to the irreligion of the Sophists, we find a clear conception of a Divine Personality and an attempt to prove its existence. Socrates makes use of the doctrine of final causes for this purpose, maintaining, against the Sophistic materialism, that the universe is the product of benevolent moral will (*Phœdo*, 96, 199); that this will holds personal relations with all his creatures, and seeks to bring the highest good to all. This he taught while practically all the East worshiped the objects of nature (sun, trees, etc.) as God, and, therefore, Socrates may be regarded as the founder of theism as understood in the West. Plato added little to the fundamental conception except to develop it by means of his doctrine of the Idea (*ἰδέα*, *εἶδος*). The absolute Idea is the Good, i.e. God. In the *Republic* (509 b.) we accordingly read: "All intelligible beings derive their being and their essence from the good." To this thesis he adduces four proofs, all bearing on Socrates's idea of final cause. (1) From the notion of efficient cause. All things proceed from some cause, and the cause must be adequate to produce what exists. (*Sophist*, 205 b.) (2) From the ideal nature of the Cause. If there be a universe of real things, as no one can doubt, it can proceed only from an ideally perfect cause, i.e. from God. (*Philebus*, 30.) (3) From the idea of cause as motion. All motion implies a self-mover, i.e. an adequate originating cause for the motion and change. (*Laws*, x.) (4) From the finality of cause. All things seek their end. The end must be moral, and therefore transcendent. In other words, the universe must at last prove itself to be a revelation of the Good, i.e. God. This is the heart of the Platonic theism. "Let me tell you, then, why the Creator made this world of generation. He was good, and the good can never have any jealousy of anything. And being free from jealousy, He desired that all things should be as like Himself as they could be." (*Tim.* 29.)

Aristotle's argument is the same as Plato's, but deeper in its empirical developments. He rises, synthetically, through nature, to his proof of the divine existence. In the eighth book of his *Physics* he gives us what he calls his 'proof of the First-Mover.' Everything that is in motion is moved either by something else or by itself. If the former be the case, we are obliged to follow up the series of causes until we arrive at the idea of a self-mover, i.e. an immovable cause having its end in itself. Hence the first-mover must have been set in motion by itself, i.e. it is a self-mover. But, inasmuch as, commonly speaking, it is essential to the idea of motion that there be something to be moved, it follows that there may be three kinds of movers: first, the mover that imparts motion and is moved; second, the mover that is movable in itself but immovable in relation to others; and third, the mover that is immovable both in itself and in relation to others. It is the last kind alone that gives us the speculative foundation of theism; for this is the mover that moves the rest of the world and is nevertheless absolutely immovable by anything external to itself; a true cause of the origin and end of all things.

Augustine, the most eminent of the early Christian thinkers, adopted the Platonic theism, seeking to combine it with the Christian views. He accepted substantially all the principal proofs of God's existence and His providential government as these had been prepared in Greek thought; but there were points where he added to previous thinking. The Greeks had put a gulf between God and the world, so great that the tendency was to separate them absolutely. Augustine completed this by declaring that God made the world out of nothing, and without the aid of intermediate agents. Second, Augustine taught that God creates out of His mere goodness and bounty, not because He has need of anything; so that in creating He adds nothing to His nature. (*Conf.* xiii. iv.). This view struck at the Stoic pantheism, at the Oriental theories of emanation, and at the fundamental weakness of the platonic theism, the failure to define the nature of the relation between God and the finite world.

The various other proofs of the existence of God given in the Middle Ages pursue two methods, one *a priori*, the other *a posteriori*. That is, one starts in Platonic fashion with the idea of a perfect being and infers its existence from this idea; the other argues, after Aristotle, from the evidences of order and perfection in the world to the idea of a perfect being who is the author of them. Anselm is an early and prominent representative of both this and the *a priori* or ontological argument, which assumes that God is a being of such a nature that it is impossible to conceive any greater. The defect of this argument, as Gaunilo pointed out, consists in arguing from existence in thought to existence in fact. From the former, of course, we can logically infer nothing but an ideal thought-existence.

Other theistic proofs during the Middle Ages were concerned with the course of nature and history. Thus Duns Scotus declared that the impossibility of conceiving an infinite chain of natural causes necessarily carried the mind to the idea of a great First Cause adequate to the production and preservation of the world. Aquinas also (*Summa* I., qu. 2) reaches the same conclusion, *a contingentia mundi*, reproducing Aristotle's proofs almost word for word. The contemplation of final causes, though not extensively meditated upon, led to very similar logical results from the cosmological point of view; for mediæval thinkers were fond of dwelling on the fact of the imperfection of the physical and of inferring therefrom the existence of a perfect being in whose spiritual essence the soul could find the ground of the Christian faith. Thus we find that theism received the stamp of Christian ideas; that the greatest minds in the mediæval period gave it their support because they found in it the ground of the harmony of speculative reason and piety.

In modern times philosophical meanings have largely supplanted the theological. Thus Descartes, the most important modern thinker on this subject, developed his theism only after sweeping aside all presuppositions derived from a supernatural source or from the symbols of the Church. Starting with the bare fact of thought (*cogito, ergo sum*), he argues that there must be an adequate cause for the thought of God in the mind. By this thought Descartes says that he means "a substance infinite, eternal, immutable, independent, all-knowing, all-powerful; by which I myself and every other thing have been produced." (*Med.* iii.) Now this thought cannot be a mere negation; for it has reality. Nor can it have arisen by adding many ideas together; for it is simple. Could it have arisen as a result of my growing intelligence? No; because the idea does not admit of growth: God is infinite always and does not admit of more or less. Hence the idea must have a divine origin. A second proof may be stated thus. We need this idea in order to explain to us the immediate existence and continuance of the universe. God is not only needed as a Creator, or logical Prius of the universe, but much more as a Preserver. A merely primary creative cause might be lost in the infinite complex of secondary causes, as in pantheism or deism, but the immediate dependence and continuance of the universe involves the idea of a preserving and sustaining cause, not only that of an originating one. A true cause must, therefore, be adequate to the task of continuing the universe from moment to moment. The existence *now* of a universe involves the self-existence of its absolute Cause. As a third proof Descartes revived Anselm's so-called ontological argument, i.e. the argument from the idea of a most perfect being to its existence. Reality, in his view, is as much a part of the idea of a perfect being, as the angles of a triangle are of the essence of our idea of a triangle, or the perfume of a rose of our idea of a rose.

Kant, in the third part of his *Dialectic*, criticises this argument of Descartes. He does not, indeed, deny the fact that we have the *idea* of a perfect being, but he doubts if *from the idea* we have any right to infer its real existence, since it is possible for us to have an idea (for example, of a centaur) that does not correspond to any object. And inasmuch as all possible proofs of the existence of God are reducible to this one, the ontological, Kant considers that all the arguments of Descartes and of the mediæval thinkers failed to establish their point. Accordingly he proposed a new and infallible proof, the so-called practical or moral arguments for the existence of God, which is as follows. We have the notion of a moral law; conscience responds to the categorical moral imperative. Universal experience proves that happiness and virtue involve each other and cannot be separated. Obedience to these moral conditions is the law of life, of conduct, and character; for the wicked are never, in the long run, happy. Now, said Kant, for this conviction there is needed a cause, supreme and infinite; a cause capable of clinching this relation between happiness and virtue to all eternity; a cause which will secure the triumph of justice as against the moral inequalities of the present life. This moral cause we call, by faith, God. Thus the only ground for insisting on 'proofs' of the existence of this cause is for Kant the subjective need of a cause of the moral law within our souls, and further than this Kant held it was impossible for the human mind to go.

Hegel disagreed with Kant's conclusions, and sought to revive the ontological argument of Anselm and Descartes, in a new form, contending that the idea of a perfect being was an expression of the nature of all thought and all reality. He refused to believe that the traditional separation of thought and thing, upon which Kant depended, represented any real or valuable distinction. For him thought and reality are the same. We cannot ever get 'beyond' thought. To put a barrier, as Kant did, between thought and thing is, for Hegel, to cease to think. All recent reflection on the theistic problem rests on this idealistic presupposition of Hegel. He may, therefore, be regarded as furnishing present-day theism with its most valuable logical foundation.

Consult: Harris, *The Philosophical Basis of Theism* (New York, 1883); Flint, *Theism* (Edinburgh, 1887); Ladd, *The Doctrine of Sacred Scripture* (New York, 1884); Bowne, *Theism* (ib., 1903); Fisher, *Grounds of Theistic and Christian Belief* (ib., 1883; new ed., ib., 1903).

THEISS, tīs (Hung. *Tisza*, Lat. *Tissus*). The largest tributary of the Danube, and, next to the latter, the principal river of Hungary (Map: Hungary, G 3). It rises in the Carpathian Mountains and flows first westward, then south, the lower half of its course being parallel with that of the Danube below Budapest. It joins the Danube about 30 miles above Belgrade. Its total length, including the smallest windings, is about 800 miles. In its upper course through the narrow mountain passes it is rapid and clear, but in the great plain of Central Hungary it is very sluggish, and winds between low, marshy banks. The country here is subject to disastrous inundations, and large sums have been expended in attempts to regulate the flow of the river and drain the marshes. The Theiss is navigable for boats to Mármaros-Sziget near its source, but steamboats ascend generally only to Szegedin at the mouth of the Maros (q.v.), the chief tributary. From the lower course of the river a canal runs westward to the Danube. The Theiss is famous for its fish.

THELLUSSON (tĕl'lŭs-son, *or Fr. pron.*, tå'lụ'sôɴ') **ACT**. See PERPETUITY.

THEME (Lat. *thema*, from Gk. *θέμα*, thing laid down, deposit, prize, proposition, subject, from *τιθέναι*, *tithenai*. to set, place; connected with Skt. *dhā*, OChurch Slav. *dēti*, Lat. *con-dere*, to put, place, OHG. *tuon*, Ger. *thun*, AS. *dōn*, Eng. *do*). In music, a term which is in a general sense synonymous with subject or motive (q.v.). Every composition is built up from themes which constitute the basic material. In a specific sense, the *theme* of a fugue is the *subject* (*dux*). In variations the *theme* is a complete musical idea, generally of periodic structure. It is always played in its entirety before the variations begin. See SONATA; SYMPHONY.

THE′MIS (Lat., from Gk. θέμις, justice personified, from τιθέναι, *tithenai*, to set, place). In Greek mythology, the goddess and guardian of the eternal laws, established by the gods. In the Hesiodic theogony she is called the daughter of Uranus and Gæa (heaven and earth), the wife of Zeus, and, by him, mother of the Horæ (hours) and Mœræ (fates). In Æschylus she is identified with Gæa, and called mother of Prometheus. As guardian of the due order of things, she was also possessed of prophecy. The popular conceptions do not seem to have distinguished sharply between Themis and Gæa, and at Athens we hear of *Gē Themis* as a single divinity. At Rhamnus she was honored in the Temple of Nemesis, and here has been found a fine statue by Chairestratos of Rhamnus, an artist of the early third century B.C.

THEMIS′TIUS (Lat., from Gk. Θεμίστιος) (?-c.388 A.D.). A Greek rhetorician of Paphlagonia, surnamed Euphrades (eloquent), who lived at Constantinople, as a teacher of philosophy and oratory. Though a pagan in religion, he was highly honored by several of the emperors for his nobility and learning. He was tutor to Arcadius, the son of Theodosius, who made him prefect in 384. There are extant 34 of his speeches (πολιτικοί), which, though chiefly eulogisms in compliment to various emperors, contain interesting allusions to contemporary history, and instructive quotations from the ancient philosophers; and four of his paraphrases of portions of Aristotle. The orations have been edited by Dindorf (Leipzig, 1832); the paraphrases by Spengel (Leipzig, 1866).

THEMIS′TO (Lat. from Gk. Θεμιστώ). In Greek legend, the third wife of Athamas. Her husband, on discovering that his former wife, Ino, was still alive, sent for her, and Themisto in revenge planned to slay Ino's children. With this intention she directed a new slave to clothe her children in white and Ino's in black, but Ino, who was herself the slave in disguise, reversed the command, and Themisto killed her own children, whom she did not distinguish in the night.

THEMIS′TOCLES (Lat., from Gk. Θεμιστοκλῆς, *Themistoklēs*) (c.514-449 B.C.). An Athenian general and statesman, born about B.C. 514, the son of Neocles, an Athenian citizen of middling station and circumstances, and a Carian or Thracian woman. After the battle of Marathon (B.C. 490), when the first invasion of the Persians had been successfully resisted, Themistocles, with keen foresight, recognized that the final decision of the question of supremacy would come on the sea, and that the only way for the Greeks to be victorious was to have a large fleet. He aimed, therefore, at the development of a strong Athenian navy. To this end he persuaded the Athenians to devote the proceeds arising from the working of the silver mines at Laurium, which it was intended to distribute among the citizens at large, to the construction of a strong fleet. He secured the passage of a law that a certain number of new triremes should be built every year. From the time of the expulsion of Aristides by ostracism (B.C. 483), Themistocles was at the head of the politics of Athens, and in B.C. 481 was made archon eponymus. When it was learned that Xerxes was preparing a powerful armament wherewith to invade Greece, and the Athenians had been told by the Delphian oracle to defend themselves with the 'wooden wall,' it was Themistocles who interpreted this answer as referring to the ships of Athens. At the battle of Artemisium (B.C. 480) Themistocles, who was commander of the Athenian fleet, which was the largest in Greece, consented to fight under the Spartan commander, Eurybiades, but it was only through the former's tact and adroit use of bribes that the Greek commanders were finally induced to make a stand in that place. This engagement was indecisive. In the same year, at Salamis, was fought the battle which shattered the naval power of Xerxes. Here again Eurybiades was commander-in-chief, and here again it was owing to the efforts of Themistocles alone that the Greeks were induced not to retreat to the Isthmus of Corinth, but to give battle in their present position. He threatened, if a separation were now made, that the Athenians would take their women and children and sail to Italy, there to found a new home. Finally, he precipitated the contest, by dispatching to Xerxes a secret message to the effect that, if the Persians wished to crush the Greek fleet, they should advance to the attack without delay, before the Greeks had an opportunity of fleeing. After the battle of Salamis Themistocles was the most important man in Greece. When the Persians had retreated from Greece and the Athenians undertook to restore their city, the Spartans, sending an embassy to Athens, urged the Athenians not to attempt to rebuild the fortifications. Then Themistocles, going on an embassy to Sparta, entertained the Spartans with his false professions, and kept the matter in abeyance till such time as the walls were sufficiently advanced to allow of their being defended. In B.C. 471 he was ostracized and retired to Argos; and finally, to escape being tried for treason, in which, according to some accounts, he was implicated by the correspondence of Pausanias, he betook himself in B.C. 465, to the Court of Artaxerxes, King of Persia; but before he would see the King himself, got permission to wait a year, during which he made himself master of the language and usages of the country. At the end of this time he managed to raise himself so high in the King's favor that, after the Persian fashion, the town of Magnesia was appointed to supply him with bread, Lampsacus with wine, and Myus with other provisions. He lived securely at Magnesia until his death in B.C. 449. Some authorities assert that he poisoned himself. A monument was erected to Themistocles in the market-place of Magnesia, and it is said that his bones were secretly taken to Attica, and there burned. Consult: Wecklein, *Ueber Themistokles* (Munich, 1892); Bauer, *Themistokles* (Merseburg, 1881).

THÉNARD, tā′när′, Louis Jacques (1777-1857). A French chemist, born at Nogent-sur-Seine. He was professor of chemistry at the Ecole Polytechnique, at the Collège de France, and at the University of Paris. From 1810 he was a member of the Institute. His original researches resulted in numerous important contributions to chemistry. He improved the methods of ultimate organic analysis; investigated the compound ethers or esters; discovered the peroxide of hydrogen, cobalt ultramarine (Thénard's blue), etc. He published: *Traité de chimie élémentaire,* *théorique et pratique*, which passed through several editions, and, jointly with Gay-Lussac, two volumes of *Recherches physico-chimiques* (1811).

THE'OBALD I. King of Navarre. See THIBAUT I.

THEOBALD, LEWIS (1688-1744). A Shakespearean editor, born at Sittingbourne, in Kent. Though educated for the law, he early turned to literature. He wrote and adapted plays, and made translations from Sophocles, Aristophanes, and other Greek authors. In 1725 Pope published an edition of Shakespeare, work for which he was ill equipped. Theobald sharply reviewed it in a volume entitled *Shakespeare Restored* (1726). Pope retaliated by making Theobald the first hero of the *Dunciad* (1728). Early in 1734 Theobald brought out his own edition of Shakespeare in seven volumes. At the time of his death Theobald was at work on an edition of Beaumont and Fletcher, which appeared six years later. Theobald's original prose and verse is of little account, but as a textual critic he possessed rare insight. His one aim was to divine, in a corrupt passage, what Shakespeare wrote, and he made over 300 corrections, which have been generally adopted. Consult Collins, *Essays and Studies* (London, 1895). See POPE, ALEXANDER; DUNCIAD.

THEOBROMINE (from Neo-Lat. *Theobroma*, from Gk. θεός *theos*, god + βρῶμα, *broma*, food), $C_7H_8N_4O_2$. An organic substance chemically allied to uric acid and still more closely related to caffeine (theine). It is found in considerable quantities in chocolate and may be extracted from cacao-nuts. It may also be obtained from the lead salts of xanthin by the action of methyl-iodide. Theobromine is a white crystalline substance sparingly soluble in water and forming crystalline compounds with both acids and bases. Among the compounds of theobromine may be mentioned theobromine-sodio-salicylate, a substance obtained by mixing sodium salicylate with sodium-theobromine, and used in medicine under the name of *diuretin*. Diuretin acts as a diuretic without having any action upon the heart.

THEOC'RITUS (Lat., from Gk. Θεόκριτος, *Theokritos*) (c.310-c.245 B.C.). The first and greatest of the Greek bucolic poets. The details of his life are not clearly known. He was commonly reckoned a Syracusan, although there is reason to believe that Cos may have been his birthplace. In any case, he spent considerable time in that island and Eastern Greece, where he was acquainted with the elegiac poet Philetas and the writer of epigrams Asclepaides, whom tradition makes his teachers, and also with the physician Nicias of Miletus and the poet Aratus of Soli. He spent some time at the Court of Ptolemy Philadelphus in Alexandria and also at the Court of Hiero II. at Syracuse; but the exact dates for these periods cannot be determined, as the chronological order of his poems is uncertain. He appears to have returned later to Eastern Greece, where he met his death. We have current under his name 31 poems and a number of epigrams. Of the longer poems 10 are bucolic, three are mimes in imitation of the mimes of Sophron and very similar to the recently discovered mimes of Herondas, and the other poems are of varying subjects and character, while a few are spurious. Theocritus displayed marvelous power in uniting artistic and popular elements in his verse in a way which has never been equaled by his followers and imitators. His language is, for the most part, a modified Doric; two poems are in the literary Æolic. In spite of the fact that Theocritus lived in an artificial period when scholarship rather than poetic genius flourished, there is still in his work a simplicity, a fidelity, and a love of nature that has given him universal fame. His dramatic and mimetic power was great, so that his peasants, shepherds, reapers, and fishermen have a real existence and are not merely literary creations, as the characters of all his imitators have been. He was imitated by Bion and Moschus among the Greeks, and by Vergil most successfully among the Romans. Important editions are by Ahrens (2 vols., Leipzig, 1855), and especially by Ziegler (Tübingen, 1879). The best edition with commentary is by Fritzsche-Hiller (Leipzig, 1881). There are English editions by Snow (London, 1885) and by Cholmeley (ib., 1901); English translations by Calverley (2d ed., Cambridge, 1869) in verse, and by Andrew Lang (New York, 1880) in prose. Consult also Legrand, *Etude sur Théocrite* (Paris, 1898).

THEODICY (from Gk. θεός, *theos*, god + δίκη, *dikē*, justice). The exposition of the theory of divine providence, and particularly the defense of the goodness and wisdom of God against objections drawn from the existence of pain and sin in the world. The problem is as old as human thinking; the name is modern and dates from the close of the seventeenth century. The first to consider the question in its entire scope was Leibnitz (q.v.) in his *Essais de théodicée* (1710). In England a long list of publications has appeared, principally in reply to the sensational school beginning with Hume and closing with J. S. Mill, who could scarcely maintain the existence of God, and saved His benevolence only at the expense of His omnipotence. In America, where Jonathan Edwards made contributions to the discussion in his famous *Freedom of the Will* (1754), and was followed by Bellamy, *Wisdom of God in the Permission of Sin* (1758); Hopkins, *Sin Through the Divine Interposition an Advantage to the Universe* (1759); and many others, down to N. W. Taylor, whose contribution to the subject may be condensed in the hypothesis that in the best moral system a benevolent God might not be able to prevent sin consistently with the maintenance of the system and the attainment of the highest results therefrom. He thus gave a place to the human will which no theologian of orthodox descent had previously given. Since the appearance of Hegel, the Christian idea of God has met with new objections, and theodicy has been enlarged to consider these, especially by Maret and Gratry in France. The appearance of pessimism in Germany has given a new turn to the argument, since it is no longer possible to assume as undisputed the principle of Leibnitz, that God has chosen the best possible world. And with the appearance of evolution and the Spencerian agnosticism, the argument has turned to the more fundamental matters; so that theodicy has almost disappeared as a distinct department of theology.

THEODOLITE (of uncertain etymology; perhaps from Gk. θεᾶσθαι, *theasthai*, to see +

ὁδός, *hodos*, way + λιτός, *litos*, smooth, even; hardly from Gk. θεᾶσθαι, *theasthai*, to see + δολιχός, *dolichos*, long). An instrument used in surgery especially in geodetic work for the measurement of horizontal and vertical angles. It is larger than the transit and, having larger and more carefully graduated circles, is employed in measuring angles where the highest accuracy is demanded. In its main features it is similar to this instrument, but differs chiefly in that its telescope does not revolve completely or 'transit' in its horizontal axis. The description and illustration under ENGINEERING INSTRUMENTS will convey an idea of its essential characteristics, while reference should also be made to the article GEODESY, where the method of measuring angles is discussed.

THE'ODO'RA (c.508-48). A Byzantine Empress, wife of Justinian. She was the daughter of Acacius, the keeper of the wild beasts at the circus of Constantinople, and after his death was for a time a favorite on the stage and a common prostitute. She fascinated Justinian, nephew of the Emperor Justin I., by her great beauty, and about 525 he married her. Thereafter she led an exemplary domestic life. In 527 Justinian became Emperor, and Theodora henceforth exerted a commanding influence upon public affairs. She was extremely cruel, and her numerous spies ferreted out all who were opposed to their royal mistress. At the time of the Nika Riot (532) she prevented Justinian from fleeing and brought about the suppression of the insurrection. Most of our information concerning Theodora is derived from Procopius's *Anecdota*. Consult: Marrast, *La vie byzantine au VIème siècle* (Paris, 1881); Mallet, "The Empress Theodora," in the *English Historical Review*, vol. ii. (London, 1886); Gibbon, *Decline and Fall of the Roman Empire*, ed. by Bury, vols. iv. and v. (ib., 1898).

THEODORA (?-867). Byzantine Empress. She was born in Paphlagonia and in 829 married the Emperor Theophilus (died 842), whom she succeeded in the government as Regent for her four-year-old son Michael III. While her husband was a violent iconoclast, she was attached to the worship of images, and consequently expelled the iconoclasts from office and recalled the banished image-worshipers. She also convoked the Constantinople synod of 842 which restored the images to the churches, a triumph annually celebrated in the Greek Church by the Sunday of Orthodoxy (the first Sunday in Lent). Her rule was on the whole wise, but some of her wars were unfortunate. When Michael came to the throne in 856 he deprived his mother of her position and she died in a convent.

THEODORA. A member of the Roman nobility, who lived in the tenth century. She was very beautiful, of unknown parentage, wife of the Consul Theophylact. She ruled Rome and controlled the Papacy for a long term of years, calling herself by the title of Senatrix. She was the mother of Marozia and Theodora II., who were equally licentious and unscrupulous. She placed several of her creatures on the Papal chair, among whom John X. may be specially mentioned. Consult Gregorovius, *History of the City of Rome During the Middle Ages*, translated by Hamilton (London, 1895-1902).

THEODORE, King of Abyssinia. See ABYSSINIA.

THEODORE I., King of Corsica. See NEUHOF, THEODOR VON.

THE'ODORE OF MOP'SUES'TIA (c.350-428). The most noted biblical scholar and theologian of the school of Antioch. He was born in Antioch, was educated under the rhetorician Libanius, and studied theology with Diodorus. At the age of thirty-two he was made presbyter of the Antiochian Church, and in 392 he became Bishop of Mopsuestia, a little village in Cilicia, about 40 miles from Tarsus. In fame and influence he surpassed all the other Christian teachers and writers of the East. His biblical scholarship seems almost modern. His commentaries have in many cases perished, but enough remains to show his historical spirit, and the simple, literal method of interpretation which characterized the school of Antioch, as against the mystical, allegorical method of Alexandria. Theodore expounded almost all the books of the Bible. He also wrote on the Incarnation and various other theological topics. Soon after his death, charges of doctrinal error began to be brought against him, yet no word of censure was spoken by the Council of Ephesus (431). He had no doubt favored the Pelagians, and the fact that he had been the teacher of Nestorius was afterwards remembered against him. Opposition to his theology continued and increased until the fifth general council (Constantinople, 553), when he was explicitly condemned, in connection with the 'Three Chapter Controversy.' Yet Theodore remains one of the truly great teachers of the ancient Church, worthy to be compared with Origen, whom he equaled in knowledge of the Bible, and surpassed in soundness of its interpretation. Part of the remains of Theodore's works are printed in Migne, *Patrologia Græca*, vol. lxvi. The Latin version of his commentary on the minor Pauline Epistles has been edited by Swete (Cambridge, 1880-82), and the Syriac version of his commentary on John by Chabot (Paris, 1897). The best general account of Theodore in English is the article by Swete in Smith and Wace's *Dictionary of Christian Biography*, vol. iv. Consult also, Moeller, *History of the Christian Church*, vol. i. (London, 1892); Bardenhewer, *Patrologie* (Freiburg, 1901).

THEODORE OF TAR'SUS (c.602-690). Archbishop of Canterbury. He was born at Tarsus; studied at Athens; became a monk; early distinguished himself as a scholar and was familiar with Greek and Latin literature; was consecrated at Rome as Archbishop of Canterbury by Pope Vitalian and arrived at his see May 27, 669. He did a great work for the Church in England, which at the time of his coming had sunk to a low state. He divided his large dioceses into more manageable ones; appointed worthy bishops; promoted learning and clerical discipline; increased the monasteries; held progressive synods; and so left the Church a compact and enlightened body. See ENGLAND, CHURCH OF.

THEOD'ORET (Gk. Θεοδώρητος, *Theodōrētos*) (c.393-457). A Greek Church historian and biblical scholar. He was born at Antioch, of Christian parents, and studied theology under Theodore of Mopsuestia (q.v.). Theodoret is to be classed with the Antiochian school, as opposed to the Alexandrian. He was rational rather than mystical in his theology, and historical rather than allegorical in his biblical interpretation. He entered the monastic life at Apamea, and was loth to leave his monastery when made Bishop of Cyrus in Syria (423). Theodoret achieved great success in winning back to orthodoxy the survivors of the ancient Marcionites (see Marcion), and in suppressing the use of Tatian's *Diatessaron*, a compilation of the Gospels which had long been current in Syria. (See Tatian.) His connection with the cause of Nestorius (q.v.), which began in his youth, continued until near the close of his life. He stoutly opposed Nestorius's condemnation at Ephesus (431), and denounced the famous 'Anathemas' of Cyril, which had been launched against Nestorius shortly before. His own orthodoxy was seriously questioned, and the 'Robber Synod' (449; see Ephesus, Councils of) deposed him from his see, only, however, to be reinstated by the Council of Chalcedon, two years later. Under great pressure by the Council of Chalcedon, Theodoret was finally prevailed upon to anathematize Nestorius, but he did it with the utmost reluctance, and it is doubtful whether his real opinion was ever changed. About 200 of his letters survive, giving valuable information on the events of his age. Most important perhaps of all his works is the *Ecclesiastical History*, written in continuation of Eusebius, and bringing the narrative down to 428. His *Works* have been several times edited, e.g. by Schultze (Halle, 1769-74), and Migne, *Patrologia Græca*, lxxx.-lxxxiv. An English translation of the *History*, *Dialogues*, and selected *Letters*, with valuable prolegomena, is given in *The Nicene Fathers*, edited by Schaff and Wace, second series, vol. iii. (New York, 1892). Consult: Harnack, *History of Dogma*, vol. iv. (London, 1898); Bright, *Age of the Fathers* (ib., 1903); Schubert-Moeller, *Lehrbuch der Kirchengeschichte* (Tübingen, 1902).

THEOD′ORIC I., King of the Visigoths (419-51). See Goths.

THEODORIC (Lat. *Theodoricus*), surnamed the Great (c.454-526). The founder of the Ostrogothic Kingdom in Italy. He was born on the banks of the Neusiedler See, in Pannonia. His father, Theudemir, was one of the three brothers who on the death of Attila (A.D. 453) freed their nation from the yoke of the Huns, and being the representatives of the royal line of the Amali, exercised a united sovereignty over it. In his eighth year Theodoric was sent as a hostage to the Eastern Emperor and was trained in all kinds of athletic and martial exercises. He returned to his people about 473 and in 474 succeeded his father as head of the nation. In the previous year the Ostrogoths had obtained parts of Mœsia and Dacia, as settlements, from the Emperor Zeno. For the next thirteen years Theodoric was frequently engaged in strife, sometimes against the Empire, sometimes in its service. In 484 he was made consul; in 478 he ravaged Thrace. The Emperor, to free himself from Theodoric, gave him permission to invade Italy, a suggestion gladly adopted by the warlike monarch, who began his march in 488, and arrived in the summer of 489 on the frontiers of Italy. Odoacer (q.v.), King of Italy, the first of the Germanic rulers of that country, was both forewarned and forearmed; and a desperate battle was fought near Aquileia (August 28, 489), the result of which was decidedly to the advantage of the Ostrogoths. A second and more disastrous defeat was inflicted on Odoacer near Verona (September 27th), after which he took refuge in Ravenna; but having again gathered a large force, he was totally routed a third time on the banks of the Adda (August, 490), and again blockaded in Ravenna, while the whole of Italy was being subdued; and having at last surrendered, was treacherously murdered (March, 493). Theodoric now assumed the title of King of Italy, resisted the claim of suzerainty preferred by the Eastern Emperor, and with the exception of a victorious campaign against the Franks, to compel them to cease their assaults on the Visigothic dominions, the suppression of a rebellion in Spain against the authority of the infant monarch, his own grandson Amalric (during whose minority Theodoric administered also the government of the Visigothic kingdom), and an expedition against the robber hordes of the Bulgarians, the whole of his long reign was devoted to the consolidation and development of his new kingdom. His followers received only one-third of the conquered country; the rest was legally secured to the rightful possessors. He made Ravenna his capital, occasionally, when his northern frontier was threatened, removing to Verona.

Theodoric showed no desire of further conquest; cultivated the friendship and esteem of the surrounding nations; ruled all classes of his subjects with irresistible authority, but with corresponding justice and moderation; zealously promoted agriculture and commerce; and, himself an Arian, exhibited a tolerance of all other sects which was then almost unknown. The one great error of his administration consisted in his wholly neglecting to assimilate his Ostrogothic subjects with the previous inhabitants, either by a common code of laws or by common official preferment. Theodoric left no son; but his daughter, Amalasuntha (q.v.), succeeded him as regent for her son, Athalaric. Theodoric became a hero of many Germanic legends under the name of Dietrich of Bern. Among the men who held office under Theodoric were Boëthius and Cassiodorus. The former, who had incurred the suspicions of the monarch toward the close of his reign, was unjustly put to death. Consult: Hodgkin, *Theodoric the Goth* (London and New York, 1893); Gibbon, *Decline and Fall*, vol. iv., ed. by Bury (London and New York, 1898); Hodgkin, *Italy and Her Invaders*, vol. iii. (Oxford, 1885); Dahn, *Die Könige der Germanen*, part iii. (Würzburg, 1866).

THEODORIC, TOMB OF. A structure near Ravenna, Italy, erected about 530 as a mausoleum by Theodoric's daughter. It is now the Church of Santa Maria della Rotonda. The edifice rests on a substructure of ten arches and has a flat dome, 36 feet in diameter, formed of a single block, reputed to weigh 470 tons.

THEODOSIA, thē′ŏ-dō′shĭ-ȧ, or **FEODOSIA.** A seaport of the Crimea. See Kaffa.

THEODOSIUS, thē′ŏ-dō′shĭ-ụs. The name of three Roman emperors.—Theodosius I., surnamed the Great, Emperor from 379 to 395, was of Spanish descent, and was born either at Italica, or more probably at Cauca, near Segovia, about A.D. 346. His father, also named Theodosius, was the great general of the Roman Empire, who, after freeing South Britain from the Caledonians, and annihilating the formidable rebellion of the Moor Firmus, was beheaded at Carthage in 376. Theodosius, who had accompanied his father in his British campaigns, and afterwards, by routing the Sarmatians, saved Mœsia from devastation, retired from active service after his father's murder, and occupied himself with the care of his patrimonial lands in Spain. But on the defeat and death of Valens (q.v.), his colleague, Gratianus (q.v.), feeling his inability to sustain alone the cares of empire, summoned Theodosius from his retirement, invested him with the Imperial purple, and intrusted to him, January 19, 379, the administration of Thrace, Dacia, Macedonia, Egypt, and the East, and especially the protection of the Empire against the Goths. This last charge called for the full exercise of the new Emperor's abilities, for the army at his command dared not face the Goths in the open field. Theodosius found it most prudent to sow jealousy and dissension among them by promises and bribes, and after a four years' so-called campaign, succeeded in pacifying the Visigoths, the Ostrogoths retreating toward Scythia. The latter returned in 386, their ranks swelled by Scythians, but were totally routed in attempting to pass the Danube, and the survivors were transported to Phrygia and Lydia.

In 387 Theodosius undertook to restore to the throne of the Western Empire Valentinian II. (whose sister, Galla, he married), the brother of Gratian, who had been expelled by Maximus; and after a uniformly successful contest, the usurper was captured and put to death at Aquileia (388). In 392 the suspicious death of Valentinian and the elevation of the puppet Eugenius by Arbogastes, the real ruler of the West, again summoned Theodosius to interfere; and after two years of preparation his army gained a complete victory over the army of the West, and the two portions of the Roman Empire were again united under one ruler. The union, however, lasted only four months, owing to the death of Theodosius, January 17, 395. Theodosius, though a professor of the orthodox Christian faith, was not baptized till 380, and his behavior after that period stamps him as one of the most cruel and vindictive persecutors who ever wore the purple. His humiliation before Saint Ambrose, Bishop of Milan, for the massacre at Thessalonica, was regarded by the Church as one of its greatest victories over the temporal power. See Ambrose.

Theodosius II., Emperor of the East from 408 to 450, was the only son and successor of Arcadius (q.v.). He was but seven years old when he ascended the throne. The chief events of his reign were the invasion of the Empire by the Huns under Attila, a war with Persia, renewed efforts to extirpate paganism, and the compilation of the *Codex Theodosianus*. See Code.—Theodosius III. was an unimportant Byzantine Emperor (A.D. 716-717), who abdicated after a few months' reign.

THEODOSIUS, Arch of. A triumphal arch at Rome, erected in A.D. 405 at the approach to the Pons Vaticanus, in honor of the three emperors Arcadius, Honorius, and Theodosius, in commemoration of their destruction of the Goths.

THEOG'NIS (Lat., from Gk. Θέογνις) (6th century B.C.). A Greek elegiac poet, born at Nisæan Megara. During the conflict in his native city between the aristocratic and democratic parties, in which he took the side of the aristocrats, he lost his estate and was reduced to poverty and driven into exile. He appears to have visited Sicily, Bœotia, Eubœa, and Sparta, and later, apparently under changed conditions, he returned to his native city. Theognis is the only elegiac poet whose works have come down to us in anything like complete condition. We possess under his name 1389 verses in two books which set forth the political belief and ideals of the Dorian oligarchs. The work is fragmentary and has suffered largely from interpolations. The genuine remains of his work are valuable evidence as to the state of political parties and social conditions in the sixth century. The fragments are edited by Bergk in his *Poetæ Lyrici Græci* (4th ed., Leipzig, 1882); by Ziegler (2d ed., Tübingen, 1880); by Sitzler (Heidelberg, 1880); and by Hartmann in his *Studies in Theognis* (Cambridge, 1902).

THEOGONY (Lat. *theogonia*, from Gk. θεογονία, generation of the gods, from θεός, *theos*, god + -γονία, *-gonia*, generation, from γόνος, *gonos*, seed). A genealogy of the gods. The earliest theogonies among the Greeks were that of the epic cycle, of unknown authorship, now lost, and the extant work of Hesiod. According to Pausanias, the poems of Onomacritus, who lived at the close of the sixth century B.C., belonged to this class. The Orphic theogony, which had a great influence among the Neo-Platonists, was composed at a late period, although it may have embodied much of the earlier Orphic doctrine. See Hesiod.

THEOLOGICAL EDUCATION. The system of training in theology, with special reference to professional preparation for the work of the ministry. It will naturally have to be considered under two main heads, owing to fundamental differences in the point of view.

THE CATHOLIC SYSTEM.

The older system of theological education, that prevailing in Catholic institutions, is the result of a gradual historical development from the beginning of the Church. Although the aim and ideal have remained unchanged, the matter has broadened and the lines widened and deepened in response to the demands on the Church's organic activity. The training of the subject, the man, has ever been its first and most important function—consisting in the assimilating of his mind to the object matter of the theological disciplines and of his conduct to the ideal of the priestly vocation. The first thologians were educated and instructed in the school of Christ. They in turn handed on to their disciples what they had received from their master. Its matter was the Bible, the Old and New Testament, the latter especially, with the oral interpretation gathered and treasured from the instructions of Jesus. The form was simple, unsystematic, adapted to the synthetic soul rather than the analytic mind. Both aspects—the matter and the form—are indicated with sufficient detail to enable one to estimate their character in the letter of Saint Paul to Titus and his two letters to Timothy. Contact with Judaism developed a somewhat more definite exegesis, and conflict with paganism a direct apologetic. The necessity of defining and defending the explicit content of revelation resulted in a gradual growth of dogmatics, with a well-marked branch of polemics, while the bearings of the new religious-moral truths on the growing complexities of life in the world and the cloister necessitated an unfolding of moral and ascetical theology. Eusebius in the meantime had founded ecclesiastical history, and with the Decretists and the Decretalists canon law received an organic shape. After the collapse of the Roman Empire educational activity, theological as well as secular, was practically confined to the monasteries, and was limited to the conserving of the materials inherited from the past.

Throughout the Middle Ages the various branches of the theological curriculum became more systematic and coördinated. Biblical study was emphasized, though principal attention was given to the philosophico-theological systematization of the speculative content of religious faith and to the motives, faculties, and laws of moral and religious conduct. Historical and critical studies were, however, but slightly and superficially cultivated.

A great change begins with the rise of the Humanists and the Reformation, followed by the opposite reform instituted by the Council of Trent. Progress lay principally in the circle of biblical and historical studies. Exegesis was pursued with great zeal, and the study of the Bible centred mainly on historico-critical questions. The founder of isagogics as a special discipline was Richard Simon, and in the second half of the eighteenth century, in which, besides, the division of theology into separate departments was completed, it was marked off against the rest of biblical science. In Church history, reëstablished by Baronius (1607), the auxiliary sciences attained chiefly through the Benedictines of Saint Maur their form and demarcation: patrology, archæology, and chronology. In criticism of sources Mabillon (1707), in the study of the Catacombs Bosio (1639), in hagiography Bollandus (1665), were most prominent. Besides these Petavius (1652) and Thomassin (1695) established scientifically the history of dogma, which since the latter half of the eighteenth century has been independent. In systematic theology, moral theology, which had made great advance, separated definitely from dogmatic and was raised to an independent discipline. Casuistry received particular interest and care. In dogmatics Melchior Cano (1560) created by his *Loci Theologici* the science of theological noetics, to which Stapleton (*De Principiis Fidei Doctrinæ*) gave scientific finish. In post-Tridentine dogmatics, polemics took a broad and important place. To it men like Bellarmine, Suarez, and Soto devoted their best powers. Mystics and ascetics, earnestly cultivated even in patristic times (their founder was the Pseudo-Dionysius), were greatly developed, but attained no independent position. They remained, like casuistics, in connection with and in the service of moral theology. Thus the theological cycle was, at the close of the sixteenth century, divided into the following departments: Biblical science (undivided), Church history, dogmatics, moral and canon law. The differentiation of the other theological disciplines was accomplished only in the second half of the eighteenth century. The latest to appear as a separate branch was pastoral theology, in Germany, with the erection of a special chair for its teaching under Maria Theresa. Later on it divided into three departments: homiletics, liturgics, and the theory of the pastoral life. Apologetics, as fundamental theology, though zealously cultivated for centuries, separated from dogmatics only in the nineteenth century.

The actual curriculum of the ecclesiastical, or, as it is usually called, the diocesan seminary, in which the system of theological education is imparted, dates in its present organization from the Council of Trent, but, like the system itself, is the outcome of a gradual historical growth. In the early centuries theological education was received partly at central catechetical schools (e.g. at Alexandria and Antioch), but chiefly at the bishop's residence and under his guidance and spirit. The episcopal school was afterwards supplemented by the monastic institutions and the schools established by Charlemagne. These in turn were succeeded by the great mediæval universities and the *collegia* attached thereto. The growing laxity of discipline at these institutions induced the Council of Trent to establish the present seminary system, which since then has gradually become universal throughout the Church. The purpose of these institutions, one or more of which exist in almost every diocese or ecclesiastical province, is primarily a moral one; the training of the person, the forming of the youth, by strict discipline and the practices of religion, to habits of self-control and to the shaping of his life in harmony with the priestly ideal. The graded course of study pursued in them averages from ten to twelve years, divided into three distinct but closely connected stages: the preparatory, the philosophical, and the strictly theological, to which the first two are subordinate. In the preparatory department the usual college studies are pursued, though special importance is placed on Latin. As this language is the vehicle of most of the subsequent studies—text-book and lecture being usually in Latin—the student passing from the preparatory seminary is required to have an easy reading familiarity and a fair speaking facility in the language. The two years of philosophy are devoted to logic, psychology, metaphysics, and ethics (including sociology), the physical sciences, Hebrew, and Greek. The theological curriculum of four years is organized on the following lines:

I. *Theology in Its Unity* (*Synthesis*).—(1) The theologian: His ideal, moral, and intellectual equipment; preparatory training in languages, philosophy, history, natural sciences, and arts. (2) Nature, origin, and classification of religion. (3) Relation of theology to religion. (4) Object, nature, relations (to reason and faith), and history of theological science.

II. *Departments of Theology* (*Analysis*).—A. *Historical.*—(1) The Bible, criticism, exegesis. (2) Biblical theology: (a) history of the Old and New Testament; (b) their general doctrinal contents; (c) aids to study: biblical philology, archæology, hermeneutics. (3) Church history (1) scope, methods, epochs; (2) divisions: (a) patrology; (b) symbolism; (c) ecclesiastical archæology and art; (d) auxiliary disciplines: geography and statistics, ecclesiastical chronology, and philology.

B. *Systematic Theology.*—(1) Apologetics; (2) dogmatics, relation to morals; (3) moral theology (Christian ethics).

C. *Practical Theology.*—(1) The Christian pastorate as a continuation of Christ's ministry in its several departments, magisterial, sacerdotal, gubernatorial. (2) Divisions: catechetics: pastoral didactics; the instruction of children. (3) Homiletics: theory of sacred eloquence. (4) Liturgy. (5) Theory of the relations of pastor and people.

D. *Canon Law.*—Science of ecclesiastical discipline.

In some minor details the foregoing programme will vary according to local convenience. On the whole, however, the course as outlined is followed in every ecclesiastical seminary. As at each successive stage in the Church's history special care was devoted to one or other of the theological branches in answer to external and internal exigencies, so, too, at the present day. In the philosophical department empirical psychology, epistemology, and sociology are absorbing more interest and are being pursued in a more historical light and a more critical spirit than was the case a generation ago. The same is true of biblical studies, ecclesiastical history, and apologetics within the theological domain.

From the foregoing account it will be readily inferred that the question of 'reconstructing theology,' which has of late been engrossing many minds outside the Catholic Church, has no meaning in connection with the system of theological education within her pale. The primary principles of that system are the 'articles of faith' contained within the deposit of revealed truth, which, together with the assurance of inerrancy in discerning, formulating, and interpreting them, she claims to have received from her Founder. In the exercise of the logical faculty developing those principles and coördinating the conclusions into a systematic body of theological science, in the work of the critical faculty within the domains of biblical, historical, and scientific studies, she recognizes the fullest rights of human reason, provided it does not usurp the license of transgressing the ascertained manifestations of the divine reason.

Bibliography. The best work in English is Hogan's *Clerical Studies* (Boston, 1898). Kihn's *Encyklopädie und Methodologie der Theologie* (Freiburg, 1892) is profound, erudite, and rich in bibliography. Krieg's *Encyklopädie der Theologischen Wissenschaften* (ib., 1899) has the same qualities, but is more compendious. Consult also: Didiot, *Cours de théologie catholique* (Paris, 1894); Aubry, *Idées sur la théorie catholique des sciences et sur la synthèse des connaissances humaines dans la théologie;* id., *Les grands séminaires en France* (Paris, 1894); Wilhelm and Scannell, *Manual of Catholic Theology*, based on Scheeben's *Dogmatik;* and Hunter, *Outlines of Dogmatic Theology* (London, and New York, 1890).

THE PROTESTANT SYSTEM.

The great leaders of the Protestant Reformation insisted upon the necessity of higher education for the clergy at the universities. This was natural, as they believed in an established Church supported by the State, and strongly emphasized the duty of its ministers to inculcate sound doctrine, which necessitates special theological training. The Baptist thinkers, who contended for freedom of conscience, liberty of prophesying, and complete separation of Church and State, put the emphasis so strongly upon experience and conduct as to make doctrinal agreement a matter of secondary importance, and the education of a special clerical class seem undesirable. It was fortunate that the prevailing tendencies made a home for Protestant theology at the great centres of intellectual life. The theological curriculum at the universities was changed in several respects, particularly by the greater attention given to the biblical studies, the importance attached to the Hebrew and Greek texts, and the more or less determined abandonment of the allegorical method of interpretation. Other Lutheran universities modeled their course upon that prescribed by Luther and Melanchthon at Wittenberg. Between 1529 and 1563 this system was introduced at Marburg, Tübingen, Leipzig, Königsberg, Greifswald, Heidelberg, Jena, Rostock, Upsala, and Copenhagen. Similar courses of theological study were established by Beza at Lausanne, by Calvin at Geneva, and theological schools at Nîmes, Sedan, Saumur, and Montauban followed the same methods. In Holland the University of Leyden (founded 1575) became the centre of Protestant theology. The Free Church in Scotland established three divinity halls at Edinburgh, Aberdeen, and Glasgow, and the theological education at the Universities of Saint Andrews, Aberdeen, and Glasgow was likewise modified in character. Cambridge, under the teachings of Erasmus, Tyndale, and Latimer, became the foremost exponent of the new theological as well as humanistic teaching, and Vermigli at Oxford expounded Protestant principles of exegesis.

If the theological education of the Reformation period was chiefly characterized by the greater attention paid to the Bible, and a certain movement of thought away from Catholic dogma, its most marked peculiarity in the immediately succeeding period was the inculcation of Protestant dogma, on which a growing emphasis was placed. In Germany the type of teaching represented by Flacius proved more acceptable than that of Melanchthon and his followers, and Calovius bore off the victory over Calixtus and the Helmstedt school. The greatest service rendered by Flacius was the attention he and the other Madgeburg Centuriators paid to the history of the Church. New centres of theological study were created at Giessen, Kiel, Dorpat, Lund, Gröningen, and Utrecht. In Holland the orthodox tendencies prevailing at the Synod of Dort were offset by the influence of Scaliger and Grotius. In the French schools Cameron, Amyrault, and Louis Cappel maintained a more liberal type of thought. The expatriation of the Huguenots left only Montauban as a Protestant school. In England the theological education was less affected by exaggerated doctrine concerning the Bible than was the case in Germany, Switzerland, and Holland. The colonies were long supplied by ministers who had had their training in European universities. A professorship in divinity was established at Harvard in 1638, and a similar provision was made at Yale in 1740.

A new direction was given to theological education by the Pietist movement. At Halle a university was founded in 1694, where it was possible for Spener and Francke to exemplify their principles. They maintained that the Christian minister must himself have a profound religious experience, that he should not be bound by an oath to teach in accordance with man-made creeds, but that he should proclaim the word of God contained in the Scriptures. The influence of English Quakerism with its doctrine of the inner light and its protest against a hireling ministry is unmistakable. In the *seminarium ministerii ecclesiastici* established at Halle in 1714 Francke endeavored to give to converted men desirous to serve as preachers such a knowledge of the Bible and such an acquaintance with the practical duties of the pastor as to fit them to be true spiritual leaders. While the demand for a spiritual crisis rather than a normal growth of religious experience could not be carried out in a State Church and had a tendency to foster self-deception, the break with dogmatism and the centring of interest upon the practical aspect of the ministry, the training of the man rather than the elaboration of his doctrine, bore permanent results. The appeal to Christian consciousness and the disregard for the letter led to biblical criticism, as is seen in Dippel, Edelmann, Michaelis, Zinzendorf, and Semler, and a new estimate of the history of the Church, doing more justice to the heretical bodies, was introduced by Gottfried Arnold.

At the English universities rationalism exercised a greater influence than pietism. This was largely the result of the zealous cultivation of natural science. The idea that revelation itself is to stand or fall by the test of reason was accepted by the apologists as well as by the Deists, by Lardner and Paley not less than by Collins and Toland. From England this rationalistic movement spread to the Continent. In the school of the Remonstrants at Amsterdam, Le Clerc expounded to theological students the principles of Collins and Locke. Göttingen was established in 1737, largely to serve as a bulwark against supernaturalism, and other centres of rationalism were Jena, Helmstedt, and Heidelberg. Theological students came under the influence not only of Eichhorn, Paulus, and Henke, but also of such men as Reimarus and Lessing, Herder and Goethe, Kant and Fichte. If the effect of pietism upon theological education was that much stress was laid upon the conscious experience of an inner change, and the nourishment of religious emotion, rationalism put the emphasis upon the reasonableness of true religion and the supremacy of morality.

During the nineteenth century certain important changes occurred. A large number of schools grew up in Europe and America. In Germany the most important additions were the Universities of Berlin (1810), Bonn (1818), and Strassburg (reorganized 1871). In Switzerland schools unsupported by the State have been established at Geneva, Lausanne, Neuchâtel, Basel, Bern, and Zurich, and State universities teaching theology at Fribourg and Neuchâtel. In France the theological faculty of the University of Strassburg was removed to Paris in 1877, and the Ecole des Hautes Etudes was founded in 1868. The University of Amsterdam was established in 1877, and universities were founded in Christiania in 1813, and Helsingfors in 1827. Besides Oxford, Cambridge, and Durham, the Church of England has twenty-three theological schools, the English Methodists ten, the Congregationalists eleven, the Baptists nine, the Presbyterians three, the Unitarians one, and two are undenominational. Except the Dutch Reformed Seminary at New Brunswick, N. J. (1784), and the United Presbyterian Seminary at Xenia, Ohio (1794), all Protestant schools of theology in the United States have been founded in the nineteenth century. They number about 120. When the large extent of territory, the numerous denominations, and the special needs of the colored and the foreign churches are considered, the number is not excessive. Concerning many of them, however, it must be said that they are very inadequately equipped, both as to teaching force and library facilities, and they do not represent a high grade of scholarship. Some of these are connected with universities. Many are located in or near important educational centres. The course is generally three years in length, and a collegiate training is as a rule required for admission.

A tendency to seek independence of educational control is characteristic of the period. In Germany, Switzerland, Holland, and France the principle of academic freedom has won general recognition. Berlin at the outset repudiated all attachment to any particular creed or school. While pressure is often brought to bear in the matter of appointments, the tradition of a German university is generally the determining feature. In Holland the relations between pulpit and chair are more cordial. In England and Scotland freedom of investigation is now generally granted to the biblical teachers. All higher institutions of learning in the United States were for a long time either founded by religious bodies or privately endowed. The former were naturally controlled by the denominations supporting them; the latter either give no theological instruction or are affiliated with some ecclesiastical organization. Theology is not taught in any of the State universities founded in the latter part of the century. But as it is widely felt that the various disciplines that enter into the theological curriculum have a universal human interest, and should be studied in an atmosphere of scientific research and free from ecclesiastical dictation, many of them have found a way into such universities as Johns Hopkins, Cornell, Columbia, Pennsylvania, Michigan, California, and others. Harvard by making its school undenominational has taken an important step in this direction.

The most significant change in theological education during the century was the general introduction of historico-critical methods of investigation. In the interpretation of Hebrew and early Christian literature, and the study of Church history, German theological teachers have been the chief leaders; but, owing to the relations of the faculties to the Christian State as well as to the Church, no provision is yet made in any German university for the comparative study of the religions of mankind. Paris offers the amplest facilities for such study, but Leyden and Amsterdam also pay considerable attention to it. Critical methods prevail in Old Testament exegesis in Great Britain and America, as well as in the European universities. There is less consistency in their application to New Testament exegesis. The treatment of ecclesiastical history is characterized by increasing fairness and objectivity. While many contributions have been made to dogmatics by theological teachers, the acceptance of the results of criticism has tended to render impossible the old type of systematic theology. In so far as it concerned itself with the Bible and the creeds, biblical theology, embracing the religious views of the biblical writers and the history and philosophy of Christian dogma, has taken its place. In so far as it attempted to bring all truth into one system, it can survive only as comparative theology studies all the religious phenomena of man's life. For this there is no adequate provision in any theological school in the English-speaking world, though at some universities there are chairs for the history and philosophy of religion. The introduction of such a course is likely to cause a profound change not only in the theological curriculum, but in the spirit of theological study. Consult: K. A. Schmid, *Geschichte der Erziehung* (Stuttgart, 1884-92); K. Schmidt, *Geschichte der Erziehung* (Köthen, 1876); W. Lexis, *Die deutschen Universitäten* (Berlin, 1893).

THEOLOGICAL SEMINARY OF THE REFORMED CHURCH IN AMERICA. A divinity school at New Brunswick, N. J., organized in 1784. Its classes were held in New York City until 1796, and at Flatbush, L. I., till 1810, when it was removed to its present home. The seminary is under the direct control of the General Synod of the Reformed Church. Its theology is in sympathy with the moderate Calvinism of the Reformed Church standards. The school has a well-equipped dormitory, Peter Hertzog Hall; a capacious building, James Suydam Hall, devoted to lecture rooms, museums, and gymnasium; a fireproof library in the Gardner A. Sage building, containing in 1903 over 47,000 volumes; and six dwelling houses for professors. In 1903 its endowment was $473,000, and the attendance was 27, with a faculty of six instructors.

THEOLOGY (Lat *theologia*, from Gk. *θεολογία*, a speaking concerning God, from *θεός*, *theos*, god + *-λογία*, *-logia*, account, from *λέγειν*, *legein*, to say). A term which, in the larger sense, may be used as equivalent to the science of religion, and will then include all the various theological disciplines, the sacred languages, and the interpretation of the Bible; the history of the Church, including the history of doctrine; the history of religions in general; the contributions of our own age to the knowledge of the objects of theological study from other sciences, such as biology; systematic theology, or the system of doctrines and duties; and, finally, practical theology, or the application of theology to life, in the pulpit, in Church administration, and in the various forms of contact with the world. But more strictly and correctly, the term theology is employed of systematic theology, which may be defined as the science of Christianity, or the scientific explanation of the specific Christian life, the development of its characteristic principles, conditions, and general relations. Viewed thus it yields a system of doctrines and a system of duties, or dogmatics and ethics.

The claim of theology to be a science depends upon the question whether there are any peculiar facts of which it takes cognizance, as it professes, and whether its method is calculated to yield reliable knowledge. As to the facts, these are not tangible facts, and if tangibility is made the criterion of reality, as is done by some writers, the case is closed against theology. But Christians claim for themselves great facts of spiritual experience, which are matters of consciousness and thus belong in the same category as the facts of psychology. And if once the inspiration of the Bible is reached by processes of reasoning which are valid and hence yield true, though not tangible results, the teachings of this book form a body of objective facts which are capable of scientific treatment, and indeed demand it. Modern theology has largely followed the method which is as valid in theology as in chemistry or biology, though some theologies have been and some still are *a priori*.

Formerly a sharp distinction was drawn between natural and revealed theology. The former embraced those doctrines as to God, freedom, and immortality which could be reached without the aid of revelation, and upon them was built the proof of the Bible as a revelation from God, and consequently the system of revealed theology, which was then conceived as exclusively the scientific interpretation of the Bible. But with the increasing evidence that even the first doctrines of natural theology, such as the existence of God, have been historically dependent upon revelation, and that the doctrines of revealed theology have their confirmation in facts drawn from other sources than the Bible, the sharp line between the two departments has been largely erased. Natural theology is now replaced by apologetics, the business of which is to defend the doctrines developed by systematic theology.

Many of the special topics of theology will be found treated in separate articles. See also such articles as DEVELOPMENT OF DOCTRINE; GERMAN THEOLOGY; THEOLOGICAL EDUCATION. No attempt can be made here to give an adequate selection from the literature in all departments. Mention may be made of the histories of doctrine, such as Hagenbach (Leipzig, 1840; 12th ed. 1889; Eng. trans., Edinburgh, 1846, revised and enlarged, New York, 1861); Baur (Stuttgart, 1847; 3d ed. 1867); Neander (Berlin, 1857; Eng. trans., London, 1858); Schmid (Nördlingen, 1860; 4th ed. 1887); Dorner (*Geschichte der protestantische Theologie*, Munich, 1867; Eng. trans., Edinburgh, 1871; *System der christlichen Glaubenslehre*, Berlin, 1879-81; 2d ed. 1886-88); Thomasius (Erlangen, 1874-76; 2d ed. 1886-89); Werner (Munich, 1889); Loofs (Halle, 1889; 3d ed. 1893); Harnack (Freiburg, 1889; 3d ed. 1898; Eng. trans., Boston, 1895-97). The histories of doctrine of Shedd (New York, 1869), Sheldon (ib., 1886), and Fisher (ib., 1896) are brief manuals by American writers. Charles Hodge, *Systematic Theology* (New York, 1872), presents the Calvinistic system. Watson, *Theological Institutes* (London, 1822-28; 8th ed. 1850), is a standard

Methodist work. The *Systematic Theology* of A. H. Strong (Rochester, 1886) is by a Baptist. Percival, *Digest of Theology* (Philadelphia, 1892), and Mortimer, *Catholic Faith and Practice* (London, 1901), are scholarly presentations of the High Church Anglican view of the teaching of the undivided Church. Treatises from the point of view of the different religious denominations will be found mentioned in many of the articles upon the various religious bodies. The standard encyclopædic works are the Herzog *Realencyklopädie* (2d ed., 18 vols., Leipzig. 1877-88; 3d ed., by Hauck, 1896 et seq.), and (Roman Catholic) Wetzer and Welte, *Kirchenlexikon* (12 vols., Freiburg, 1882-1901).

THE'ON (Lat., from Gk. Θέων) **OF ALEXANDRIA** (c.370 A.D.). One of the last of the Greek mathematicians and astronomers. He was a teacher at Alexandria and the father of the celebrated Hypatia (q.v.), whose name is also connected with the history of mathematical science. Theon's chief works are an edition of Euclid's *Elements* and a commentary on Ptolemy's *Almagest*. The former was prepared for his students at Alexandria and the various manuscripts have played an important rôle in all subsequent attempts to reproduce the *Elements*. The latter is especially valuable for its notes showing the use of sexagesimal fractions, and the operations of division and square root.

THEON OF SMYRNA, smēr'nȧ (c.100 A.D). A Greek mathematician and astronomer. He was the author of a work, commonly known as the *Expositio*, treating of mathematical rules necessary for the study of Plato. Two books of this work, probably the whole of it, are extant, one on arithmetic and the other on astronomy. The work contains two propositions on the theory of numbers of peculiar interest: (1) If n be any number, n^2 or n^2-1 is divisible by 3 or 4 or both. If n^2 is divisible by 3 and not by 4, n^2-1 is divisible by 4. (2) If two groups of numbers be arranged as follows:

$$\begin{array}{ll}
n_1 = 1 + 0 & d_1 = 1 + 0 = 1 \\
n_2 = 1 + 1 & d_2 = 2 + 1 = 3 \\
n_3 = 2 + 3 & d_3 = 4 + 3 = 7 \\
n_4 = 5 + 7 & d_4 = 10 + 7 = 17 \\
\cdots\cdots\cdots & \cdots\cdots\cdots\cdots\cdots \\
\cdots\cdots\cdots & \cdots\cdots\cdots\cdots\cdots \\
n_r = n_{r-1} + d_{r-1} & d_r = 2n_{r-1} + d_{r-1},
\end{array}$$

then d^2 is of the form $2n^2 \pm 1$; e.g. $d_1^2 = 1 = 2 \cdot n_1^2 - 1$, $d_2^2 = 9 = 2 \cdot n_2^2 + 1$. Theon called these numbers *diameters*. It is interesting to observe that the ratios

$$\frac{d_1}{n_1} = 1, \frac{d_2}{n_2} = \frac{3}{2}, \frac{d_3}{n_3} = \frac{7}{5}, \text{-----}$$

are the convergents of the continued fraction

$$1 + \frac{1}{2} + \frac{1}{2} + \frac{1}{2}, \text{---}$$

and hence approximate the value of $\sqrt{2}$, also that these diameters are solutions of a pair of indeterminate quadratic equations, relations unknown to Theon.

THEOPH'ANO (c.955-91). The wife of Otho II. of the Holy Roman Empire. She was the daughter of the Byzantine Emperor Romanos II., and was married to Otho II. at Rome in 972. She was a woman of great beauty and noble character and soon won great influence over the Emperor, in whose Court she introduced much of the learning and refinement of Constantinople. After the death of her husband (983) she ruled as Regent for her son Otho III. till her death.

THEOPHANY (ML. *theophania*, *theofania*, from Gk. θεοφάνια, *theophania*, θεοφάνεια, *theophaneia*, manifestation of a divinity, from θεός, *theos*, god + φαίνεσθαι, *phainesthai*, to appear). An appearance of gods, or of God, to men. In the heathen religions theophanies under various forms were regarded as of frequent occurrence. In Christianity the term has sometimes been applied to the appearance of God in Christ, in distinction from the *epiphany*, which was the appearance in the form of a dove, and the audible communication of God, at the baptism of Jesus (Mark i. 9-11 and parallels). It is now generally restricted to the appearances of God as related in the Old Testament. They are presented in many ways as simple historical occurrences, often without suggestion as to the manner, sometimes as in the form of man, sometimes as the 'angel of Jehovah.'

THEOPHILANTHROPISTS (from Gk. θεός, *theos*, god + φιλανθρωπία, *philanthrōpia*, love to man, from φίλος, *philos*, dear + ἄνθρωπος, *anthrōpos*, man). A sect which arose in France under the Directory, held its first meeting on January 15, 1797, and was dissolved by Napoleon in 1802. They reduced all religion to the doctrines of God and immortality and the principles of morality resulting from these. They established regular divine service, which had its liturgy, its prayer and hymn book, and its preachers. They received from the Directory ten churches in Paris for their assemblies, and spread somewhat throughout the country. Their spirit and purpose may be seen from their creed: "We believe in the existence of God and the immortality of the soul. Pray to God, love your brother, make yourself useful to your country. The good is everything that serves to support and perfect man, the evil what has a tendency to corrupt and debase him. Children, honor your fathers and mothers, obey with loyalty, support their age; fathers and mothers, instruct your children. Wives, behold in your husbands the heads of your houses, and make one another happy." Thomas Paine was a member of the sect. Their literary productions were printed at Basel (2 vols., 1797-99). Consult Grégoire, *Histoire des sectes religieuses*, vol. i. (Paris, 1828).

THEOPH'ILUS (Lat., from Gk. Θεόφιλος). The person to whom the author of the third Gospel and the Acts addressed these works. He is spoken of in terms of highest respect, as 'most excellent.' The notices (Luke i. 1-4, Acts i. 1) imply that he was a man of some standing, the friend, if not the patron, of the evangelist, and a convert to Christianity, who would be interested in a full and accurate account of its beginnings. Beyond these notices nothing is known of him. Early Christian tradition is silent concerning him. Later conjectures, ancient and modern, are more interesting than convincing. Some, following a hint by Origen, have conjectured that the term is used by Luke in a fictitious sense, since all Christians are *theophiloi* (lovers or friends of God). Ramsay (*Saint Paul the Traveller and the Roman Citizen*, p. 388) thinks that the term 'most excellent' implies that Theophilus was an officer of equestrian rank. Antioch, Rome, Greece, and Alexandria have all been advocated as his place of residence.

THEOPHILUS. One of the most important precursors of Dr. Faust. The facts appear to be that in the sixth century there was a Theophilus who was treasurer of the church at Adana, near Tarsus, in Cilicia Secunda. He was elected bishop, but refused the honor, out of humility. The new bishop removed him from his office. Later he adopted heretical views, but on repentance was forgiven and restored. These facts were embellished by later story-tellers, until the legend arose that after his deposition he had recourse to a Jew magician, who took him to a midnight meeting of devils. But he was soon overtaken with remorse, and, through forty days' fasting and prayers, prevailed on Mary to intercede with her son for him. Then he made a public confession of his crime, told of the goodness of the Virgin Mary, and died three days after. This legend, whose origin is traced back to an unknown Greek of the name of Eutychianus, was brought, during the tenth century, to the West, where it quickly spread far and wide. It was made the subject of poems and dramas in many languages, and frequent allusions to it are found in Latin, German, Anglo-Saxon, Icelandic, Swedish, French, and Spanish literature.

THE'OPHRAS'TUS (Lat., from Gk. Θεόφραστος) (c.372-287 B.C.). A Greek philosopher, born at Eresus, in Lesbos. He studied philosophy at Athens, first under Plato and subsequently under Aristotle, who at his death made him head of the Peripatetic School, which he directed for thirty-five years, 322-287. Under his leadership the character of the school was well maintained; it had a large number of pupils, and enjoyed a high reputation at home and abroad. In philosophy he followed closely in the footsteps of his master, but was more inclined to natural history than to metaphysics. His discourses on ethics were greatly admired, but his chief renown was gained by his botanical works. Two of these, his *History of Plants*, in nine books, and his *Theoretical Botany*, in six, are still extant, together with fragments of his work *On Mineralogy* (Περὶ λίθων), *On Fire* (Περὶ πυρός), *On the Senses* (Περὶ αἰσθησέων καὶ αἰσθητῶν), *Metaphysics* (Μεταφυσικά), and other similar subjects. Especially famous is his book of sketches called *Characters* (Χαρακτῆρες). They have been extremely popular and have been imitated many times, especially by the French and English of the eighteenth century. The best complete editions of his works are by Schneider (Leipzig, 1818) and by Wimmer (Paris, 1866). The *Characters* have been many times edited separately. Especially famous is the edition by Casaubon with commentary (Leyden, 1592); edited also by Ussing (Copenhagen, 1868), by Jebb (London, 1870), and with translation and commentary by the Leipzig Philological Society (1897).

THEOPH'YLACT (Gk. Θεοφύλακτος, *Theophylaktos*) (died c.1107). A Bible commentator, born probably at Constantinople. He became tutor to Constantinus Porphyrogenitus, son of Michael VII. In 1078 Theophylact was made Archbishop of Achrida and Metropolitan of Bulgaria. He labored diligently to extend Christianity, but was hindered by the half-civilized people of his diocese, and vainly endeavored to lay down the duties of his office. He wrote valuable commentaries on the minor prophets and on the greater part of the New Testament. In addition he wrote 75 epistles and a number of tracts. His commentaries are founded on those of Chrysostom (q.v.). His exegesis is direct, precise, and textual in its treatment. His works were much esteemed by later writers. Maria de Rubeis published his works in Latin and Greek at Venice in 4 folio volumes (1754-63).

THE'OPOM'PUS (Lat., from Gk. Θεόπομπος) **OF CHIOS** (c.378-c.300 B.C.). A Greek historian. In early life he left home with his father, who was banished on account of his predilection for the Spartans, and took refuge in Athens. There he was trained in oratory by Isocrates. In addition to numerous panegyrics, of which that on Mausolus was the most celebrated, his works included Ελληνικαὶ ἱστορίαι or Σύνταξις 'Ελληνικῶν, a *History of Greece* in twelve books, embracing the period from B.C. 411, where Thucydides breaks off, to the battle of Cnidus, in 394; and Φιλιππικά in fifty-eight books, a history of the life and times of Philip of Macedon. Of these works only fragments remain, but an abridgment of the Latin translation of the Θιλιππικά, by Trogus Pompeius, has been preserved by Justin. Though the ancient critics commend his accuracy, they blame Theopompus for the harshness and illiberality of his remarks. This, however, was due to his fearless exposition of the corruption among the politicians of his day. According to Pliny, he was the first Greek writer to make any definite mention of Rome. For the fragments, consult Müller, *Fragmenta Historiorum Græcorum* (Paris, 1841); Bünger, *Theopompea* (Strassburg, 1874).

THEOR'BO (It. *tiorbo*, of unknown etymology). An obsolete musical instrument of the lute family, of which it formed the bass. Besides having strings running over the fingerboard, it had a number of bass strings stretched alongside of the board. These strings were longer and were fastened in a separate neck attached to the neck containing the strings stopped by the fingers. The theorbo was an indispensable instrument in the orchestra of the seventeenth century and was especially used for accompanying the voice. For illustration, see Plate of MUSICAL INSTRUMENTS.

THEOREM (Lat. *theorema*, from Gk. θεώρημα, sight, principle considered, rule, theorem, from θεωρεῖν, *theōrein*, to view, from θεωρός, *theōros*, spectator, from θεᾶσθαι, *theasthai*, to view, behold). In mathematics, a proposition to be demonstrated. A theorem consists of two parts: the *hypothesis*, or the given, and the *conclusion*, or what is to be proved. One theorem is the *converse* of another when the conclusion and the hypothesis are interchanged in the two theorems. The converse of a theorem is, however, not necessarily true. A *corollary* (q.v.) of a theorem is a truth easily deduced from it and not requiring a separate demonstration. A lemma (q.v.) is generally a theorem used to prepare the way for another.

THEOSOPHICAL SOCIETY. A society founded by Helena Petrovna Blavatsky (q.v.) in New York, November 17, 1875, assisted by

Colonel Henry S. Olcott, William Q. Judge, and others. Its objects were: (1) To form the nucleus of a universal brotherhood of humanity; (2) to study and make known the ancient religions, philosophies, and sciences; (3) to investigate the laws of nature and to develop the divine powers latent in man. Blavatsky left New York, December 17, 1878, and went to India, accompanied by Colonel Olcott, where a system of propaganda was organized and numerous branches were formed. Judge remained in New York, and built up the society in the United States. He formed a strong branch, the Aryan Theosophical Society, in New York City, of which he was president. Madame Blavatsky left the Theosophical Society as an international body with headquarters at Adyar, India, and with three sections: the Indian, comprising the Orient; the English Section, having jurisdiction over Europe; and the American Section for America. Olcott, at Adyar, was president; Judge, at New York, vice-president. Each section had a general secretary—Bertram Keightley, of Adyar, of the Indian; G. R. S. Mead, of London, of the English; and Judge, of New York, of the American Section. There was an inner body, the Esoteric Section (E. S.), at the head of which was Madame Blavatsky. At her death she was succeeded by Judge and by Annie Besant, of London, jointly, both supposedly mouthpieces of an unknown master, the real head of the theosophical movement. Charges of fraudulent use of this master's name were preferred against Judge by Mrs. Besant. These charges, though never proved, caused a split between the supporters and opponents of Judge. In Boston, in April, 1895, the American Section almost unanimously declared its autonomy as the "Theosophical Society in America" (T. S. in A.), with Judge as president. It had about 150 branches in the United States with several thousand active members. In so far as these members belonged to the Esoteric Section, they recognized Judge as the outer head (the real head being the unknown master), and, following their example, those theosophists throughout the world who believed the charges false formed independent bodies in their separate countries, called respectively the Theosophical Society in England (T. S. in E.), in Sweden (T. S. in S.), in Australia, etc.

The society under Olcott kept up its organization, though the English and American sections were much weakened. Mrs. Besant remained the head of that Esoteric Section which was connected with the society under Olcott. Judge died March 19, 1896, leaving his society in a flourishing condition, but with no successor as head of the Esoteric Section, or the T. S. in A. Katherine A. Tingley then obtained recognition, first from a few members, and through skillful advances from the bulk of the society, as the successor of Blavatsky and of Judge, and as the leader of the theosophical movement throughout the world. Many members at once left the T. S. in A., and more dropped out as she gradually changed the policy of the society. At a convention in Chicago, in February, 1898, she formed "The Universal Brotherhood Organization," of which she was the absolute ruler, and the possessor of all its property. Of the remnants of the T. S. in A. she made a literary department of her "Universal Brotherhood." The headquarters in New York City were abandoned and she took her remaining followers, not more than a dozen of the old members of the T. S. in A., to Point Loma, near San Diego, Cal., where she formed a colony. Mrs. Tingley caused the life of the branches of the T. S. in A. to become gradually extinct. A few members exist here and there, but are not active. The theosophical movement continues, however, on the one hand as the organization under Olcott, as president, and on the other, under the form of independent local societies, recognized as theosophical by their adherence to the three objects of the society founded by Madame Blavatsky. The most active of these independent societies is called "The Theosophical Society, New York," and has existed since 1898.

THEOSOPHY (Gk. *θεοσοφία*, *theosophia*, wisdom in divine things, knowledge concerning God, from *θεόσοφος*, *theosophos*, wise concerning God, from *θεός*, *theos*, god + *σοφός*, *sophos*, wise). A term used to denote a system or systems of philosophy based on an inwardly revealed and mystic knowledge of God and the laws of the universe, giving a supersensual insight into their operations. The belief in revelations of this type is of course far anterior to the term theosophy, which has been applied to cults of varying tenets and diverse uses of the concepts of divinity at different periods. The ancient systems of belief falling under this head may be divided roughly into Oriental and Occidental, the former being the older. The earliest traces of theosophic thought are found in the Sanskrit Upanishads (q.v.), which represent a revulsion from the ritualism of the Vedas (q.v.) and the Brahmanas (q.v.) to mystic meditation on the nature of the All-Soul or Atman. It is in a sense true that all subsequent Hindu philosophy is theosophic. From India this mystical speculation spread to Persia, and from the Persians it was absorbed by the Arabs after their conquest of Iran. In a somewhat similar sense the *Yi-King* and the *Tao-teh-King* of China and the Egyptian *Book of the Dead* may be regarded as theosophic.

Among the Jews a theosophy whose origin was somewhat analogous to that of the Indian system arose about the beginning of the Christian Era, and attained wide currency in Europe between the twelfth and sixteenth centuries. The teachings of the Cabbala (q.v.) as represented in the writings of Simeon ben Jochai and Moses de Leon, however, are so widely different from the theosophy of India as to preclude any idea of Hindu influence. On the other hand, the Cabbalistic doctrines were profoundly modified by what may be regarded as the typical Occidental theosophy, Neo-Platonism (q.v.), represented by Ammonius Saccas, Plotinus, Porphyrius, and Proclus, and by the Gnostics, represented by Valentinus and Basilides. In the Middle Ages theosophy was taught by Tauler, Eckhardt, Paracelsus, Van Helmont, Robert Fludd, Thomas Vaughan, Heinrich Kunrath, Jakob Boehme, Johann Georg Gichtel, and later by Count Saint Martin. At different periods in history men appeared, teaching the immortality of the soul, and the existence of a vast cosmos, moved by occult forces, of which cosmos this earth is but an infinitesimal part. They showed the in-stability of material existence, the reality of an occult world which reaches everywhere into ours.

In modern times, the name theosophy has been given to a form of belief promulgated by a Russian, Madame Blavatsky (q.v.), who gave out such doctrines concerning cosmogony and anthropology, and who made such claims as to the source of her instructions, which, she said, were obtained from certain Masters, that 'theosophy' now connotes the cult established by her. The authoritative work on modern theosophy is her book, *The Secret Doctrine,* which states "the three fundamental propositions" as follows: (1) An omnipresent, eternal, boundless, and immutable principle on which all speculation is impossible, since it transcends the power of human conception and could only be dwarfed by any human expression or similitude. (2) The eternity of the universe in toto as a boundless plane, periodically the playground of numberless universes incessantly manifesting and disappearing—the law of periodicity. (3) The fundamental identity of all souls with the universal Over-Soul, the latter being itself an aspect of the unknown Root: and the obligatory pilgrimage of every soul—a part of the Over-Soul—through the cycle of incarnation in accordance with cyclic and karmic law, during the whole term. The esoteric philosophy admits of no privileges or special gifts in man save those won by his own Ego through personal effort and merit throughout a long series of reincarnations.

According to theosophic teaching, God is said to be infinite and absolute. Therefore, no attempt is made to qualify or describe the Great Unknown; but the manifested universe is traced back from the material world, through the powers of nature, to the Logos, from which all manifestation begins. Evolution is accepted, but as only half a law. The other half is involution. Spirit and matter are the two aspects of one root-nature. According to immutable law, the spirit involves into matter and matter evolves the spirit. Thus there is a circulation downward and upward, from spirit into matter and from matter to spirit.

All worlds pass through seven great periods of manifestations called Rounds. Spiritual at first, they become denser and darker in the downward cycle, the fourth of which is the densest and our present material world. Thence begins its upward movement toward spirituality. The advantage gained is the experience and ultimately the emancipation of the soul. In each of these rounds, periods of incalculable duration, there are seven great root-races. Each root-race has seven sub-divisions or sub-races corresponding with the rounds, which become more material from the first to the fourth. We are at present in the fifth sub-race of the fifth root-race, and on the upward cycle of the fourth round. Evolution is constant progress, an unfolding of consciousness from the most primitive forms of life to the highest intelligence.

Humanity is one great family. All souls are the same in essence, but they differ in degrees of development; each bears a certain relation to the others and to the whole. The apparent separateness of beings is overcome by the experiences of its involution and evolution. The more advanced souls are the natural guardians of the less developed. Man is composed of seven principles, which are divided into a lower or mortal, and a higher or immortal nature. The lower nature, constituting his personality, is fourfold. One-fourth, the physical body is visible, three-fourths invisible. These three are the astral or design body (*linga śarīra*), on which are molded the physical atoms, then the life principle, and the principle of desire. The physical body (*sthūla śarīra*) is material without form. It is held in form by the astral body, and moved to action by the fire of desire (*kāma*). This fourfold nature is common to all animal beings, is mortal and subject to dissolution at death. The higher nature of man is threefold, the mind (*manas*), soul (*buddhi*), and spirit (*ātman*). The mind distinguishes man from the animal. It makes him appear to be separate from others by his self-consciousness. Entering the animal body, the mind thinks of itself as separate from others. The soul is universal, overcoming separateness and showing relationship of soul with soul. The spirit is the one indivisible which passes through all things and unites them with each other. Death is the separation of the principles. The physical body returns to the elements which gave it. The astral body disintegrates more slowly. The life (*prāṇa*) passes at once into the universal life (*jīva*). Desire forms itself into a body (*kāma-rūpa*) which gradually becomes exhausted, leaving seeds (*skandhas*), from which the returning soul forms a later and new personality.

The trinity of mind, soul, and spirit, when freed from the trammels of a mortal garment, passes through certain states of consciousness until it reaches the condition called heaven (*dēvacāna*), where it enjoys a period of bliss and rest proportionate to its good thoughts and ideals while on earth. When these exalted ideals have been exhausted, its period of rest is at an end and it descends gradually to earth. The trinity, after enjoying its rest, and realizing those ideals which could not be attained on earth, is attracted again to earth by the unfulfilled longings and desires which remain behind as seeds. These it animates. It sinks into the emotional world, is attracted to a particular family, who can furnish a body and surroundings suited to its new experience, and is reborn into this world. The higher nature must become consciously immortal, that is to say, it must acquire a continuity of consciousness, thus making it consciously immortal while in the physical body. One earth-life is not sufficient. Hence rebirth into the school of life is the lot of the soul until all the lessons have been learned. This doctrine is closely associated with that of Karma, which is the law of balance, of action and reaction, of effect inevitably connected with the preceding cause. Applied to man, it is a moral law of unerring justice, and to it all other laws, physical and otherwise, are subservient. It returns to man measure for measure his good or evil thoughts and deeds. It is inseparable from reincarnation. Man has his Karma in his duties. It is by performing every duty willingly that Karma is exhausted. If one evades the duty of the moment, Karma will ultimately compel him to perform that which is the outcome of his past thoughts and acts. Karma is the cause, reincarnation the effect. Karman is the action and interaction between desire and mind.

The phenomenon of life is a question of planes or states of consciousness. Consciousness is one, but matter is of seven grades or states. Consciousness of each of the seven planes or states independent of it, and endows it with a consciousness of each of the seven planes or states on which that matter is manifested. Consciousness remains the same in all planes. The seven states of consciousness are: Elemental, or atomic (*prakṛti*), which is a simple consciousness of the elements of matter. Mineral or molecular consciousness (*linga śarīra*) is the consolidating of the elements into form according to a definite principle of design. Vegetable or cellular consciousness (*prāṇa*) is a recombining of that matter through growth and expansion by the principle of life. Animal or organic consciousness (*kāma*) is the directing of the life of matter and design by the principle of desire. Human or 'I—am—I' consciousness (*manas*) is the self-identifying of the consciousness, as being distinct and separate from others by the intelligent principle of mind. At this point a man may rise to the divine or sink below the consciousness of the brute—at will. Universal or 'I am thee and thou art I' consciousness (*buddhi*) is the relating of the elements and of all souls with each other, thus overcoming the sense of separateness of the mind by the principle of the divine soul. Divine consciousness (*ātman*) which sees no separateness but unites all as one.

Hell (*avīci*) is a low and depraved condition on this earth. A life of intense selfishness and wickedness with no spiritual thoughts or aspirations causes the immortal soul to abandon the body before death. In such a case, it is not, however, the soul, but the body with the lower principles which is lost. After the death of such a body the desires with a reflection of the mind may be reincarnated in human form almost immediately. Such a creature is entirely material and animal, intensely selfish in its propensities and doomed to final destruction, unless it makes a strong appeal to its divine soul, in which event the soul might again connect with, and try to help on its upward path.

In man divine powers are latent, for he is essentially a soul, a divine being. He has within his personality the potential powers of a God. By purification and training of the body, the latent and divine powers will develop and become active. In every period of evolution a number of souls reach perfection. They are men whom the bonds of personality no longer bind to the attractions of the senses. They have consciously related themselves to the source of their being and have become one with the divine. They watch over humanity and are its guardians. Although they have earned their freedom from rebirth, they prefer to remain in contact with men on earth, to teach and to guide them. At certain periods some appear among men as great law-givers, rulers, teachers, and their agents found religious systems and schools of philosophy.

Consult: Blavatsky, *The Secret Doctrine* (2 vols., London, 1888); id., *Isis Unveiled* (2 vols., New York, 1877); id., *Key to Theosophy* (London, 1891); id., *Voice of the Silence* (ib., 1891); Judge, *Echoes from the Orient* (New York, 1890); id., *The Ocean of Theosophy* (1893); Sinnett, *Esoteric Buddhism* (Boston, 1884); id., *The Occult World* (ib., 1885); id., *Growth of the Soul* (London, 1896); Besant, *Theosophical Manuals* (ib., 1893); id., *The Ancient Wisdom* (ib., 1899); id., *Esoteric Christianity* (New York, 1901); Anderson, *Reincarnation* (San Francisco, 1896); id., *Septennary Man* (ib., 1895); Walker, *Reincarnation* (New York, 1888); Hartmann, *Magic Black and White* (ib., 1890); id., *Paraceleus* (ib., 1891); Collins, *Light on the Path* (ib., 1897); id., *Idyl of the White Lotus* (ib., 1890); id., *Through the Gates of Gold* (Boston, 1887).

THEOTOCOPULI, tā-ō'tō-kō-pōō'lē, Domenico (c.1548-1625). An Italian painter, engraver, architect, and sculptor, known as Il Greco, born probably in Crete, and supposed pupil of Titian. His early life is surrounded by uncertainty and the first undoubted fact relative to him is that he was residing at Toledo, Spain, in 1577, when he began to paint for the Cathedral "The Parting of Christ's Raiments." In his quality of architect he designed and carved the retable in which the picture was hung and for which he was paid 182 ducats more than for the picture itself. Summoned to Madrid by Philip II., he executed altarpieces for the Escorial, in which he attempted to adopt a style which should be distinctively his own, but failed entirely. His best work is the "Burial of the Count of Orgaz in 1323" (1534), in Santo Tomé, Toledo, containing many portraits of contemporary great personages. Other fine specimens of his ability as a portrait painter are in the Madrid Museum, which also contains a "Dead Christ" and several biblical scenes; and a portrait of himself and one of his daughter are in the Louvre. The National Gallery, London, possesses a "Saint Jerome" and the Dresden Gallery the "Healing of the Blind." As an architect and sculptor, Il Greco attained considerable reputation and designed several churches and admirable monuments. His most important structure was the church and monastery of the Bernardine monks at San Domenico di Silvos, of which he executed the whole—architecture, sculpture, and painting.

THE'RA. The ancient name of Santorin (q.v.), one of the Cyclades. The chief town is Thera.

THERAMENES, thē-răm'ē-nēz (Lat., from Gk. Θηραμένης) (?-404 B.C.). An Athenian politician. In B.C. 411 he was a leading member of the oligarchy of the Four Hundred at Athens, but soon, going over to the opposition, took a leading part in the deposition of that body. In B.C. 410 he took part in the battle of Cyzicus, and in B.C. 408 was present at the siege of Chalcedon and the capture of Byzantium. At the battle of Arginusæ, B.C. 406, he was one of the subordinate officers in the Athenian fleet, and after the battle was ordered to return to the spot where the action had taken place and rescue such of the disabled ships and their crews as he could. A severe storm having intervened, he found it all but impossible to execute this order, and as a result a large number of Athenian citizens were drowned. Then, anticipating the wrath of the people, he hastened to Athens and accused the commanders-in-chief of negligence. When, in B.C. 404, Athens was besieged by the Lacedemonians, Theramenes was sent to Lysander to arrange a peace, but, after remaining in Lysander's quarters more than three months, until the Athenians were reduced to such a state of suffering that they were ready to submit to any terms, he returned to report that he could accomplish nothing, but that an embassy must be sent to the Spartan ephors. Being a second time sent forth, this time to Sparta, he concluded a peace unfavorable to the Athenians. He was chosen one of the Thirty Tyrants who were set up at Athens, but, taking sides against the more violent members of that body, he was accused by Critias of being a traitor and was put to death. Consult Pöhlig, *Der Athener Theramenes* (Leipzig, 1877).

THERAPEUTÆ (Neo-Lat. nom. pl., from Gk. θεραπεύτης, *therapeutēs*, attendant, servant, from θεραπεύειν, *therapeuein*, to attend, from θεράπων, *therapōn*, attendant; connected with Lat. *firmus*, strong, Skt. *dhar*, to hold). The name given to an ascetic sect in a Greek treatise *On the Contemplative Life or the True Virtues*, which on the basis of Eusebius's testimony (*Hist. Eccles.* ii. 16, 17) has been attributed to Philo Judæus. It is thought by some scholars to belong to the close of the third century and to describe, not a Jewish sect, but Christian monks living in Egypt. On this theory the author, a Christian who flourished shortly before the days of Eusebius, wrote the treatise as a panegyric on asceticism. He uses as illustrations the customs prevailing in his days among ascetics and more particularly in his own country, Egypt, and in order to add weight to his utterances he puts his treatise under the name of Philo. Conybeare, Wendland, and others maintain the genuineness of the work. The Therapeutæ are described as living chiefly on the lake Mareotis, near Alexandria, and having also numerous colonies in other parts of the world. Consult: Lucius, *Die Therapeuten und ihre Stellung in der Geschichte der Askese* (Strassburg, 1880); Conybeare, *Philo, About the Contemplative Life* (Oxford, 1895); Wendland, *Die Therapeuten* (Leipzig, 1896).

THERAPEUTICS (from Gk. θεραπευτικός, *therapeutikos*, relating to medical treatment, from θεραπευτής, *therapeutēs*, attendant, servant). The branch of medicine which has as its object the cure of disease. The conception of disease which is found among primitive races is associated with the idea of demon possession. The earliest therapeutic measures were devoted to driving out these demons from the bodies of their victims. Two methods were employed: one consisted in the recital of charms or magic over the ailing part, or over the sick person; and the other consisted in the internal administration or the external application of certain aromatic or bitter herbs. In the early history of both Eastern and Western nations there was a blending of the office of priest and physician. Among the ancient Egyptians the treatment of disease had acquired a character which was by no means unscientific. They used many remedies of vegetable, mineral, and animal nature, a number of which are of acknowledged value. Careful directions are to be found as to the administration of drugs as well as the indications for their use. Egyptian physicians' knowledge of hydrotherapy, dietetics, and hygiene was far advanced. Among the Hebrews the infliction and cure of diseases is on various occasions in Scripture ascribed to the direct interposition of God. Their methods of treatment consisted principally of strict hygienic means, careful attention to diet, ablution, separation, and combustion of infected garments. A large list of remedies is mentioned in the Bible. The Babylonians had no practitioners of medicine; they exposed their sick in public places in order that travelers might communicate their experiences as to the best mode of cure. In Assyria the sick were similarly exposed, and purges, emetics, and blisters were employed as matters of routine for three days successively each month. We know also that they used salt and alum, as well as fumigations with mixtures of various drugs. The Chinese assert that with them the study of medicine was coeval with the foundation of their empire. They possess extensive works on treatment which are of great antiquity. Ginseng they regarded as a panacea, and also employed opium, mercury, and a number of other drugs of value. The Greeks may have borrowed something from the Eastern nations of their knowledge of medicine and treatment; but researches have shown that under the scientific spirit of Hippocrates they had evolved a system which commands respect. Hippocrates ascribed disease to alterations of the humors of the body (the blood, phlegm, and yellow and black bile). He employed baths, diet, exercise, blood-letting, the actual cautery, and other surgical means, and also an extensive series of medicines derived from mineral, vegetable, and animal sources. The Alexandrian School, which succeeded the Hippocratean, opposed bleeding and returned to simple remedies. This sect was followed by the Empiricists, who followed experience as their sole guide. Then came the Methodic School, which rejected all previous theories and explained all normal and abnormal processes by the contraction and relaxation of the pores of the body. They regarded all medicines as possessing astringent or relaxant qualities, and their choice of remedies depended upon which effect upon the pores they aimed to secure. Galen represented the highest development of Greek medicine. He explained the operation of drugs by reference to their elementary qualities, heat, cold, dryness, and moisture. In the early periods of Roman history medicine was practiced by the slaves and freedmen and its highest development was reached under the influence of the Greek School. In the Dark Ages medicine was practiced by the monks. Magic and astrology were potent influences. During this time the doctrine of 'signatures' arose. According to this idea a remedy was chosen on account of its fancied resemblance in form or color to the organ affected. To this doctrine we trace the introduction into medicine of such drugs as the bloodroot and liverwort. The old Galenists used only organic drugs, but in the fifteenth century under Paracelsus and his followers there was an overthrow of the older methods. He first introduced chemical agents (employing mercury in syphilis) and substituted tinctures, essences, and extracts for various disgusting preparations. Toward the middle of the eighteenth century the practice of therapeutics had reached a most complicated stage. There were theories and counter-theories and physicians were prescribing huge doses of unpleasant mixtures in the hope of securing the good from all the remedies recommended. A natural reaction set in which resulted in the establishment of homœopathy, an outgrowth of the reactionary doctrine of 'vitalism.' Later there arose the therapeutic nihilists, prominent among whom were Van Swieten and Skoda. This school rejected drug treatment altogether.

Modern therapeutics may be said to have begun with the discovery of morphine, an alkaloid of opium, in 1817. The present method of treatment is embodied in rational therapeutics, which implies the use of remedies based on a knowledge of the diseased condition present in the patient, a knowledge of the nature of disease itself, and of the physiological action of the agent employed, as determined by experimental investigation on animals, from which may be deduced the action on men. The knowledge of the action of drugs must include the manner in which they affect the nerve centres, the respiration, the circulation, and especially their influence on blood pressure, and on body temperature. The range of medicinal dosage, as well as the minimum and maximum fatal dosage, must also be determined. In treating disease it is the aim of the physician to seek the cause of the condition present and to endeavor from a true appreciation of the knowledge of drug action to administer such remedies as will effect a cure. A remedy which possesses the influence of curing positively a certain disease is called a specific. Such is the action of mercury in syphilis and quinine in malaria. Empirical therapeutics was based on the cumulative evidence that certain drugs were of service in certain conditions, and experiment was the sure guide. Symptomatic treatment aims to relieve the symptoms of disease irrespective of their cause. Rational or scientific therapeutics recognizes that both these previous methods may have to be followed at times, but it aims especially at the removal of the cause of disease by appropriate treatment of whatever sort. It has been developed by the increased knowledge of disease which we have acquired through the growth of the sciences of pathology and bacteriology. *Materi medica* comprises a knowledge of the remedies employed in medicine; while the methods by which drugs are prepared and combined for administration, as well as the separation of the active principles of drugs, belongs to the department of therapeutics known as pharmacy. It is essential that there should be a uniform standard of strength and purity of medicinal products, as well as uniformity in their preparation, and to attain this object the various countries have standards established by law or by professional authority, to which the drugs prepared by the pharmacists must conform. These standards are published by each nation in works known as Pharmacopœias. The first United States Pharmacopœia was published in 1820, previous to which time European works were mainly used as authorities. This work is revised every ten years by a committee of physicians and pharmacists. Those preparations which follow its direction and are named in the work are called *official*. *Unofficial preparations*, including many newer drugs, are in use. The best of these are finally included in the Pharmacopœia, provided they are regarded of sufficient value. The term therapeutics is usually restricted to the administration of medicinal drugs, but in its broadest sense, general therapeutics, it includes every form of treatment. Natural therapeutics is the healing power of nature to cure disease through the operation of the so-called *vis medicatrix naturæ*. In what is known as expectant treatment the physician depends solely on this force and sustains the patient's strength by food and nursing. Treatment by surgical means is regarded as a special and separate department of medicine. A large number of other means than treatment by drugs is in use and each is designated by an appropriate prefix. Electrotherapeutics, the use of electricity as a healing agent, is especially valuable in certain cases of disease of the nervous system or local injury to a nerve. By this means the nutrition of paralyzed muscles may be maintained by electrical stimulation until the nerve is in a condition to resume its function. Radiotherapy or X-ray therapy is the use of the Roentgen rays for the purpose of treatment. Hydrotherapy is the treatment of disease by the application of water, either as baths of various temperatures (balneotherapeutics) or by drinking, douching, spraying, etc. Suggestive therapeutics is the name given to treatment in the form of suggestion made to the patient while in an induced hypnotic state, with the object of the patient's following the suggestion when awakened from the hypnotic sleep. This treatment is of limited utility in a few varieties of nervous disease of so-called functional origin, in which no organic disease exists. Climato-therapeutics is the utilization of certain locations on account of their peculiar adaptability to the patient's condition; as the sending of patients suffering with consumption to high altitudes and dry climates. Therapeutics fully recognizes the value of diet in disease in an important department of the subject known as dietetics or dieto-therapeutics. The use of extracts of various glands of the body, especially of the thyroid and the suprarenal glands, has of late been attracting considerable attention. This department of therapeutics is called opo-therapy and promises wide usefulness. Massage and various allied measures have a prominent place in the treatment of certain conditions and assist in sustaining the nutrition of the muscles. This is sometimes called masso-therapeutics.

There have been a number of methods of classifying remedies followed by various authorities, but none of these is entirely satisfactory. The most important are: (1) the botanical method, which groups the vegetable remedies according to the botanical classifications; and (2) the arrangement according to the therapeutic action of drugs. Many drugs, however, are used for a number of purposes, and it is undesirable to describe them under more than one heading. Finally, there is (3) the pharmacological classification, which arranges drugs according to their action on living matter. This method does not take into account the chemical composition or therapeutic action of drugs, but those having the most characteristics in common are placed together. The groups are named for the most prominent member or from some marked property possessed by all. The chief divisions, under which are included many sub-groups, are thus stated by Cushny: (1) Organic substances which are characterized chiefly by their local action, such as pepper, mustard, and turpentine. (2) Organic substances characterized chiefly by their action after absorption, such as alcohol, strychnine, and morphine. (3) The alkalies, alkaline earths, acids, and allied bodies. Under this head are grouped the various salts of ammonia, etc. There is a gradual transition from this group to (4) the heavy metals, as silver, gold, iron, etc. Another class (5) embraces ferments, secretions, and toxalbumins, thus consisting of a number of substances which are either present in the normal body or are merely substitutes for normal secretions. In the last group (6) menstrua and mechanical remedies are found, preparations which are used only for their mechanical effects, and which, while they are included in the Pharmacopœia, are not for the most part drugs.

THERE′SA, Saint. See Teresa.

THERESINA, tā′rē-zē′nȧ, or **THEREZINA.** The capital town of the State of Piauhy, Brazil, on the right bank of the river Paranahiba, 230 miles from the city of that name at its mouth (Map: Brazil, J 5). The town is regular in construction, but uninteresting and unhealthful. Population, about 6500.

THERESIOPEL, tȧ-rȧ′zē-ō′p'l, or Maria-Theresiopel (Hung. *Szabadka*). A royal free city of the County of Bács, Hungary, 109 miles by rail south-southeast of Budapest (Map: Hungary, F 3). It is a scattered town, lying in a great, rich plain between the Danube and the Theiss, and has noteworthy churches. Theresiopel is the centre of a fine large corn-raising district, which also produces tobacco. The manufactures include linens and shoes. The town has a fine trade in grain, wine, horses, cattle, hogs, hides, and wool. Population, in 1890, 73,526; in 1900, 82,122, chiefly Catholic Magyars and Serbs.

THER′IDI′IDÆ (Neo-Lat. nom. pl., from Gk. θερίδιον, *theridion*, diminutive of θήρ, *thēr*, wild beast). A family of spiders known as the cobweb-weavers. These are small spiders with very slim legs, and include most of the familiar house spiders. They are generally soft and of a light color, with the abdomen large and round and the legs lacking in spines. The eyes are all of about the same size and are placed in two rows across the front of the head. The mandibles are weak and without teeth at the end. The maxillæ are pointed at the end and turn inward toward each other. The family is one of the largest of the order Arachnida. Many species of Theridiidæ spin their webs in the fields on bushes. The web is a flat or curved sheet, supported by threads which run in many directions, under which the spider hangs head downward. The egg cocoons are round and soft and hang in the web.

THE′RIODON′TA (Neo-Lat. nom. pl., from Gk. θηρίον, *thērion*, diminutive of θήρ, *thēr*, wild beast + ὀδούς, *odous*, tooth). A suborder of extinct Permian and Triassic reptiles, the skulls of which show remarkable resemblance to those primitive carnivorous mammals. See Cynognathus; Theromorpha; Reptilia.

THE′RIOSU′CHUS (Neo-Lat., from Gk. θηρίον, *thērion*, diminutive of θήρ, *thēr*, wild beast + σοῦχος, *souchos*, crocodile). An extinct crocodile with body less than two feet long, skeletons of which are found in the Purbeck beds of the English Upper Jurassic. See Crocodilia; Teleosaurus.

THERMAL SPRING (from Gk. θέρμη, *thermē*, heat from θερμός, *thermos*, hot). A spring whose temperature is higher than the average temperature of the locality in which it emerges. The temperature may vary therefore from a minimum of a few degrees above the freezing point, which, however, is limited to thermal springs in high altitudes or great elevations, to a maximum represented by the boiling point of water under the local conditions. When the temperature reaches the latter limit the flow of the spring may take the form of periodical eruptions; a thermal spring of this character being known as a geyser (q.v.). The higher temperature of thermal springs as compared with ordinary springs may be caused by volcanic agencies or by the circulation of the waters at great depths in the earth's crust previous to emergence. The hottest springs are usually found in volcanic regions, and their high temperature is due to coming in contact with uncooled lava, which when buried at some depth retains its heat for a long time. It seems probable, also, that some springs are heated by gaseous emanations from the earth's interior, or, indeed, receive material contributions from that source. Thermal springs are quite common, however, in districts that have been free from volcanic disturbances, at least since remote geological times. The increase in temperature under such conditions can best be explained by peculiarities of geological structure which permit the surface waters to descend to great depths when they are heated and thence are returned to the surface under the influence of hydrostatic pressure. See Spring.

THERMES, târm (Fr., from Lat. *thermæ*, warm baths). The only remains of the Roman palace which occupied the site of the present Hôtel de Cluny, Paris. The ruins are those of the great baths connected with the palace, and include a frigidarium 65 feet long and 59 feet high, still uninjured, although up to 1820 it had long borne the weight of a garden laid out over it. The ships' prows of the vaulting are said to be the origin of the arms of Paris. A collection of Roman antiquities discovered in Paris is preserved in the hall.

THERMIC FEVER. See Heat-Stroke.

THERMIDOR, *Fr. pron.* târ′mē′dôr′ (Fr., from Gk. θέρμη, *thermē*, heat + δῶρον, *dōron*, gift). The eleventh month in the French revolutionary calendar. It extended from July 19th to August 18th in the years I.-VII. and from July 20th to August 19th in the years VIII.-XIII. The 9th Thermidor of the year II. (July 27, 1794) is historically memorable as the date of Robespierre's fall and the termination of the Reign of Terror. The name Thermidorians was given to all those who took part in this coup d'état, but more particularly to those who were desirous of restoring the monarchy. See French Revolution; Robespierre.

THERMO-CHEMISTRY. The branch of general chemistry that deals with the thermal phenomena accompanying chemical transformations. While those phenomena are caused partly by the chemical changes proper, they may be due in part also to the purely physical changes of state that often accompany chemical reactions; and for this reason the scope of thermo-chemistry must extend over physical as well as chemical changes of matter. For the principles of thermo-chemical notation, see CHEMISTRY, section on *Transformations*.

What has thus far been accomplished in the domain of thermo-chemistry may be summed up as follows: First, a large number of transformations have been subjected to calorimetric measurement, and so the total amounts of heat given off or absorbed during a great many changes have been determined experimentally; secondly, the principles of thermodynamics have been successfully applied to the consideration of chemical changes, and thus thermo-chemistry has been highly developed theoretically.

EXPERIMENTAL THERMO-CHEMISTRY. The actual execution of thermo-chemical measurements is a matter of some difficulty, owing to the considerable errors that may be caused by more or less heat being lost by radiation while the measurement is being carried out. The heat given off or absorbed is determined by keeping the vessel in which the reaction takes place immersed in a known quantity of water, and observing the temperature of the latter before and after the reaction. But whatever the details of such a 'calorimetric' arrangement may be, whatever the precautions taken to isolate the calorimeter from its surroundings, the loss of heat during an experiment would render the observation worthless in every case in which the chemical change studied would take place slowly. In consequence of this, thermo-chemical knowledge would necessarily be confined to rapid reactions alone, if it were not for the fact that early in the history of thermo-chemistry a principle became known that permitted of ascertaining the heat of slow reactions, too, by indirect methods. The principle in question is known as *the law of constant heat-sums*. While clearly established by Hess in 1844, i.e. before the law of the conservation of energy became known, it is nothing but a special form of the law of conservation. It is as follows: *The amount of heat given off or taken up when a given chemical system is changed into another is the same whatever the way in which the change may take place.* Let, for example, the given chemical system consist of 17 grams of gaseous ammonia in one vessel, its equivalent 36.5 grams of gaseous hydrochloric acid in another vessel, and a large quantity of water. This system may be changed into a dilute aqueous solution of ammonium chloride in two different ways: (1) ammonia and hydrochloric acid may be caused to combine in the gaseous state, yielding solid ammonium chloride and *developing* 42,100 calories of heat; then the ammonium chloride may be dissolved in the water—a change accompanied by the *absorption* of 3900 calories; or (2) the gaseous ammonia may be dissolved in a large amount of water—a process *developing* 8400 calories; the gaseous hydrochloric acid may be dissolved in a separate large quantity of water—a process *developing* 17,300 calories; and, finally, the dilute aqueous ammonia may be mixed with the dilute aqueous hydrochloric acid —a process *developing* 12,300 calories. Whichever the way adopted, the result is the same—viz. a dilute aqueous solution of ammonium chloride. The heat developed when the first way is adopted is 42,100—3900=38,200 calories; the heat developed when the second way is adopted is 8400 + 17,300 + 12,300 = 38,000 calories. The figures 38,200 and 38,000, differing by only 2 parts in 382 (little more than ½ per cent.), i.e. by less than the unavoidable experimental error, must be considered as equal—which is in accordance with the law of constant heat-sums. If, for some reason, it were impossible directly to measure, say, the heat produced by the combination of gaseous ammonia and gaseous hydrochloric acid, that heat might be calculated, according to the law of constant heat-sums, by adding 3900 calories (the heat absorbed when one equivalent of ammonium chloride is dissolved in much water) and 38,000 calories (the total heat produced during the transformation, by the second way, of gaseous ammonia and hydrochloric acid into dilute ammonium chloride). The sum, 41,900 calories, would be as near the truth as the 42,100 calories found by direct experiment. To take another, even simpler example, suppose it were asked, How much heat would be evolved or absorbed in the transformation of 12 grams of amorphous carbon into diamond? The transformation, although accomplished on a minute scale by Moissan, in his electric furnace, is of course inaccessible to direct calorimetric measurement. But the law of constant heat-sums permits of answering the question by measuring the heat of combustion of amorphous carbon and that of diamond. The transformation of amorphous carbon into carbon dioxide, whether accomplished by direct combustion or by first changing the carbon to diamond and then burning the latter, must be accompanied by the evolution of the same amount of heat, viz. 97,650 calories; and as the heat of combustion of diamond is 94,310 calories, the transformation of amorphous carbon (12 grams) into diamond must, according to the law of constant heat-sums, be accompanied by the evolution of 97,650 — 94,310 = 3340 calories.

In a similar manner Hess's law permits of ascertaining the heat that would be developed during the formation of compounds (e.g. the majority of organic compounds) whose formation from the elements could not be directly studied calorimetrically. Let it be required, for instance, to ascertain the heat that would be developed or absorbed if ordinary alcohol (C_2H_6O) were made from its elements—carbon (in the form of diamond), hydrogen, and oxygen. To do this, we may determine calorimetrically the heat (call it a) developed by the *combustion* of one gram-molecule of alcohol and the heats of combustion (b and c) of quantities of isolated carbon (diamond) and hydrogen equal to those contained in one gram-molecule of alcohol. The three combustions may be represented by the following equations:

$$C_2H_5OH + 6O = 2CO_2 + 3H_2O + a \text{ calories};$$
$$2C + 4O = 2CO + b \text{ calories};$$
$$3H_2 + 3O = 3H_2O + c \text{ calories}.$$

Adding the second and third equations, we get:

$$2C + 3H_2 + 7O = 2CO_2 + 3H_2O + b + c,$$

and subtracting the first equation from this, we get:

$$2C + 3H_2 + O - C_2H_5OH = b + c - a,$$

or $$2C + 3H_2 + O = C_2H_5OH + b + c - a.$$

This last equation, expressed in words, means that if carbon, hydrogen, and oxygen combined to form ordinary alcohol, an amount of heat would be formed equal to the heat of combustion of the isolated elements of alcohol *minus* the heat of combustion of alcohol itself; *b*, the heat of combustion of two atoms (i.e. twice 12 grams) of carbons, is found to be $94{,}300 \times 2 = 188{,}600$ calories; *c*, the heat of combustion of three molecules (i.e. 3×2 grams) of hydrogen; is found to be $67{,}500 \times 3 = 202{,}500$ calories; finally, *a*, the heat of combustion of one molecule (46 grams) of alcohol, is found to be 340,000 calories. Hence, $b + c - a$, the heat of formation of alcohol, is $188{,}600 + 202{,}500 - 340{,}000 = 51{,}100$ calories. See COMBUSTION.

THEORETICAL THERMO-CHEMISTRY. This, as already stated above, consists in the application of the principles of thermodynamics to chemical phenomena. The subject, if not very difficult, requires a working knowledge of the higher mathematics and thermodynamics, and can therefore be discussed here only in its more elementary aspects. The principal questions to which thermodynamics have been applied concern: (1) the influence of temperature upon the total energy-change (*Wärmetönung*) of reactions, i.e. heat given off or absorbed, no mechanical work being performed; (2) the influence of temperature upon the velocity of reactions (see REACTION, CHEMICAL); (3) the influence of temperature on chemical equilibrium; (4) the determination of the maximum mechanical work that can be performed by the chemical energy of reactions. We will briefly consider these questions in their consecutive order.

With reference to the dependence of the energy-change of a reaction upon the temperature, the verdict of thermodynamics is, first of all, that in case the heat-capacity of the reacting substances is the same as that of the products of the reaction, the energy change of the reaction does not vary with the temperature. This is generally the case when the reacting substances and the products of the reaction are all solids. Thus the combination of silver and solid iodine into silver iodide sets free practically the same amount of heat (about 14,000 calories), no matter at what temperature the combination is caused to take place. On the other hand, if a given reaction does cause a change in the heat-capacity, then, if t denotes the difference between two temperatures at which the reaction may take place, $u_1 - u_2$ the difference between the energy-change at the first and that at the second temperature, and c the difference between the heat-capacity of the reacting substances and that of the products of the reaction,

$$u_1 - u_2 = ct.$$

By measuring calorimetrically the heat-capacities in question and the energy-change of the reaction at some one temperature, it is therefore easy to calculate the energy-change of the reaction at any other temperature—a result of considerable importance, because direct calorimetric measurements of the energy-change can by no means be readily carried out at any desirable temperature.

As to the velocity of reactions (see REACTION, CHEMICAL), it is well known empirically that a relatively small rise of temperature often causes reactions to take place with great rapidity—sometimes with explosive violence. Usually a rise of 10° C. doubles or even trebles the velocity. In a perfectly general manner, however, the dependence of the velocity on temperature cannot as yet be formulated. As far as chemical knowledge goes at present, it seems probable that a law analogous to Ohm's law in electricity will some time be found to express the relation between the reaction-velocity, the chemical force causing the reaction, and the 'chemical resistance.' If chemists should succeed in working out a clear conception of the latter, in measuring it, and expressing quantitatively its variation with the temperature, then the problem of the dependence of reaction-velocity on temperature would be solved. But all this remains to be done; and chemists realize that it is not by any means an easy matter to do it; for 'chemical resistance,' and hence also the velocity of reactions, depend, besides the temperature, on a number of more or less accidental factors—on the accelerating influence of certain 'catalytic agents' (see CATALYTIC ACTION), on the retarding influence of certain other substances, indeed sometimes on the material of the vessel in which the reaction takes place. Under such circumstances, the field for the mathematical application of thermodynamical principles is naturally very limited. Nevertheless, Van 't Hoff has succeeded in showing that *in many cases* the dependence of reaction-velocity on the temperature can be expressed by simple equations of the following form:

$$\log k = -\frac{A}{T} + B,$$

an equation established by him by combining the principles of thermodynamics with experimental observations. In this equation k stands for the velocity at the instant when the product of the active masses equals unit; T stands for the absolute temperature (i.e. the centigrade temperature *plus* 273 degrees); and A and B are constants whose numerical values depend on the nature of the substances taking part in the reaction. If k is actually measured at only *two* different temperatures, and its two corresponding values (say k_1 and k_2), together with the two temperature numbers (say T_1 and T_2), are substituted in the above equation, we get:

$$\log k_1 = -\frac{A}{T_1} + B,$$

$$\log k_2 = -\frac{A}{T_2} + B,$$

two equations with two unknowns, A and B. Solving these equations, and substituting the resulting numerical values of A and B in the general equation given above, we obtain a general relation between k and T for the given reaction. In other words, we can readily calculate what may be termed 'the standard velocity' for any temperature whatever—the 'standard velocity' being the velocity at the instant the concentrations of the reacting substances are such that the product of their active masses equals unit. The law of chemical mass-action then permits of calculating the reaction-velocity for all other possible concentrations.

With reference to chemical equilibrium (see REACTION, CHEMICAL), thermodynamics, as Van 't Hoff has shown, permits of foreseeing the equilibrium of a reaction at some temperature

T_2, if the equilibrium at some given temperature T_1 and the average of the energy-changes (heats given off or taken up by the reaction) at the two temperatures are known. In this manner it is possible to calculate, for instance, the degree of dissociation of ammonium chloride (see DECOMPOSITION; DISSOCIATION) at different temperatures, if the degree of dissociation at some one temperature, and the heat of dissociation, are known.

In connection with the influence of changes of temperature on chemical equilibrium, it is necessary to mention *Gibbs's phase rule*, which is of great importance in classifying the phenomena of equilibrium in material systems. By the 'phases' of a chemical system Gibbs means its several homogeneous parts that can be separated from one another mechanically. For instance, let water be shaken up in a bottle with ordinary ether, and three layers will form—a solution of ether in water, a solution of water in ether, and, over the liquid, a mixture of the vapors of water and ether; the three homogeneous layers can be separated by mechanical means, and hence they constitute the three 'phases' of the system. Since all gases and vapors form homogeneous mixtures, it is evident that no system can contain more than one gaseous phase. According to Gibbs's phase rule, n phases in equilibrium with one another cannot possibly be made up by less than $n-2$ independent chemical substances, or, what is the same, $n-2$ independent chemical substances cannot possibly form more than n phases in equilibrium with one another. When $n-2$ independent substances do form n phases, then the slightest change of temperature destroys the equilibrium, a transformation takes place, and one of the phases disappears. For instance, let $n-2=1$, and therefore $n=3$, as is the case at the melting-point of ice, when ice, liquid water, and water vapor may form three phases made up of a single chemical substance—water. As long as the temperature is constant, the three phases remain in equilibrium; let the temperature rise, and all the ice will have melted away; let the temperature fall, and all the water will have frozen. The melting-point of water is sometimes referred to as its *triple point*, because of the three phases which may exist in equilibrium at that point. Above and below that point, in the regions of the simultaneous existence of only two phases (liquid water and its vapor, or ice and its vapor), a change in temperature causes a corresponding *change* in the equilibrium, the vapor-tension, and hence the concentration of the gaseous phase varying with the temperature; but none of the phases necessarily disappears, i.e. the equilibrium of the several phases is not necessarily *destroyed*. In the case of ether and water forming three phases (see above), the number of independent substances being only one less than the number of phases, a change in temperature would likewise cause a change in equilibrium; but ordinarily none of the phases would necessarily disappear, i.e. again, the equilibrium would not necessarily be destroyed. If, however, the temperature should fall to the point at which water would begin to freeze out of the aqueous solution of ether, then a fourth phase (ice) would be added to the three phases of the system; the number of phases (4) would then exceed by two the number of independent substances (2, ether and water) composing them, and the equilibrium that would then ensue would be destroyed by the slightest variation of temperature from that 'quadruple point' (i.e. the point of four phases) of the system. Temperatures like the triple point of water and the quadruple point of water and ether are referred to generally as the *multiple points* of chemical systems. The above examples, involving physical transformations alone (melting, freezing, evaporation, solution), have been considered here for simplicity's sake. But the phase rule is equally applicable to systems in which very complex chemical phenomena may be taking place, and its value lies largely in the fact that it likens very complex phenomena of chemical equilibrium to the simple phenomenon of the physical equilibrium between water and ice. It further, evidently, permits of classifying the phenomena of chemical equilibrium with reference to the number of substances taking part in them, and thus possesses considerable didactic importance. Finally, it can serve as a guide to the discovery of new substances (for instance, new hydrates of inorganic salts) that may appear as phases in chemical systems in equilibrium and thus render service to certain branches of purely experimental research.

One more important application of thermodynamics to chemical phenomena has been made and requires mention in the present sketch. Thermodynamics, in studying a transformation of some material system, endeavors to ascertain the maximum mechanical work that might be produced by the transformation, the 'maximum work' meaning the work that might be obtained by the use of some ideal mechanical device, frictionless and permitting, so to speak, of *no leakage* of energy. The importance of knowing this maximum of work is very great. Any natural change taking place of itself—whether it be the falling of a stone, the expansion of a compressed gas, the combustion of coal, or any other change, mechanical or chemical—may be used to produce mechanical work; and no material system is capable of changing unless it possesses *the capacity for producing work*—or, as Helmholtz terms it, 'free energy.' In other words, it may be said that it is *because* a system can produce mechanical work that it is capable of changing spontaneously. The burning of coal (i.e. the chemical transformation of the system, carbon and oxygen), once started, can go on of itself *because* it can be used to produce mechanical work, or, what is the same, because the system carbon and oxygen possesses a certain amount of free energy. When, therefore, the free energy of a system has been used, without loss, to produce mechanical work, and that work has been measured, we have a measure of the cause of the given transformation. The cause of chemical transformations is generally termed 'chemical affinity.' Obviously, then, the maximum work that can be produced by a chemical transformation is a measure of the chemical affinities involved in it, and this is why the determination of maximum work has great importance for chemical theory. But it may also be valuable for purely practical purposes. Take, for instance, again the combustion of coal. It is well known that steam engines are very wasteful of energy. In connection with the problem of a more economic use of coal the question must naturally arise, How much mechanical work could possibly be obtained altogether by burning a certain amount of coal, supposing that an ideally perfect device were employed for the purpose? The direct measurement of the maximum work, although theoretically possible, could not be actually carried out. But the maximum work of a reaction can be readily calculated, with the aid of thermodynamics, if the concentrations of the reacting substances and their products, when in the state of chemical equilibrium, are known. In the case of the combustion of coal the equilibrium-concentrations have been determined by indirect measurement, and on the basis of this Nernst has calculated approximately the maximum work of the combustion for three different temperatures: If 12 grams of carbon were burned at the absolute zero (—273° C.), the equivalent of 97,650 calories might be obtained; at 18° C. the maximum work would be equivalent to 91,470 calories; at 1000° C. the equivalent of only 70,625 calories can be obtained; this in spite of the fact that the heat given off by the combustion is practically the same at all temperatures, viz. 97,650 calories. Only at the absolute zero of temperature could the heat produced by the combustion of coal be entirely transformed into mechanical work.

In conclusion, a few words must be said with reference to an erroneous principle that has gained somewhat wide acceptance among chemists—viz. Berthelot's principle, according to which it is the heat produced by a reaction, and not the maximum possible mechanical work, that measures the cause of the reaction; and of two reactions that might take place in a given system, the one accompanied by the greatest evolution of heat must necessarily take place. This principle holds good often, but not always, and so cannot be looked upon as a law of nature. The most important argument against it is that, were it unlimited in its application, as Berthelot claims it to be, reversible reactions would be impossible; for one of a pair of reversible reactions not only does not *develop* heat, but necessarily *absorbs* heat; and hence, if Berthelot's principle were correct, that reaction could not take place at all, and its opposite reaction would be complete. See Reaction, Chemical.

The principal names connected with experimental thermo-chemistry are those of Hess, Julius Thomsen, Berthelot, and Stohmann. The first to apply the principles of thermodynamics to chemical phenomena was Horstmann. The problem was next taken up by Dr. Gibbs, of Yale University, whose thorough and original treatment of the subject remained unknown for a number of years. The importance of Van 't Hoff's thermo-chemical work may be readily seen from the present sketch. Finally, Le Chatelier, Planck, Riecke, and Duhem have made noteworthy contributions to the mathematical treatment of the subject.

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THERMO-COUPLE, THERMOPILE. See Thermo-Electricity.

THERMODYNAMICS (from Gk. θέρμη, *thermē*, heat + δύναμις, *dynamis*, power). The application of the principles of mechanics to heat-phenomena. It is shown in the article Heat that all heat-effects can be traced for their cause to work having been done against the molecular forces of the body—e.g. friction, compression, etc.—or to the reception of energy by the minute portions of the body—e.g. radiation, conduction, etc. In short, it may be regarded as proved experimentally that heat-effects always accompany changes in the intrinsic energy of a body; and the idea that the numerical value of the heat-effects depends on the *energy* added to the minute portions of the body and on that alone is now accepted by every one. If a small amount of energy ΔQ is added to a body, its intrinsic energy is changed (dU) and as a rule a certain amount of external work is done by the expansion of the body (pdv, where p is the external pressure on the body and dv is the change in volume). By the conservation of energy, then, if no other work is done,

$$\Delta Q = dU + pdv.$$

This is sometimes called the 'first principle of thermodynamics.'

In any form of heat engine—e.g. a steam engine—the 'working substance,' water, starts at ordinary temperature; heat-energy is added to it by the boiler; it reaches a high temperature, that of the boiler, and a high pressure; it expands doing work in pushing out the piston; its temperature and its pressure therefore fall; the 'cylinder' is now joined to the 'condenser,' and the steam passes out and is condensed to water, giving up heat-energy; the piston is drawn back and the process is repeated. So far as the heat-energy and work are concerned, heat-energy (Q_1) at a high temperature has been given to the working substance, heat-energy (Q_2) at a low temperature is taken away from it, external work (W) is done. By the first principle of thermodynamics $W = Q_1 - Q_2$, if we assume that the water at the end of its cycle of changes has the same energy that it had at the beginning. The 'efficiency' of the process is defined as the ratio $\frac{W}{Q_1}$ or $\frac{Q_1 - Q_2}{Q_1}$. In considering the efficiencies of various processes Carnot in 1824 was led to imagine one which bears his name and which can be discussed theoretically. This process is one which consists of a working substance inclosed in a cylinder with a movable piston passing around a cycle so as to return to its initial condition. There are supposed to be two large reservoirs of a liquid, at different temperatures. The cylinder containing the working substance at a high pressure and small volume is imagined placed in the high-temperature tank; the substance is allowed to expand, so slowly that its temperature remains practically unchanged at that of the surrounding liquid in the tank; in doing this, heat-energy must flow into the working substance, otherwise its temperature would fall; after the volume has increased sufficiently, the cylinder is removed from the tank, and the inclosed substance is allowed to expand under such conditions that no heat-energy can enter, and its temperature falls; when it reaches that of the second tank the cylinder is placed in it, the piston is forced in by external force, thus reducing the volume; if this process is done slowly the temperature will not rise, but heat-energy will flow out into the liquid of the tank; when the volume is sufficiently reduced, the cylinder is removed and the piston is pushed in under such conditions that no heat-energy can leave or enter; if the volume at the beginning of this last step is chosen correctly the working substance will after a sufficient compression be restored to its original condition. There have been four steps, two 'isothermal' and two 'adiabatic.' The net result is: No change in the working substance; external work (W) done by the substance; heat-energy Q_1 withdrawn from the high-temperature tank; heat-energy Q_2 given out to the low-temperature tank. Therefore, by the first principle of thermodynamics,

$$W = Q_1 - Q_2.$$

This process of Carnot's is perfectly 'reversible;' by doing an amount of work W on the working substance it may be made to pass around the cycle in the reverse way; the low-temperature bath losing an amount of heat-energy Q_2 and the high-temperature bath gaining an amount Q_1. The conditions for reversibility are that each 'point' of the whole cycle should be one of equilibrium; and it is apparent that for this to be satisfied the changes must all be made slowly and that when the substance receives or gives out heat-energy it must be in contact with a large tank of liquid at the same temperature, within an infinitesimal amount, as it itself is at that instant. (If a gas expands out of a high-pressure reservoir into the open air—e.g. illuminating gas rushing out of a burner—the process is irreversible; if in an engine the flame is at a higher temperature than the steam in the boiler—as it always is—the process is irreversible.) It was stated by Carnot that the efficiency of his process, $\frac{W}{Q_1}$, was the same for all working substances and depended alone on the temperatures of the two baths. His proof was, however, erroneous, and was corrected by Clausius in 1850, who showed that the statement was correct if one assumed that heat-energy of itself always passes from high to low temperature. The statement that heat-energy of itself does always pass from high to low temperature is called the 'second principle of thermodynamics.' Lord Kelvin has shown that this principle is identical in its conclusions with the assumption that it is impossible by any material agency to derive mechanical effect from any portion of matter by cooling it below the temperature of the coldest of the surrounding objects.

Since $\frac{W}{Q_1}$ is a function of the temperatures of the two tanks alone, it is possible to give such numbers to the temperatures of these tanks as will be independent of the working substance (i.e. thermometric substance). Kelvin—then William Thomson—suggested that the numbers T_1 and T_2 be so chosen for the temperatures of the tanks that $\frac{T_1}{T_2} = \frac{Q_1}{Q_2}$. In this case $\frac{T_1 - T_2}{T_1} = \frac{Q_1 - Q_2}{Q_1} = \frac{W}{Q_1}$ and is therefore independent of everything except the temperatures; $T_1 - T_2$ may be chosen to have any arbitrary value; $\frac{T_1}{T_2}$ is fixed by the above definition as depending upon making the thermometric substance pass around a Carnot's cycle; and then T_1 and T_2 are obtained. It is found by direct experiment that if $T_1 - T_2$ is chosen as 100 for two tanks of melting ice and boiling water, the numbers on 'Thomson's absolute scale' are almost exactly the same as obtained in a gas thermometer using the 'absolute centigrade scale.' See THERMOMETRY.

Since the efficiency increases as T_2 becomes smaller, and since the efficiency cannot be greater than unity, there must be a minimum temperature in the universe. This is known as the 'absolute zero;' its value is about 273° C., as shown by the agreement between the two 'absolute scales' just described.

Carnot stated further that the efficiency of an irreversible process could not be greater than that of a reversible one with the two limiting temperatures of the tanks; and Clausius proved that this is true if the second principle of thermodynamics is true.

It is generally accepted that the efficiency of an irreversible process is less than that of a reversible one between the same two temperatures, but it cannot be regarded as a deduction from the two principles of thermodynamics. All processes in nature—chemical, electrical, etc.—are irreversible; and a natural system will therefore be in equilibrium if all imaginable processes compatible with the existing conditions necessarily involve an efficiency equal to or greater than that which corresponds to a reversible process. This general idea forms the basis of the modern development of thermodynamics by Gibbs, Planck, and others.

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THERMO-ELECTRICITY. It was observed by Seebeck in 1822 that, if the two junctions of a closed metallic circuit made up of two different wires in series were at different temperatures, there was produced an electric current. As the difference of temperature at the junctions is increased, the current increases. It was shown, however, by Cumming in 1823, that for any temperature of one junction there is one for the other junction such that there is no current: this is known as the temperature of 'inversion.' If in general, then, as the temperatures of the junctions are made more and more different, the current increases, then decreases, becomes zero, and is finally reversed. The average of the temperatures of the junctions when the current is zero is called the 'neutral' temperature, and is a constant for any two bodies.

These thermo-electric currents are due to molecular actions at the junctions and also throughout the conducting wires, owing to their non-uniformity of temperature. Where the two different metals join there are electric forces called the 'Peltier electro-motive forces;' while the electric forces through the conductors themselves are called 'Thomson electro-motive forces.' The existence of these electro-motive forces is proved by forcing a current around a circuit by means of a battery or cell; at the junctions there is rise or fall of temperature depending upon the direction of the current, showing a force opposing or helping on the current; similarly the conductor itself has its temperature raised or lowered, depending upon the direction of the current—quite apart from the usual heating effect of a current.

The properties of thermo-electric currents are best studied by diagrams. Some one metal is chosen as a standard; lead is generally selected because it has no 'Thomson effect.' A circuit is made part of lead and part of another metal; one junction is kept at 0° C., and while the temperature of the other is varied continuously, both above and below zero the total electromotive force around the circuit is measured. These values of the E.M.F. for different values of the temperature of the variable junction are plotted in a curve, having E.M.F. for ordinates and temperatures for abscissæ. These curves when drawn for different bodies—all with reference to lead—are found to be approximately parabolas. Another form of diagram is made as follows: The junctions of the two metals, one of which is lead, are kept at temperatures T and $T + \Delta T$, where ΔT is a small quantity; the resulting E.M.F. around the circuit is measured, call it. ΔE. The ratio $\frac{\Delta E}{\Delta T}$ is called the 'thermo-electric power;' it is evidently a function of the temperature T, and when plotted on a diagram having temperatures as abscissæ, the curves are practically straight lines.

A thermo-couple is one of the most sensitive instruments known for detecting differences in temperature. It can be improved by joining in a zigzag series several couples; first, a piece of bismuth, then one of antimony, then one of bismuth, etc., the first end of the first piece of bismuth and the last end of the last piece of antimony being joined by a wire passing around a galvanometer. Thus every other junction of bismuth and antimony is turned to form one face of the zigzag; and, if one face is at a higher temperature than the other, each couple helps the others, and thus a considerable current may be produced through the galvanometer. Such a combination of couples forms a 'thermopile.' It was invented by Nobili in 1834.

THERMOMETER (from Gk. θέρμη, *thermē*, heat + μέτρον, *metron*, measure). An instrument for measuring temperature, but in early times erroneously supposed to measure heat. A brief account of the underlying theory and the history of thermometry are given under the title Thermometry. This article will deal only with those forms of thermometers that are at present in ordinary use.

The Air or Gas Thermometer. This form of the instrument is accepted as the standard and the indications of mercurial, alcohol, or other thermometers are all supposed to be corrected so as to agree with the standard adopted by the International Bureau of Weights and Measures at Paris. This standard consists of a hollow bulb of platinum filled with pure, dry nitrogen. When kept at a uniform pressure the volume of the gas expands in direct proportion to its temperature. By calling the volume at the melting point of ice V, and the volume at the boiling point of water V + 100°, we establish a scale of centigrade degrees, which may be extended above or below these limits, so that, for instance, the temperature of the absolute cold or entire absence of heat would be —273° C. and the temperature of the boiling point of mercury would be about +357° C. Numerous precautions are needed in the use of the air thermometer, all of which are explained in the *Travaux et memoires* of the International Bureau of Weights and Measures and in Guillaume, *Thermometrie* (Paris, 1890). According to the theories of thermodynamics the peculiarities of platinum, nitrogen, or of any other materials that may be used, introduce small irregularities, so that the scale of equal changes of volume is not exactly proportional to the quantity of heat or the change in temperature. Therefore some recommend that a slight correction be applied to the nitrogen gas thermometer in order to obtain the ideal thermodynamic equivalent. In Fig. 1 we see the simplest or portable form of air thermometer, as arranged by Joly, for measuring temperatures below the boiling point of water. The large glass bulb on the left is filled with dry air, or dry nitrogen, and ends in a short vertical glass tube attached to the flexible rubber tube whose other end opens into another short glass tube, shown on the right-hand side, whose upper end is hermetically closed and constitutes the vacuum chamber of a barometric column of mercury. The glass bulb is immersed in a liquid or gas whose temperature is to be measured. If the volume of the inclosed gas expands with the higher temperature that is to be measured, then this expansion is counterbalanced by raising the vacuum chamber and the flexible tube on the right until the increased pressure of the mercury column compresses the expanding gas in the large bulb so as to keep it at a constant volume, which is indicated by the fact that the mercury in the left-hand tube just touches the tip of a fine glass point that is permanently fastened inside the tube. The pressure exerted by the

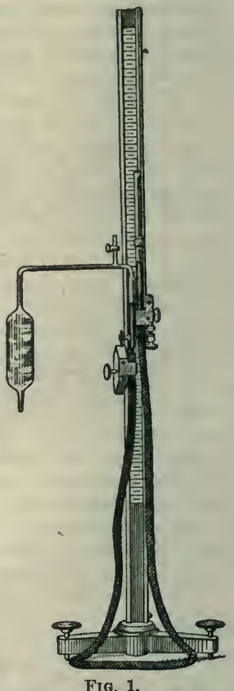


Fig. 1.
JOLY AIR THERMOMETER.

mercurial column is measured by the difference in the level of the mercury in the right-hand and left-hand tubes. The scale for this measurement is graduated on a strip of mirror set into the vertical framework that supports the bulb and the tubes.

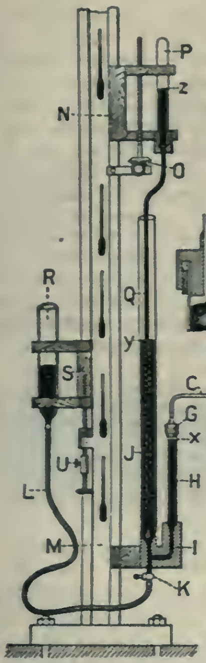


Fig. 2. Chappuis air thermometer.

In Fig. 2 we see an arrangement of the air thermometer for more exact measurements, etc. The thermometric substance (nitrogen) is inclosed in the platinum bulb A, which is supported inside of a bath, B, which is so arranged that the hot gas or liquid whose temperature is to be measured may completely surround the bulb by flowing in at E and out at F. D D are metal screens. There are a number of mercurial thermometers, T, which are at the same temperature as the bulb. The bulb communicates with the barometer at G by the tube C, the connection being shown enlarged at V. The pressure of the mercurial column needed to keep the gas in the bulb at a constant volume is that due to the height of the column from X to Y, and may amount to several atmospheres, or to a height of many feet. The lower end of the mercurial column, or the tube H, I, J, K, is fixed, but the upper tube, P Q, can be raised indefinitely. As Q rises inside of the large tube, J, more mercury may be needed, and this is supplied from the reservoir, R, through the flexible tube, L. The difference in height between the mercurial surfaces at X and Z is measured by a reading telescope or cathetometer. M is the upright standard carrying the apparatus, N a movable cradle for the barometer tube worked by the adjusting screw O. S is a similar arrangement for the reservoir, R, with its adjusting screw, O.

The Mercurial Thermometer. This consists of a glass bulb terminating in a long capillary tube. The bulb and lower portion of the tube are filled with clean mercury, while the upper portion is supposed to be quite empty and to be hermetically sealed. When the bulb is warmed the mercury is seen to rise in the tube, because it expands more than the glass of the bulb. This difference of expansion is not regular, nor is it the same for all kinds of glass or for impure mercury. If we wish to construct an independent standard mercurial thermometer, we immerse the bulb in melting ice and make a slight scratch on the glass tube to mark the height of the mercurial column. A similar mark is made for boiling water and the space between the two is divided into a hundred equal parts for centigrade degrees, or a hundred and eighty equal parts for Fahrenheit degrees. This intermediate space is called the fundamental distance. Owing to the irregular expansion of mercury in glass, the so-called standard mercurial thermometer will differ from the standard air thermometer by as much as half a degree about midway between freezing and boiling water. Therefore for accurate work the mercurial should be carefully compared with the air thermometer and the resulting system of corrections throughout the entire length of the scale should be well determined and carefully applied. Owing to the gradual contraction of the glass bulbs, which goes on for several years after they are freshly made, the mercurial thermometer usually has an error that increases with the lapse of time. This error is due to the change in the volume of the bulb, and should be determined after any important work has been done by immediately making a new determination of the freezing point. Instead of this procedure the error can be calculated theoretically, but the actual new determination is far preferable.

A thermometer is not considered first class whose errors of division exceed one or two tenths of a degree centigrade, or two or three tenths Fahrenheit. In determining the temperature of a liquid by the use of the mercurial thermometer one must be very careful to keep the liquid thoroughly stirred, because when permitted to rest the colder portions of the liquid settle. In meteorological work all thermometers are exposed in some sort of protecting cage through which the wind may blow freely, but into which the sun's rays, or any obnoxious radiation, cannot penetrate. It is believed that after making due allowance for the sluggishness of the thermometers and the inefficiency of the screens and the ventilating apparatus, it is still true that the various meteorological services of the world obtain the temperature of the air within a half degree Fahrenheit or two-tenths Centigrade. A general comparison between the Centigrade and Fahrenheit scales is given in the accompanying table:

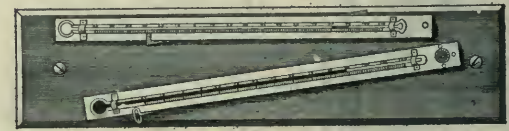
Cent.	Fahr.
+125°	+257°
100	212
75	167
50	122
+ 25	+ 77
0	+ 32
— 17.8	0
— 25	— 13
— 40	— 40
—273	—491

The Dew Point Thermometer. This is an ordinary thermometer specially arranged for the determination of the temperature at which dew is formed in the atmosphere when the air is cooled. To this end the bulb and larger part of the stem of the thermometer are immersed in a thin glass cup nearly full of sulphuric ether. A current of air is driven rapidly through the ether, causing it to evaporate and therefore to cool. The thermometer follows the falling temperature of the ether until the observer perceives the deposition of dew on the outside of the glass cup. The current of air is then cut off. The ether and glass cup begin to warm; the dew evaporates from the surface, and as it disappears the temperature is again read off. The mean of the two readings of the thermometer corresponds closely to the dew point. See Hydrometry.

The Wet Bulb Thermometer. This is an ordinary thermometer whose bulb is covered very neatly with the thinnest muslin which is kept wet. The wet bulb thermometer should either be rapidly whirled in the air or else exposed to a current of air at the rate of five or ten feet a second. The evaporation of the water cools the thermometer to the temperature of evaporation, which is about half way between the temperature of the air and the temperature of the dew point. The combination of a dry bulb and a wet bulb thermometer constitutes a psychrometer, and the whirled or ventilated psychrometer is the ordinary apparatus used by meteorologists for determining the humidity of the atmosphere. The formulæ and tables used by the Weather Bureau in this work are those prepared by Professor C. F. Marvin and published as Weather Bureau Document No. 235 (Washington, 1900). See Hygrometer for illustration and further description.

The Alcohol Thermometer. This differs from the mercurial thermometer only in that the interior liquid is alcohol. But this difference is important from many points of view, since one class of errors disappears and another is introduced. Alcohol or ether must be used for the measurement of very low temperatures, since mercury freezes at about —40° Fahrenheit. The principal error in using the alcohol thermometer for low temperatures arises from the fact that the liquid becomes viscid, adheres to the sides of the glass tube, and requires a long time to drain down, which indeed it never does perfectly. The alcohol thermometer cannot be used for temperatures above its boiling point or 80° Centigrade, whereas the mercurial can be used up to a temperature of about 350° Centigrade.

Solar Radiation Thermometer, or Black Bulb Thermometer. This is essentially an ordinary mercurial thermometer, whose bulb is covered with a thin layer of non-reflecting and almost perfectly absorbing lampblack. Under the assumption that the black bulb thermometer absorbs and radiates more easily than the plain glass bulb, and especially more so than a polished silver bulb, the difference between the readings of two such thermometers exposed to the sunshine will depend primarily upon the intensity of the radiation received by them. In order to measure the solar radiation, it is necessary, first, to diminish as much as possible the conduction and convection of heat to or from thermometer bulbs. They are, therefore, inclosed in large thin glass bulbs within which there is as perfect a vacuum as it is possible to make. It is also necessary to cut off as much as possible of radiation from the surrounding objects, and especially reflected sunshine by means of screens. Under these conditions the solar radiation thermometer, or the so-called Arago-Davy actinometer may be used in two ways: (1) The static method. The thermometers are allowed to attain the highest temperatures they can in the full sunshine; the difference between their readings expresses approximately the intensity of the solar radiation, the exact value of which may be more exactly computed by the method and formulæ given by Professor William Ferrel in his memoir "Temperature of the Atmosphere and Earth's Surface," pages 34-50, *Professional Papers of the Signal Service No. 13* (Washington, 1884). (2) The dynamic method. The bright and black bulb thermometers are successively exposed to the full sunshine and shaded from it a minute at a time, so that one may determine the initial rate of increase of temperature in the sunshine and the rate of cooling in the shade. From these rates the solar radiation is calculated by the formulæ first applied by Pouillet to his actinometer.



U. S. WEATHER BUREAU MAXIMUM AND MINIMUM THERMOMETER.

The Maximum Thermometer. This is usually a mercurial thermometer having a device by which the top of the column of mercury remains at the highest point that it attains during any given interval of time until the observer has recorded the reading and adjusts the instrument for another observation. In the Rutherford maximum the stem of the thermometer lies nearly horizontal. The rising mercury pushes a little steel index upward within the bore of the tube. When the temperature falls the index is left in place until the observer draws it back to the top of the mercurial column by means of a magnet. In the Phillips or Walferdin thermometer the thermometer stem is horizontal. A small bubble of air makes a permanent break in the upper part of the mercurial column. When the temperature begins to fall the lower column contracts into the bulb, but the upper portion remains and registers the maximum temperature. The Negretti and Zambra maximum thermometer has the bore of the tube constricted below the bottom of the scale so that the mercury that has pushed up past this point cannot easily slide back. After the maximum temperature has been recorded the observer forces the column of mercury back by whirling the thermometer in a circle. The clinical thermometers of physicians are made after this pattern.

The Minimum Thermometer. The best form of this the Rutherford alcohol minimum, in which the stem is kept nearly horizontal, and the contracting column of alcohol draws downward a light steel or glass index which remains in place when the temperature rises. The observer sets the index anew by drawing it back by means of a magnet.

Combined Maximum and Minimum or Six's Thermometer. This consists of a U-shaped tube whose upper ends have respectively a large bulb full of alcohol and a small bulb containing air and vapor of alcohol. The lower portion of the legs of the U is filled with mercury and in each leg there floats an index. One of these indices is forced up by the expansion of the alcohol in the bulb and the index is left at the maximum temperature. The other index is raised by the contraction of the alcohol and the consequent rising of the mercury which is pushed up by the expansive force of the air pressure in the small bulb. Modifications of this thermometer are used in Austria, England, and America, but none of its forms is considered to be so reliable as the separate maximum and minimum thermometers previously described.

THE UPSETTING THERMOMETERS. These were invented by Negretti and Zambra and have been modified and improved from time to time. An ordinary thermometer has its tube so bent that when the thermometer is turned upside down the column of mercury above the constriction will run off into a separate portion of the tube, where it remains until the observer can make the necessary reading. The thermometer is especially adapted for recording deep ocean temperatures or temperatures at any hour of the night.

METALLIC THERMOMETERS. These depend for their action upon the differential expansion of metals. As made by Breguet, 1817, or Herrman and Pfister, 1865, they consist essentially of two thin spiral bands of different metals soldered together. Differences of temperature cause the spiral to coil or uncoil and the apparatus can easily be adapted for self-registration.

OPTICAL THERMOMETERS. The plane of polarization of a quartz crystal is rotated about the axis of a beam of light by the varying temperature of the quartz, increasing with great regularity with the increase of temperature. This apparatus is recommended by Cornu for the study of high temperatures when the gas thermometer fails because of the softening of the bulbs containing the gas or air.

ELECTRIC THERMOMETERS. Melloni's thermoelectric pile. Pairs of pieces of different metals are soldered together and the extremities communicate by a wire with a needle galvanometer. Any difference of temperature between two consecutive junctions causes the electric current to traverse the wire; its strength is measured by the galvanometer. The absolute value of the galvanometer scale can be expressed in thermometric degrees by means of careful comparisons. The thermo-electric thermometer can be made to give extremely reliable results.

RESISTANCE-COIL THERMOMETER. (1) Absolute resistance—the resistance experienced by an electric current flowing through an insulated wire—ordinarily increases with the temperature of the wire, and is shown by the deflection of a galvanometer needle. The resistance is not precisely proportional to the temperature, but if it has been determined at several temperatures the wire or coil can be used for all other temperatures. By using a coil of platinum wire, a wide range of temperatures may be measured with great accuracy. See Marvin, "Recent Progress in Physical Science," *Bulletin of Philosophical Society* of Washington, vol. xiv., p. 110. (2) Differential resistance. Two similar resistance coils are balanced against each other, one of them being in the region whose temperature is to be measured, the other in a bath of liquid whose temperature can be varied and can be observed at any time by means of a thermometer. If the galvanometer needle shows that the resistance of the two coils is the same, then it is understood that the temperatures must be the same. If the resistances differ, then the liquid surrounding the accessible coil is warmed or cooled until equality is attained.

THE THERMOPHONE. This is a differential resistance thermometer, as just described, but combined with a telephone instead of a galvanometric needle. The equality of temperature due to the absence of an electric current is indicated by the absence of all sound when one listens at the telephone. This instrument, the invention of G. C. Whipple, is both accurate and portable and very convenient for use in boats on lakes or at sea. Consult "The Thermophone," *Technology Quarterly*, vol. viii., p. 25 (Boston, 1895).

LANGLEY'S BOLOMETER. This is a differential thermometer in which the difference of temperature of two delicate wires is shown by the deflections of a galvanometric needle. See BOLOMETER.

DEEP SEA THERMOMETER. This is an ordinary or self-registering mercurial thermometer wholly inclosed within a very strong protecting case of glass. The space between the thermometer and its inclosure is partly filled with water or mercury above which some air remains. When this arrangement is lowered to the bottom of the ocean the great external pressure compresses the inclosure, but does not seriously affect the bulb of the thermometer within.

SOIL THERMOMETER. This was formerly made with a large bulb and wide tube many feet in length so that a bulb buried at a depth of even twenty feet would show the top of the liquid column above the surface of the earth. As these were expensive, sluggish, and liable to accident, the modern practice is to use an ordinary thermometer inclosed in a wooden tube and pushed down to the proper depth in a hole in the ground. Modern electric thermometers, especially the thermophone, are to be recommended.

NOCTURNAL RADIATION THERMOMETER. This is supposed to give the approximate temperature of a surface exposed to radiation during the night time. The bulb is of glass, sometimes, but not necessarily, blackened; it is fully exposed to the open sky. If all terrestrial heat is cut off by screens the thermometer may be made to give an indication of the clearness of the sky or the temperature of the air that occupies the dome of the sky. If, however, no attempt is made to cut off the radiation and conduction of heat, the thermometers give the temperature of the leaves on the trees. If the thermometer lies upon the upper surface of a metal or wooden or stone object it gives approximately the temperature of the upper surface layer of that object.

INTEGRATING THERMOMETER. This is intended to sum up the temperature, or it may be the temperature changes during any given interval of time. A clock or chronometer whose pendulum or balance wheel is uncompensated or even intentionally over-compensated has a rate that varies with the temperature and becomes an admirable integrator. A metal bar supported on an inclined surface by means of sharp-pointed feet at either end, creeps upward with alternating rising and falling temperatures. Each step of its progress is proportional to the difference between the successive maxima and minima. Thus such an arrangement will, in the course of a month, sum up the daily ranges of temperature.

The Evaporation Thermometer. In 1888 Dr. Müller-Erzbach brought out a thermometer in which a vessel full of water in the sunshine communicates with an empty vessel in the shade. The water evaporated in the former condenses over into the latter vessel where it is absorbed by concentrated sulphuric acid. The weight lost in one vessel or gained in the other is an index to the average temperature that has prevailed in the water flask. Comparative observations give the means of converting these weights into temperatures. Experimental tests of this form of integrating thermometer made at the Seewarte in Hamburg show that this apparatus gives excellent results when the daily temperature variations are not too great.

Thermographs. This term may include all forms of apparatus in which continuous registration is introduced. To this end the English Meteorological Office employs photography, maintaining, as it were, a continuous photographic register of the variations of the top of the mercurial column. The French and the United States Weather Bureaus use the thermographs made by Richard at Paris, in which some form of metallic thermometer is attached to a pen which moves vertically over a sheet of paper that is drawn horizontally by clockwork so that the temperature may be subsequently read off at any given moment.

Owing to the great importance of the thermometer in every branch of science and the arts, the principal governments of the world have established bureaus of standards for the comparison and calibration of this and other forms of measuring apparatus. In all cases private individuals may send their thermometers to these institutions for examination and may receive certificates stating the exact value of the corrections for their errors if any exist. Such institutions are the following: the Kew Observatory at London, now a branch of the Bureau of Standards; the Imperial Physical and Technical Institute at Charlottenburg, near Berlin; the International Bureau of Weights and Measures, Paris; and the Bureau of Standards established by the United States Government at Washington, under the Treasury Department in 1900, and transferred to the Department of Commerce and Labor in 1903. See Thermometry and the works of reference there mentioned.

THERMOMETRY (from Gk. θέρμη, *thermē*, heat + -μετρία, *-metria*, measurement, from μέτρον, *metron*, measure). The science of assigning proper numerical values to the temperature of bodies. As explained in Heat, this involves several steps, the arbitrary selection of: (1) some substance as the thermometric body, (2) some property of it which changes with the temperature, (3) two standard thermal states, e.g. melting ice and boiling water at standard pressures, (4) the scale or the number of degrees between these standard temperatures, and (5) a number to give one of these standard temperatures.

By definition the 'temperature on the standard hydrogen thermometer,' Centigrade scale, is as follows:

Hydrogen is the gas used, the initial pressure being 100 cm. of mercury. Change in pressure at constant volume is the effect measured.

The two standard thermal states are (1) melting ice and (2) vapor rising from boiling water at normal atmospheric pressure.

One hundred degrees are chosen between these two temperatures. The temperature of melting ice is called 0°. Then, if p_0 is the pressure of the gas at 0°, p_{100} that at 100°, and p that at the temperature (t) to which a number is to be given,

$$t = 100\,\frac{p - p_0}{p_{100} - p_0}$$

Other gases than hydrogen might be used; and the same definition would apply to temperature on the new scale as on the hydrogen scale. Slight differences, however, would always be observed between the numerical values for the same temperatures.

If the change in volume is the heat-effect observed as the temperature is changed, the obvious definition of the numerical value of the temperature is

$$t = 100\,\frac{v - v_0}{v_{100} - v_0}$$

where v_0, v_{100}, v are the measured values of the volume of the gas or liquid at 0°, 100°, t°.

If the change in the electrical resistance of a given conductor is the heat-effect measured as the temperature is changed, the definition of t is

$$= 100\,\frac{R - R_0}{R_{100} - R_0}$$

where R_0, R_{100}, R are the electrical resistances at 0°, 100°, t°.

Similarly almost any heat-effect of any body may be taken as the one to measure in order to secure a number for temperature; but the numbers so found all differ in general; and if any thermometer other than the hydrogen one is actually used, the observed numbers must all be corrected by a calibration table connecting the scale of the thermometer used with the hydrogen one.

For measuring ordinary laboratory temperatures either mercury-in-glass or air-thermometers are used; for measuring extremely low temperatures, e.g. —200° C., a hydrogen thermometer or a platinum-resistance thermometer is generally used; for high temperatures, e.g. 300° C., a platinum-resistance thermometer or a thermocouple is used. (See Thermometer and Thermo-Electricity.) For a full discussion of these and other methods reference should be made to the Reports of the International Congress of Physics, Paris, 1900, vol. i., articles by Chappuis and Barus.

The scale of temperature as defined above is known as the 'Centigrade' or 'Celsius' (q.v.) scale. There are several other scales in use. The 'Fahrenheit' scale has 32° for the melting point of ice and 212° for the boiling point of water; the 'Réaumur' (q.v.) scale has 0° for the former temperature and 80° for the latter; the 'absolute gas scale' adds to the temperature on any scale the reciprocal of the coefficient of cubical expansion of hydrogen as determined on that scale—on the Centigrade scale this reciprocal is 273.04, and so $t°$ C. is $(t \times 273.04)°$ absolute. It is shown in Thermodynamics (q.v.) that there is a method of defining temperature quite independent of the thermometric substance, and in which the only arbitrary things are the choice of a number for the difference between the temperatures of any two thermal states. This scale is called 'Thomson's absolute scale,' because it was proposed by William Thomson (now Lord Kelvin). If it is agreed to have the temperature of freezing and boiling water 100° apart, it is found that the numbers on the Thomson absolute scale agree most remarkably with those given on the absolute gas scale as defined above.

History. The invention of the thermometer must be attributed to Galileo, who in about the year 1593 made an open-air thermoscope, consisting of a bulb with a long tube attached, which was provided with a scale and dipped below the surface of a liquid—water or wine; some of the air was expelled from the bulb, and so the liquid rose in the tube. This thermometer was used by Galileo for various purposes, such as studying freezing mixtures and recording atmospheric temperatures. It was later used (1611) by Sanctorius in the diagnosis of fevers. The word 'thermoscope' was used by Bianconi in 1617, and 'thermometer' in 1624 by Leurechon. The first sealed thermometers were those of Ferdinand II., Grand Duke of Tuscany (1641); these contained alcohol. In 1661 Fabri made a scale, using as the 'fixed' temperatures those of snow and of midsummer heat. Robert Hooke in 1664 proposed the freezing point of water as one of the fixed temperatures; and in 1694 Renaldini proposed this as one, and the boiling point of water as the other. In 1709 Fahrenheit introduced his alcohol thermometers, and 1714 his mercury ones. About 1731 Réaumur devised his scale, which until recently was in extensive use on the Continent of Europe. In 1742 Celsius proposed a Centigrade scale, with the temperatures of melting ice 100° and boiling water 0°. Christin, working independently of Celsius, proposed a Centigrade scale in 1743 which is the Celsius scale inverted, and is the one used now. A complete history of the ordinary thermometer is given in Bolton, *Evolution of the Thermometer* (Easton, Pa., 1900); in Abbe, *Meteorological Apparatus and Methods* (Washington, 1887); and Gerland and Traumüller, *Geschichte der physikalischen Experimentierkunst* (Leipzig, 1899). See Thermometer.

THERMOPHONE. See Thermometer.

THERMOPILE. See Thermo-Electricity.

THERMOP'YLÆ (Lat., from Gk. *Θερμοπύλαι*, from *θερμός*, *thermos*, hot + *πύλα*, *pyla*, gate). A pass famous in ancient Greek history, leading from Thessaly into Locris, named from the presence of several hot springs. It is situated south of the present course of the river Sperchius, between Mount Œta and the Maliac Gulf. In ancient times it was only a narrow track, perhaps fifty feet wide, but the alluvial deposits have altered the coast line so that there is now a broad swampy plain from a mile and a half to three miles broad. Thermopylæ has won an eternal celebrity as the scene of the heroic death of Leonidas (q.v.) and his three hundred Spartans in their attempt to stem the tide of Persian invasion (B.C. 480). In B.C. 279 a large army of Greeks held Brennus and his Gauls at bay until they also found a path over the mountains. The Greeks, however, escaped on their fleet. Again, in B.C. 191, Antiochus endeavored to check the Romans at this point, but Cato led a flanking party over the mountains, stormed the fortress which commanded the path, and, aided by a frontal attack of the main force, routed the Syrian army.

THERMOSCOPE (from Gk. *θέρμη*, *thermē*, heat + *σκοπεῖν*, *skopein*, to look). A device to indicate relative temperatures by making use of the property possessed by substances of changing their state or volume under the influence of heat. Thus, knowing the fusing point of a solid, we are enabled to determine whether a certain temperature is above or below the temperature at which it melts, while with a liquid we have two such points; namely, the temperature of vaporization and that of solidification. Such substances form what are termed discontinuous intrinsic thermoscopes and by virtue of their intrinsic properties enable us to ascertain relative temperatures. For example, butter would serve as such a thermoscope, since by its melting it would indicate that the temperature of the room was above its point of fusing. Likewise we soon use other substances, including alloys, for this purpose, and extend our observations over a considerable range. If the substance used as a thermoscope possesses the property of continuously varying in its condition with an increase or diminution of temperature, so as to afford a continuous indication over a given range of temperature, as is the case with mercury, then we have what is known as a continuous thermoscope. If this is so arranged that it can be graduated according to some previously arranged scale it then forms a thermometer. The camphor thermoscope is a sealed tube of glass containing a solution of camphor in alcohol, which indicates changes in temperature by its appearance. At high temperature the liquid is clear, as the camphor is entirely dissolved, but with low temperature it crystallizes and appears as a white fleecy mass. This instrument does not, as is commonly supposed, indicate changes either in pressure or electrical condition of atmosphere.

THERMOSTAT. See Fire-Alarm Telegraph, paragraph *Automatic Fire Detectors*.

THERMOTROPISM (from Gk. *θέρμη*, *thermē*, heat + *τροπή*, *tropē*, a turning, from *τρέπειν*, *trepein*, to turn). Primarily, the sensitiveness of plant organs to the direction of radiant heat which causes them to bend (positively) toward or (negatively) away from its source. The same organ may be both positively and negatively thermotropic under different conditions. It is often difficult to separate this phenomenon from that of heliotropism (q.v.), with which it is parallel, but there are several well-established cases of thermotropism of roots and shoots of higher plants. If shoots of germinating maize or mustard seeds be placed in the dark and at the right distance from a suitable heat-radiating surface, they will bend according to the intensity of the heat either toward or away from the radiator. The term has also been used incorrectly to denote movements due to a change in temperature, such as those of the sepals and petals in the opening and closing of the tulip flowers. Many leaves show this response also, e.g. those of rhododendron. All these reactions, however, are not examples of true thermotropism, but are rather comparable to those responses of leaves to variations in light intensity which are embraced by the terms nyctitropic movements and paraheliotropism.

THÉROIGNE DE MÉRICOURT, tȧ'rwän'y' de mȧ'rā'kōōr' (1762-1817). A prominent figure during the French Revolution. She was born at Marcourt near Liège. Her true name was Anne Josèphe Terwagne. In 1789 she went to Paris, and entered upon a life of shame. Knowing all the leaders of the Revolution, she became an enthusiastic Republican and the commander of the mobs of women that played such a conspicuous part in the dramatic days of the Revolution. Armed with sabre and pistol, this Amazon of Liberty, as she was called, led her feminine battalions against the Bastille July 14, 1789, to Versailles on October 5-6 of the same year, and after her return from an Austrian prison was prominent during the disturbances on June 20 and August 10, 1792. In May, 1793, while defending the Girondist Brissot, her lover, she was seized, stripped, and whipped by a mob of maddened women. She became insane from this treatment, and spent the rest of her life in La Salpêtrière.

THEROMORPHA (Neo-Lat. nom. pl., from Gk. *θήρ*, *thēr*, wild beast + *μορφή*, *morphē*, form). A name applied to several widely dissimilar groups of fossil reptiles which possess certain common characters of skull, vertebræ, limb-girdles, and digital formula. Another ordinal name, *Anomodontia*, is often used synonymously with Theromorpha. The thermorophs, together with the turtles and plesiosaurs, compose the great reptilian division *Synapsida* (Osborn), characterized by certain mammal-like features of the skull and the mammalian digital formula. All known theromorph remains have been found in the rocks of Permian and Triassic age. They were for the most part animals of rather heavy build, adapted to land life and sluggish habit, though one group appears to have been marine. The following suborders are commonly recognized:

(1) Cotylosauria or Pareiasauria. A group of reptiles having a solid cranial roof with a large pineal, foramen, and usually with teeth on the vomer, pterygoid, and palatine bones. It is probable that these forms stand closest to the ancestral Stegocephalia or armored Amphibia. The best-known example is *Pareiasaurus*, from the Karoo beds of South Africa, a heavily built land animal, eight feet long. (2) Theriodontia. A group which closely resembles mammals in the differentiation of the teeth into incosors, canines, and molars, and in certain features of the skull. Most genera have a distinctly carnivorous dentition, but a few, the Gomphodontia have crushing molars. Nearly all the known theriodonts are from the South African Trias. Cynognathus, in which the skull is remarkably dog-like, equaled the black bear in size and general proportions. Many zoölogists believe that mammals have been derived from theriodonts. (3) Dicynodontia. Land reptiles from the Trias of Scotland and South Africa, known chiefly from the skull, which is greatly modified, having the teeth entirely wanting, as in Udenodon, or reduced to a single pair of large tusks in the upper jaw, as in Dicynodon and Gordonia. (4) Placodontia. Named from the large, knob-like crushing teeth. Placodus, the first named genus from the marine Trias of Germany, was long known only from these teeth. The genus Placochelys is known to have had a carapace composed of a mosaic of small plates. The view held by some paleontologists that placodonts are ancestral to turtles is untenable.

SKULL OF A THERIODONT (*Galesaurus*).

THERSITÉS, thẽr-sī'têz (Lat., from Gk. Θερσίτης). In the *Iliad*, the ugliest and most impudent talker amonog the Greeks assembled before Troy. He is represented as reviling Agamemnon and Achilles, and is beaten by Odysseus for his insolence. Later writers said he was a son of Agrios, brother of Œneus, and was slain by Achilles, whom he had mocked after the death of Penthesilea.

THESAURUS. See DICTIONARY.

THESE'UM (Lat., from Gk. Θησεῖον, *Theseion*, building sacred to Theseus, from Θησεύς, *Theseus*, Theseus). An heroön or sanctuary of the hero Theseus (q.v.). The most celebrated one was that at Athens, which seems to have stood near the centre of the city, to the northwest of the Acropolis, and not far from the Stoa of Attalus. Built about B.C. 473, when Cimon brought the reputed bones of Theseus from the island of Scyros to Athens, it was decorated by Polygnotus and Micon with paintings representing Theseus's descent into the sea to Amphitrite, his battle with the Amazons, and the battle of the Centaurs and the Lapithæ. It was an important sanctuary, and the sacred precinct in which it stood was an asylum for fugitive slaves, or those who were oppressed. Here, too, the thesmothetæ drew the lots for the choice of the archons.

The name is commonly applied to the best preserved temple in Greece, which stands on a low hill (Colonos Agoraios) to the west of the ancient Agora of Athens, though the true Theseum must have been on the east. The building is a Doric hexastyle peripteros with thirteen columns on the side, and owes its preservation to its transformation in early Christian days to a church of Saint George. Its present name rests only on an anonymous description of Athens from the end of the fifteenth century, and is directly opposed to all the ancient testimony. The correct name of the building is still uncertain. It has been identified with the temple of Ares, of Hercules in Melite, of Apollo Patroös, and of Hephæstus and Athena Ergane; the last being the most plausible. It is certainly a work of the Periclean age, and probably somewhat later than the Parthenon, though on this point good authorities differ. The exterior of the building has been comparatively little harmed by the course of time, but the interior has been remodeled to serve as a church. A few years ago it was a museum, and it still serves as a storeroom for unimportant antiques. Of the sixty-eight metopes only eighteen are sculptured, namely, the ten across the eastern end, representing labors of Hercules, and the four adjoining metopes on each side, representing deeds of Theseus. Across the ends of the cella an Ionic frieze replaces the Doric, and at the eastern end is prolonged beyond the walls of the cella to the beams of the peristyle. The shorter west frieze contains the contest of the Centaurs and the Lapithæ, while the east frieze represents a battle in the presence of six seated gods, but no sure interpretation of its meaning has been reached. The sculptures which originally adorned the pediments have disappeared.

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THESEUS, thē′sê-ŭs *or* thē′sūs (Lat., from Gk. Θησεύς). The national hero of the Athenians, and, next to Hercules, the most famous character of Greek legend. His story owes its prominence largely to the influence of Athens in Greek art and literature, for in the epic Theseus has but small place. A doubtful verse in the *Iliad* associates him, not with Athens, but with the Thessalian Lapithæ and their conflict with the Centaurs, and he appears in the late passage of the *Odyssey* which describes the visit of Odysseus to the lower world. The early art knows only the slaying of the Minotaur, and seems to have borrowed the type from Mycenæan tradition. Though a thoroughly satisfactory analysis of the Theseus legend is still lacking, it seems probable that it was closely connected with the Marathonian tetrapolis, then crossed to Trœzen, whence it returned to Athens. Its first great development occurred under the Pisistratidæ, when Theseus was recognized as the uniter of Attica, and the type of the gentle and just ruler, beloved of his people, a sort of mythical predecessor of Pisistratus. Soon after the Persian wars the democracy transformed him into its real founder, who protected the injured from other States and forced Creon and Eurystheus to observe justice and humanity. At this time (B.C. 473) his reputed bones were brought from Scyros to Athens with great pomp by Cimon, and an heroön, the Theseum (q.v.), was erected. In origin, Theseus is probably best considered as a beneficent deity, a local parallel to Hercules, who slays monsters and gives peace and security to his worshipers, but, like other nature-divinities, descends into the lower world, and is subject to the powers of death. Legend made Theseus the son of Æthra, daughter of Pittheus, King of Trœzen. His father was commonly said to be Ægeus, King of Athens, though early legend recognized the paternity of Poseidon. (The two versions are really the same, Ægeus being originally a name of the sea-god.) He was brought up at Trœzen, and, on reaching manhood, proceeded to his father's residence at Athens. On his way thither across the isthmus he destroyed robbers and monsters who rendered the route unsafe for travelers, such as Periphetes, Sinis, the Crommyonian sow, Sciron, Cercyon, and Procrustes. (See PROCRUSTES.) On his arrival in Athens he found the sorceress Medea living as his father's wife, and only escaped her attempt to poison him through Ægeus's timely recognition of his own sword and sandals, which he had left in Trœzen for his son. Medea fled and Theseus overcame Pallas and his sons, who attempted to secure the royal power. He also bound the Marathonian bull, which was ravaging the Tetrapolis. Then came the expedition to Crete to deliver Athens from its tribute to the Minotaur (q.v.) of seven youths and seven maidens. On this voyage he proved his descent from Poseidon by bringing back the ring of Minos from the depths of the sea, and by the help of Ariadne (q.v.) killed the Minotaur. On his way back he founded a festival of Apollo at Delos, to which the Athenians ever after sent an annual embassy.

As his father, Ægeus, had destroyed himself in the belief that his son had perished in Crete, Theseus now became King of Athens, and consolidated into one State the twelve independent communities of Attica, in celebration of which event was instituted the festival of the Panathenæa. That the festival commemorated such an event is probable, but this does not prove the historical personality of Theseus. Legend also told of his friendship for the Lapith King Pirithoüs, at whose wedding he fought the Centaurs (see LAPITHÆ), with whose aid he carried off Helen to Aphidna, and with whom he finally descended to the lower world that his friend might carry off Persephone as his bride. Pirithoüs never returned, and Theseus remained in captivity till Hercules, on his quest for Cerberus, prevailed on Hades to release him. Athenian legend also told of the great invasion of the Amazons in his reign, of the straits to which they reduced the Athenians, and of their final rout by the hero, who secured as wife their queen, Antiope or Hippolyta, by whom he had a son, Hippolytus. Later he married Phædra (q.v.), daughter of Minos and sister of Ariadne. It was said that during his absence in the lower world Menestheus, with the help of Castor and Pollux, who had come to rescue Helen, made himself King, and that Theseus, unable to reëstablish his authority, went to Scyros, where he was murdered by Lycomedes. Much in the character of Theseus as it appears in legend seems due to Athenian desire to represent their national hero as the embodiment in heroic times of the virtues on which they prided themselves in historic times, and which the great heroes of the national epic often conspicuously lacked.

THES′MOPHO′RIA. See GREEK FESTIVALS.

THES′MOPHOR′IAZU′SÆ (Lat., from Gk. Θεσμοφοριάζουσαι, *Thesmophoriazousai*, women celebrating the Thesmophoria). A comedy by Aristophanes (about B.C. 410). It is aimed against Euripides for his innovations and his dislike for women, on account of which he is dragged to justice by women taking part in the Thesmophoria.

THESPE′SIUS (Neo-Lat., from Gk. θεσπέσιος, divinely, sounding divine). An herbivorous ornithopod dinosaur, allied to Hadrosaurus and Iguanodon, which it closely resembles, found fossil in the Upper Cretaceous beds of Colorado, Wyoming, and Montana. It was a large animal, 25 to 30 feet long and 10 to 15 feet high, with medium-sized head, small, almost useless fore limbs, and well-developed three-toed hind limbs upon which it ran in bipedal motion, using its heavy tail to balance the forward portion of the body. Another name for this creature is Claosaurus. A complete skeleton of this animal, mounted as if in the act of running, is in the museum of Yale University. Consult: Marsh, "The Dinosaurs of North America," *Annual Report of the United States Geological Survey*, vol. xvi., part i. (Washington, 1896); Beecher, "The Reconstruction of a Cretaceous Dinosaur, Claosaurus annectans Marsh," in *Transactions of the Connecticut Academy of Sciences*, vol. xi. (New Haven, 1902). See DINOSAURIA.

THES′PIÆ (Lat., from Gk. Θεσπειαί, *Thespeiai*, Θεσπιαί, *Thespiai*), or THESPIA. An ancient town in Bœotia, near the foot of Mount Helicon. Like Platæa, it was hostile to the Theban pretension to supremacy in Bœotia, and these two were the only Bœotian cities which refused to give earth and water to the heralds of Xerxes and did not side with the Persians at the battle of Salamis. Seven hundred Thespians joined Leonidas at Thermopylæ, and were slain in defending the pass. Thespiæ was burned by Xerxes, but was subsequently rebuilt. Shortly after the battle of Leuctra (B.C. 371) it was again destroyed, and was afterwards a second time restored. Here was preserved a marble statue of Eros by Praxiteles. On account of the vicinity of Mount Helicon to the town, the Muses were called *Thespiades*. The site of the ancient town was near the modern village of Eremokastro.

THES′PIS (Lat., from Gk. Θέσπις). A native of the Attic deme of Icarus in the sixth century B.C., called the father of Greek tragedy. He introduced an actor to reply to the leader of the chorus, who before had recited the adventures of Dionysus and had been answered by the chorus, and thus made an important step toward the drama.

THESSALONIANS, EPISTLES TO THE (Gk. πρὸς Θεσσαλονικεῖς, sc. ἐπιστολή, *pros Thessalonikeis*, to the Thessalonians, sc. *epistolē*, epistle). Two letters in the New Testament, purporting in their opening passages of greeting to have been written by Paul, and generally so accepted by scholars. They were written in Corinth during Paul's first visit to that city in the year 50-51 within a few months of each other, and, if a later date for Galatians be accepted, are the earliest of the preserved writings of the Apostle. They were sent to the Christian community of Thessalonica, where Paul had but recently preached the gospel, in order to comfort his people in the persecution they were suffering, the beginnings of which had driven Paul and his companions from the city. They are consequently marked by an absence of doctrinal discussion. In fact, apart from a short apologetic passage in the first Epistle, a brief statement in the same Epistle regarding the advent of Christ, and a more elaborated one in the second Epistle as to the coming of the Day of the Lord, involving a declaration of the character and work of the 'Man of Sin,' they may be considered purely pastoral letters whose concern is with the readers' practical religious needs—and even in these excepted passages the spirit of the writer is essentially that of the pastor.

Both Epistles were rejected by the Tübingen School (1845) and are disowned to-day by the radical Dutch School (1882), the force of whose criticism, however, is largely broken by the general negative position which they maintain toward all of Paul's writings. At the same time there is considerable critical debate regarding the Paulinity of the second Epistle—due to the difficult passage in chapter ii. regarding the 'Man of Sin'—a passage the subject of which is a most unusual one with Paul and the meaning of which in itself is most obscure. It is argued on the one side that the unusual character of this passage in Paul's Epistles—no parallel to it being found in his writings—the agreement of the picture which it presents with any one of several situations late in the century, particularly with the situation occasioned by the expected return of Nero, and the evident literary dependence of the rest of the Epistle on I. Thessalonians, all show the author to have been some one after Paul's day, who, apparently out of a desire to quiet tendencies to disorder consequent upon expectations of the immediate coming of Christ, described the events which must necessarily precede that coming, writing in the name of Paul in order to secure authority for his statements, and modeling his production on Paul's Thessalonian letter, the contents of which were more or less of an eschatological character.

On the other side, it is asserted that when consideration is given to the fact that recent investigations in the field of apocalyptic literature have shown the existence among the Jews of a popular anti-Messiah legend, having its source in preexilic times and coming down through various stages of development to the times of the Christian Church, and when it is remembered that this popular belief is made use of in various ways by Jesus Himself (e.g. in His eschatological discourse in Mark xiii. and parallels) as well as by some of the Apostolic writers (cf. e.g. I. John ii. 22), it cannot be held an unlikely thing for Paul also to make the use of it which we find in this passage, though such usage does not occur again in his writings. On such a theory it is maintained that the picture here presented would not need to be applied to any definite person, any more than would the corresponding pictures in the other New Testament writings. They would all refer rather to personified principles of evil hostile to Christ and His religion, or to principles impersonated generally in the enemies of Christianity. In any event, it is contended, nothing can be made out of the resemblance of the second Epistle to the first which would show a greater dependence of the latter upon the former than would be natural for Paul in writing two letters to the same people within a few months of each other. The contention that in the second Paul has reversed his belief in a sudden coming of Christ within the limits of his own lifetime which he expressed in his earlier letter, is answered by saying that in I. Thessalonians the return of Christ is presented as unexpected only to those who are evil, while the perspective given to that coming in II. Thessalonians does not necessarily carry it beyond the limit of life to which Paul might naturally look forward.

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THES′SALONI′CA (Gk. Θεσσαλονικη). An ancient Greek city, situated on the northeastern shore of the Thermaic Gulf, in Mygdonia. Tradition told of an early city, Eumathia or Halia, on this site, but the historical Greek city appears in Herodotus and Thucydides as Therme, a name due to the presence of hot springs in the neighborhood. The exact origin of the later name, which appears in Polybius, is uncertain. Most probable is the story of Strabo, that the town was enlarged and in part rebuilt in B.C. 315 by Cassander, who gave it the name of his wife, Thessalonica, the daughter of Philip of Macedon. Its strong fortifications enabled it to repel a Roman attack, and after the Roman conquest of Macedonia (B.C. 146) it became one of the chief cities of the province. Situated on the great Via Egnatie, it attracted a large trade by land and sea, while the support given to Mark Antony and Octavian seems to have made it a free city. It contained a considerable Jewish colony, and was the seat of a Christian church, founded by the Apostle Paul. It was severely punished by the Emperor Theodosius, when 7000 citizens are said to have perished because of an uprising, but appears in the later history of the Empire as a strong defense against the Goths and Slavs. It was, however, captured by the Saracens in A.D. 904, by the Normans in 1185, and finally by the Turks in 1430. For the modern city, see SALONICA.

THES′SALY (Lat. *Thessalia*, from Gk. *Θεσσαλία*, Attic *Θετταλία*, *Thettalia*, Thessaly, from Θεσσαλός, *Thessalos*, Attic Θετταλός, *Thettalos*, Thessalian). The largest division of ancient Greece, bounded on the north by Macedonia, from which it was separated by the Cambunian Mountains, on the west by Epirus, with the Pindus range as a boundary, on the east by the Ægean Sea, and on the south by the range of Œta and the Maliac Gulf. The southern boundary is not very definite. Though Achæa, Ænis, and Malis can properly be included in the general term, Thessaly proper only reaches to the range which extends from Pindus to the head of the Pagasæan Gulf. Others, who include Achæa (Phthiotis), call Mount Othrys the southern boundary. Thessaly proper is a vast plain shut in on every side by mountains; on the north and west by those already named, and on the east by mounts Pelion and Ossa, the only opening being the Vale of Tempe in the northeast between Ossa and Olympus. The plain of Thessaly is said at one time to have been a vast lake, the waters of which found an outlet by the Vale of Tempe. This plain is drained chiefly by the river Peneus (now Salambria) and its tributaries, and is the most fertile in all Greece, having produced in ancient times abundance of corn and cattle, and a breed of horses considered the finest in Greece, and still yielding large crops.

HISTORY. In the epic, Thessaly seems inhabited by a number of tribes, among whom are the Pelasgians of the Peneus valley, and the Achæans and Hellenes in the south. During the migrations that marked the period between the heroic age and that of historical Greece, tribes from the mountains of Epirus and the north pushed into this region, driving out or subjugating the inhabitants. Part of these latter migrated to Asia Minor, where they colonized Æolis. The Bœotians, too, were said to have been crowded out by the new-comers, but it is probable that Bœotians and Phocians were really the vanguard of the invaders. The conquerors settled in the rich lands of the Peneus valley, reducing the original owners to the position of serfs of the soil, who cultivated the land on their own account, paying a fixed proportion to the owners. These Penestæ could not be sold out of the country, nor put to death without a trial. The Thessalians themselves constituted a landed nobility gathered about the cities. In these cities a few great families exercised almost unlimited power, among whom in the sixth and fifth centuries B.C. the most famous were the Aleuadæ of Larissa and the Scopadæ of Crannon and Pharsalus. The league between the cities was a loose one, and there was no supreme authority, except so far as from time to time some family obtained a leading position. Four districts were recognized from early times, Hestiæotis at the north, Thessaliotis and Pelasgiotis in the centre, and Phthiotis in the south, each of which in the fourth century was led by a polemarch. A general council seems to have met when any occasion calling for united action arose, and in war a general called the tagus (*ταγός*) was chosen as commander-in-chief. The league was thus essentially military, but there must have been a well-established system, for in the sixth century B.C. the Thessalians were threatening to extend their power over Southern Greece, and seem at one time to have occupied Phocis. Their strength was in the cavalry, composed of the nobles, to which were added peltasts or light infantry, composed probably of Penestæ.

The Thessalians soon brought under their rule the mountainous districts surrounding the Peneus valley, occupied by the Perrhæbians, Magnetes, and Achæans of Phthiotis, who as independent tribes had places in the Amphictyonic Council, but later paid tribute and military service to the Thessalians. The other border tribes, the Dolopians, Ænianians, and Malians, were also in actual, if not nominal, dependence. The growing power of Thessaly received a severe check at the hands of the Phocians, and after the Persian wars it played but a small part in Greek history, until in the fourth century B.C. for a brief period it was united under the rule of the able tyrant of Pheræ, Jason, who secured his election as tagus, collected a strong force of cavalry and mercenary infantry, organized a fleet, and at the time of his assassination (B.C. 370) seemed likely to anticipate the career of Philip of Macedon. His successors were bloodthirsty tyrants and the united Thessaly was quickly dissolved, though the old district organization was revived under the influence of Pelopidas and the Thebans. During the Sacred War the country was at one time occupied by the Phocians, but in B.C. 352 passed under Macedonian control, and in B.C. 344 Philip was elected archon (the new name of the tagus) of Thessaly and the country was virtually united to Macedon. Thessaly remained subject to the Macedonian kings till the victory of Flamininus, at Cynoscephalæ, in B.C. 197, placed it under the protection of Rome. Under the Roman emperors Thessaly was united with Macedonia, but after Constantine it was a separate province. In 1204, with other portions of the Eastern Empire, it came under the dominion of the Venetians, and in the fourteenth century it was conquered by the Turks. The southern part of Thessaly was freed from Turkish rule at the time of the Greek Revolution. The bulk of the region was ceded to Greece in 1881 as a result of the demand of the Great Powers made on the conclusion of the Russo-Turkish War. A small mountainous district in the north still belongs to Turkey. In 1897 Thessaly was the principal seat of the Greco-Turkish War, the Turks forcing the Milouna and Raveni passes, in the Olympian range, on the frontier, and finally occupying Larissa. Thessaly comprises the nomes of Phthiotis, Larissa, Karditsa, Trikkala, and Magnesia.

THET′FORD. A municipal and Parliamentary borough and market town in Norfolk, England, on the Little Ouse, 79 miles northeast of London (Map: England, G 4). It has an eventful history and in the reign of Edward III. contained eight monasteries and twenty churches. Its most important relic of antiquity is the castle hill, a mound 1000 feet in circumference and 100 feet high, probably the largest Celtic earthwork in England. Population, in 1891, 4247; in 1901, 4600.

THE′TIS (Lat., from Gk. Θέτις). In Greek legend, the most famous of the Nereids (q.v.). She was the daughter of Nereus and the Oceanid Doris, and was loved by both Zeus and Poseidon. When Themis prophesied that her son would be mightier than his father the gods desisted from their suit, and compelled her to wed Peleus (q.v.), who, in spite of her frequent transformations, held her fast until she returned to human form. By Peleus she became the mother of Achilles (q.v.). In Homer she is represented as living with her father in the depths of the sea. She was said to have protected Dionysus when he fled from Lycurgus, and to have tended Hephæstus when he was hurled from heaven by Hera.

THEURIET, tẽ′rê′ȃ′, ANDRÉ (1833—). A French poet and novelist, born in Marly-le-Roi (Seine-et-Oise). He studied law in Paris, was admitted to practice in 1857, and soon afterwards accepted a position in a department of the Ministry of Finance. Already, however, his interests had turned to literature. His favorite field is the provincial idyll of humble life. His first poems were gathered as *Le chemin des bois* (1867). They show close observation of nature. The human figures are hewers of wood, whose hard struggles the poet describes truthfully and with feeling. *Le bleu et le noir, poèmes de la vie réele* (1876), is among his best volumes of verse. Theuriet describes Breton landscapes with charming and life-like touches. Of about sixty volumes of fiction the best are *Le mariage de Gérard* (1875) and *Amour d'automne* (1888). There may also be mentioned: *Reine des bois* (1890); *La Chanoinesse* (1893); *Frida* (1900); and *La sœur de lait* (1902). The nearest analogue to the best of Theuriet's fiction is the pastoral work of George Sand, but his style, marked by occasional archaisms, more nearly resembles that of Bernardin or of Rousseau. In the drama Theuriet wrote *Jean-Marie* (1871); *La maison des deux Barbeaux* (1885); and *Jours d'été* (1901). In 1896 he was elected to the Academy.

THÉVENET, tȃv′nȃ′, MARIUS (1845—). A French politician, born in Lyons. He studied law and gained great distinction at the bar of his native city, and was elected a Deputy from the Department of the Rhône in 1885. He was appointed Minister of Justice and Public Worship February 22, 1889, in the second Cabinet of Tirard. He displayed great activity in this position in the suppression of Boulangism, and vigorously prosecuted Paul Déroulède as chief of the League of Patriots. He was reëlected Deputy in 1889, lost his portfolio at the fall of the Ministry, March 17, 1890, and in 1892 was elected Senator from the Department of the Rhône. He was implicated in the Panama scandal, but escaped persecution. His militant attitude in the Dreyfus affair caused him to fail of reëlection to the Senate in 1900.

THIBAUDEAU, tė′bȯ′dȯ′, ANTOINE CLAIRE, Count (1765-1854). A French statesman and historian, born at Poitiers. The outbreak of the French Revolution found him a lawyer in his native city. He was elected to the Convention in 1792, joined the party of the Mountain, and voted for the death of the King. In 1796 he was chosen president of the Council of Five Hundred. He abandoned his extreme views, opposed the *coup* of the 18th Fructidor (September 4, 1797), and was saved from deportation by the intervention of friends. After the *coup* of the 18th Brumaire (November 9, 1799) he was made Prefect of Bordeaux and held the position of Councilor of State till 1808. In that year he became prefect of the Department of Bouches-du-Rhône. He helped in the elaboration of the Code and was made a Count of the Empire in 1809. On the second return of the Bourbons he was proscribed as a regicide and lived abroad till the Revolution of 1830. He was made a Senator by Napoleon III., and died in Paris, March 8, 1854. He wrote: *Mémoires sur la Convention et le Directoire* (1824); *Mémoires sur le Consulat* (1827); *Histoire générale de Napoléon Bonaparte* (1828); *Le Consulat et l'Empire* (1835); *Histoire des Etats Généraux et des institutions représentatives en France* (1843). His autobiography appeared in 1875.

THIBAULT, tē′bō′, JACQUES ANATOLE. See FRANCE, ANATOLE.

THIBAUT or **THEOBALD I.** (1201-53), King of Navarre from 1234 to 1253, originally Count of Champagne. He was born in France and educated at the Court of Philip Augustus. He is said to have been in love with Blanche of Castile, Queen of Louis VIII., and when Louis died, in 1226, some suspected that he had been poisoned by Thibaut. The latter at first allied himself with the league of nobles against Blanche, Regent during the minority of her son, but was soon won over by her. On the death of his uncle, Sancho the Strong of Navarre, in 1234, he succeeded to that kingdom. He went to Palestine in 1239, but was badly defeated at Gaza. He was a friend of literature and a *trouvère* of no mean order, Dante and Petrarch being among his admirers. His poems were first published by Lévesque de la Ravallière (2 vols., Paris, 1742), and have been republished several times since. Consult Delbarre, *Vie de Thibaut* (Laon, 1850).

THIBAUT, ANTON FRIEDRICH JUSTUS (1772-1840). A German jurist. He was born at Hameln, and studied at Göttingen, Königsberg, and Kiel, at which latter university he was appointed professor of civil law in 1798. From 1802 to 1806 he was professor at Jena, where he became a friend of Goethe and Schiller. In 1806 he went as professor of civil law to Heidelberg, where he remained until his death. He published *Theorie der logischen Auslegung des römischen Rechts* (1799); *Ueber Besitz und Verjährung* (1802); *System des Pandektenrechts* (1803); *Zivilistische Abhandlungen* (1814).

THIBET, tĭb′ĕt *or* tĭ-bĕt′. A dependency of China. See TIBET.

THIBODEAUX, tē′bō-dō′. A town and the parish seat of Lafourche Parish, La., 47 miles west by south of New Orleans, on the Bayou Lafourche, and on the Southern Pacific Railroad (Map: Louisiana, E 4). It derives considerable commercial importance from its situation in a fertile section producing extensively rice and sugar-cane. Mount Carmel Academy is here. The water-works and the electric light plant are owned by the municipality. Population, in 1890, 2078; in 1900, 3253.

THICKET (AS. *þiccet*, from *þicce*, thick, OHG. *dicchi*, Ger. *dick*, OIr. *ting*, OWelsh, Bret. *ten*, Welsh, Corn. *tew*, thick, and with Ger. *dicht*, Dan. *tæt*, Eng. *tight*). A plant society dominated by shrubs. In regions of great rainfall thickets may be generally regarded as forerunners of forests, but in many arid regions while present conditions remain they are usually the ultimate type of vegetation. Various names have been given to the xerophytic thicket areas. Those of the Southwestern United States are called chaparral; those of the Mediterranean region, maqui; those in Southern South America, espinal; in Australia, scrub. They all agree in having a shrubby, thorny, stunted aspect.

THICKHEAD FLY. Any one of the flies of the family Conopidæ, a group comprising species with large and conspicuous heads. They are rather large insects, but are generally slender and with a stalked abdomen. They frequent flowers and their larvæ are parasitic, chiefly upon bumblebees and wasps, and also more rarely upon grasshoppers. The eggs are probably laid upon the body of the host, and the larvæ as a rule live in the abdominal cavity. About thirty species occur in the United States.

THICK-KNEE. A large, plover-like shore bird of the Old World, representing the family Œnemidæ, of which several species are known, all characterized by the enlargement of the tibiotarsal joint. The familiar one of Western Europe (*Œdicnemus œdicnemus*) is known in Great Britain as the 'great' or 'stone' or 'Norfolk' plover, or 'stone-curlew,' and is a favorite among gunners. It is largely nocturnal, and its mellow whistling cry at twilight is a delightful sound along the sea-beaches. For illustration, see Plate of BUSTARDS.

THIELMANN, tēl′män, JOHANN ADOLF, Baron (1765-1824). A Prussian general, born at Dresden. He entered a Saxon regiment in 1782, served through the Rhine campaigns, and was engaged on the side of Prussia in the battle of Jena in 1806. He was next sent by Saxony as Ambassador to Napoleon I., became his ardent admirer, and did much to bring about the Franco-Saxon Alliance. He served with the French as major in the campaign of 1807; fought at Friedland in that year, was made major-general, and operated against the Austrians in Saxony. In the Russian campaign of 1812 he commanded a brigade of cavalry and for exceptional bravery in the battle of Borodino was made a baron. As commander of Torgau in the early part of 1813 he entered into communications with the Allies, and on being ordered by the Saxon King to deliver the town to the French, resigned his post and went over to the enemy. He was given command of a Saxon corps which participated in the invasion of France in 1814. He next joined the Prussian Army (1815), and led the Third Army Corps at Ligny and at Wavre, contributing materially to the victory at Waterloo.

THIELT, tēlt. A town in the Province of West Flanders, Belgium, 20 miles southwest of Ghent (Map: Belgium, B 3). It has an ancient cloth hall and belfry, and manufactures cotton and woolen goods, linen, leather, etc. The town was at the zenith of its prosperity during the Middle Ages, but in 1383 it was almost totally destroyed by fire, and has never regained its importance. Population, in 1900, 10.727.

THIERRY, tyâ′rē′, AMÉDÉE (1797-1873). A French historian, born at Blois, brother of the following. He was associated with the Romatnic School and especially with its journal. the *Globe*, and obtained a clerical post under the Government in recognition of his contribution to the history of Guienne in 1825. His *Histoire des Gaulois*

(1828) won for him a professorship of history at Besançon, but his teaching proved unpalatable to the reactionary Government of Charles X. and his course of lectures was suspended by official order. The Revolution of 1830 brought to him the Prefecture of Haute-Saône, which he held till 1838, when he received the office of *Maître des réquêtes.* In 1860 he was appointed Senator of the Empire. He was advanced to high office in the Legion of Honor and elected member of the Academy of Inscriptions in 1841. The most important of his books are: *Histoire de la Gaule sous l'administration romaine* (1840-47); *Histoire d'Attila* (1856); *Tableaux de l'empire romain* (1862); *Récits de l'histoire romaine* (1860-64). He wrote also *Saint-Jérôme* (1867) and *Chrysostome et Eudoxie* (1873).

THIERRY, Augustin (1795-1856). A French historian, born at Blois. He studied at the college of his native town and in the Ecole Normale at Paris, and became a teacher in a provincial school. In 1814 he went to Paris, and published his first work, *De la réorganisation de la société européenne.* Adopting the views of Saint-Simon, Thierry became his assistant for three years. In 1817 he joined Comte and Dunoyer as editors of the *Censeur Européen*, for which he wrote many articles, literary, political, and historical. In 1820 he became engaged on the *Courrier Français*, in which he published his *Dix lettres sur l'histoire de France.* He then turned almost exclusively to historical writing. His masterpiece, *L'histoire de la conquête d'Angleterre par les Normands*, was first published in 1825. His *Lettres sur l'histoire* appeared in 1827. In 1835 he published his *Dix ans d'études historiques.* In 1840 appeared his *Récits des temps mérovingiens*, which gained the great Gobert prize. His last publication was the *Essai sur l'histoire de la formation et de progrès du tiers état* (1853). He edited for Guizot's *Collection des monuments inédits de l'histoire de France* the *Recueil des monuments inédits de l'histoire de tiers état* (1849-56). He died May 22, 1856. His complete works were published in ten volumes (1856-60). His principal works have been translated into English.

THIERS, tē'âr'. The capital of an arrondissement in the Department of Puy-de-Dôme, France, 23 miles east-northeast of Clermont-Ferrand (Map: France, K 6). It is pleasantly situated on a hillside and consists of an upper and a lower town, the latter in a nearly sunless gorge (the Ville Noire of George Sand's novel of that name). The eleventh-century Romanesque Gothic Church of Saint Genès contains a noteworthy tomb of the thirteenth century, and the Church of Le Moûtier is an interesting Romanesque structure founded in the seventh century. The town is noted for its manufactures of cutlery, paper, and playing cards. Population, in 1891, 11,993; in 1901, 17,625.

THIERS, Adolphe (1797-1877). A French statesman and historian, born at Marseilles April 15, 1797. He was distinguished as a student at the lycée, and in 1815 he went to Aix to study law. There he formed a friendship with Mignet, the historian, in company with whom, after he had taken his degree as advocate (1818), he set off for Paris. Obtaining an introduction to Lafitte, he was enrolled among the contributors to the *Constitutionnel*, then the leading Liberal organ. His vigorous articles attracted attention to the young writer and won him a place in the most brilliant circles of the opposition. His *Histoire de la Révolution française* (1823-27) gave him high rank as an historian. In January, 1830, he, with Mignet and Armand Carrel, established an able opposition paper, the *National.* Thiers in this journal waged unrelenting war against the Polignac Administration, whose publication of the celebrated Ordinances of July brought on the Revolution of 1830. Under the new Government of Louis Philippe Thiers was elected a member of the Chamber of Deputies, where he quickly made his mark as a debater, was appointed to a secretaryship in the Department of Finance, and in October, 1832, was made Minister of the Interior. During the next four years he acted as Minister of the Interior, Minister of Commerce and Public Works, and Minister for Foreign Affairs under various chiefs —Soult, Gérard, Mortier, and Broglie. His views with time became more conservative, and he repressed with severity the democratic uprisings against the new Government. In February, 1836, he became president of the Council and Minister of Foreign Affairs, but in August retired when the King refused to approve his plan for intervention in Spain and became the leader of the opposition. In March, 1840, he again assumed the Premiership and the Ministry of Foreign Affairs. He wished to support Mehemet Ali (q.v.) in his struggle against the Sultan, thus seeking to carry out the Napoleonic idea of a controlling influence by France in Syria and Egypt. He therefore refused to enter the alliance of Western powers formed for the preservation of the Ottoman Empire. (See Quadruple Alliance.) When Mehemet Ali was driven out of Syria, the popular irritation in France, fostered by Thiers, was great, but Louis Philippe refused to countenance armed interference, just as he had done in the Spanish matter, and accepted Thiers's resignation in October, 1840. The next five years Thiers spent in travel and in work upon his second history, *L'Histoire du Consulat et de l'Empire* (1845-62). After 1846 he again became active in political affairs, and appeared more frequently in the Chamber as an eloquent spokesman of the opposition. In the Revolution of 1848 his part was that of a Moderate friendly to the Republic. He was banished after the coup d'état of 1851, but after a short residence abroad was permitted to return to Paris in 1852.

Thiers entered the Corps Législatif in 1863, and became the leader of the Liberal opposition, assailing the Imperial policies in a series of masterly speeches. He eloquently opposed the war with Prussia and predicted the defeat of France. After the collapse of the Empire he became the brains of the rehabilitation of France. He undertook diplomatic journeys to England, Russia, Austria, and Italy, on behalf of France—a self-imposed mission in which he was unsuccessful, but by which he acquired the gratitude of his countrymen. After the capitulation of Paris Thiers was elected to the National Assembly by twenty-six constituencies, and on February 17, 1871, became 'chief of the executive power' in the provisional Government, and as such negotiated the treaty of peace with Germany. Upon the outbreak of the war of the Commune (q.v.) Thiers took swift and energetic measures for the suppression of the movement. On August 31, 1871, the National Assembly conferred upon him the title of President of the Republic, making his term of office three years. Thiers, contrary to the expectations of the monarchical parties, became convinced of the need of a republican form of government, and in November, 1872, sent to the National Assembly a message urging the necessity of formulating an organic instrument of government for the Republic. The Clericals and Monarchists thereupon decided upon his fall, and as the result of a vote of censure passed on the Ministry, Thiers resigned May 24, 1873. He retired from public life for some time, but in 1876 was elected from Paris to the Chamber of Deputies, exercising his influence to the last in the defense of the Republic against the plots of the Monarchists.

Thiers was perhaps the most influential political leader France has produced. His figure was small, his appearance far from impressive, and his early attempts at oratory are said to have been ridiculous, but when he adopted the rapid, incisive style adapted to his personality he became one of the most effective speakers in France. His course as a statesman was guided by an intense love of country bordering on Chauvinism, and the conviction that the political power should repose in the hands of the middle class whose interests and tastes he so well represented. His histories are merely brilliant eulogies of the Revolutionary and Napoleonic ideals. He was elected a member of the Academy in 1834. Among the studies and sketches of Thiers may be noted Franck, *Vie de M. Thiers* (Paris, 1877); Mazade, *Monsieur Thiers, cinquante années d'histoire contemporaine* (ib., 1884); Rémusat, *A. Thiers* (ib., 1889; Eng. trans., London, 1892); Simon, *Le gouvernement de M. Thiers, 1871-73* (Paris, 1878; Eng. trans., New York, 1879); Goff, *The Life of Louis Adolphe Thiers* (trans. from the unpublished manuscript by Theodore Stanton, New York, 1879).

THIERSCH, tērsh, FRIEDRICH (1784-1860). An eminent German classical philologist and educator. born at Kirchscheidungen, near Freyburg-on-the-Unstrut, and educated at Leipzig and Göttingen. In 1808 Thiersch began his career as a teacher in the gymnasium at Göttingen, and in 1809 was called as a professor to the newly established gymnasium in Munich, where by his influence he became the founder of philological studies in Bavaria. The Philological Institute established by him was joined to the university in 1826, when the latter was removed from Landshut to Munich. As a result of his sojourn in Greece, in 1831-32, he published his important work *De l'état actuel de la Grèce*, etc. (1833). He was also a prime mover in establishing in 1837 regular meetings of German philologists and teachers. In 1848 he became president of the Bavarian Academy of Sciences. His published writings include: *Griechische Grammatik* (3d ed. 1828); *Pindar* (1820); *Ueber die Epochen der bildenden Kunst unter den Grichen* (2d ed. 1829); *Allgemeine Aesthetik in akademischen Lehrvorträgen* (1846); numerous monographs in the *Acta philologorum Monacensium* (1811-26); and many works on education. Consult his biography by his son Heinrich (Leipzig, 1866).

THIERSCH, LUDWIG (1825—). A German painter, born in Munich. He studied at the Munich Academy and became professor of painting at Athens in 1852. He returned to Germany in 1855. He was engaged by the Russian Government to fresco the Church of Saint Nicodemus. Similar commissions he executed for the Greek Church in Vienna, the chapels of the Grand Dukes Nicholas and Michael, and the Protestant Church of Saint Catharine at Saint Petersburg (1860-64). His easel pictures included a "Sakuntala" (1848); "Christ at Gethsemane" (1865); and "Christ in the Desert" (1874).

THIETMAR, tēt′mär, Bishop of Merseburg (975 or 976-1018). A German chronicler of aristocratic family, related to the Emperor Henry II. Thietmar was educated in the cloister schools at Quedlinburg and Magdeburg, was created in 1002 Provost of Walbeck, shared in the campaign of 1007 against Boseslav of Poland, and in 1009 was made Bishop of Merseburg. He passed the remainder of his life for the greater part at Court and sharing in campaigns against the Slavs. His *Chronicon* covers in eight books the period from Henry I. (the Fowler) to 1018, and at its close is almost a diary. It is rough and inflated with diction, credulous in narration, but shows an earnest search for truth, and is the principal source of history for the Trans-Elbian Slavic districts during the period it covers. The best edition of the *Chronicon* is by Kurtz in *Scriptores Rerum Germanicarum* (Hanover, 1889). It was translated by Laurent (Berlin, 1848, and Leipzig, 1892).

THIGH. The portion of the lower extremity which extends from the hip to the knee. The muscles of the front of the thigh are tensor fasciæ femoris, sartorius and quadriceps extensor, the last of which is a powerful group of four muscles (rectus, crureus, and the two vasti) which are inserted below into the patella, or knee-cap, and whose action is to strengthen the knee, thus being a most important factor in the preservation of the erect position and in locomotion. The muscles of the back of the thigh are biceps, semitendinosus and semimembranosus, also called the 'hamstring muscles.' Their action is to flex the leg on the thigh, to support the pelvis upon the head of the femur, or thigh bone, and to draw the trunk backward. On the inner side of each thigh is a group of adductor muscles, whose action is to bring the knees together. There is but one bone in the thigh, the femur, which articulates with the pelvis above and with the tibia below. The most important structures of the thigh lie in the triangle of Scarpa (q.v.). This is bounded above by Poupart's ligament which is the base of the triangle, internally by adductor longus, and externally by sartorius. The great femoral artery and vein pass through the triangle dividing it into nearly equal parts, the artery giving off here the profunda femoris and the vein receiving the long saphenous. The anterior crural nerve lies to the outer side of the artery. Femoral hernia appears in Scarpa's triangle, and not infrequently the extremity of a fistula running from Potts' disease of the spine appears in this space.

THIGMOTROPISM (from Gk. *θίγμα*, *thigma*, anything touched + *τροπή*, *tropē*, a turning from *τρέπειν*, *trepein*, to turn). The sensitiveness of organisms to stimuli by contact, especially to prolonged contact with solid substances. The responses in plants depend chiefly upon a modification of the growth of the organs concerned. It is especially marked in tendrils. Other examples are to be found in the similar curvatures of the petioles of leaf climbers, and in the stems of dodder. See Growth.

THIL'LY, Frank (1865—). An American educator, born in Cincinnati, Ohio. He graduated at the university of his native city in 1887, and then studied for two years at the University of Berlin, and for two more at Heidelberg. In 1892-93 he was an instructor of logic and the history of philosophy in the Sage School of Philosophy at Cornell University. In 1893 he was appointed professor of philosophy at the University of Missouri. His publications include: *Leibnitz's Controversy with Locke* (1891); *An Introduction to Ethics* (1900); and translations of Frederick Paulsen's *Einleitung in die Philosophie* (1895) and Weber's *History of Philosophy* (1896).

THIONVILLE, tē'ôN'vēl'. See Diedenhofen.

THIOSULPHURIC ACID (from Gk. *θεῖον*, *theion*, sulphur, + Eng. *sulphuric*), $H_2S_2O_3$, less properly 'hyposulphurous acid.' An acid compound unknown in the isolated state and but little known in the form of dilute aqueous solutions, but well known in the form of its salts, called thiosulphates (or hyposulphites), especially its sodium salt. The thiosulphates are formed by the action of metals (such as zinc, iron, etc.) on acid sulphites. The thiosulphates of the alkalies are freely soluble in water; those of the alkaline earths are much less soluble; while those of the heavy metals are by themselves insoluble, but generally form soluble double compounds with the thiosulphates of the alkalies. The thiosulphate of sodium may be prepared in the laboratory by boiling a solution of sodium sulphite with sulphur. It may also be made from the thiosulphate of calcium. The latter is produced by the action of sulphur on lime. Hence it is produced (along with calcium pentasulphide) when lime is used for the purification of illuminating gas. Further, it is formed when a solution of calcium pentasulphide is exposed to the oxidizing action of the air—a reaction causing the production of the thiosulphate in the manufacture of soda (q.v.) and its increased production in the purification of illuminating gas. Aqueous sodium thiosulphate has the remarkable property of dissolving the halogen salts of silver, mercurous chloride (calomel) and iodide, the iodide and the sulphate of lead, the sulphate of calcium, and the oxides of copper. Owing to its capacity for dissolving the halogen salts of silver unaltered by light, it is extensively used in photography. It is further employed in the manufacture of certain coal-tar colors and in dyeing.

THIRD. See Interval.

THIRD ESTATE (Fr. *tiers état*). See States General; France; French Revolution.

THIRL'WALL, Newell Connop (1797-1875). An English historian and bishop. He was born in London. He studied at Charter-House School and graduated at Trinity College, Cambridge, in 1818. In 1820 he entered Lincoln's Inn and was called to the bar in 1825, but the profession of the law was distasteful and he spent the intervening years until 1828 in travel and literary pursuits, publishing translations of tales from Tieck and Schleiermacher's *Critical Essay on the Gospel of St. Luke* (1825). In 1827 he took up his residence in Cambridge, and until 1834 he held various offices in the university, when he was called upon to resign his appointment as assistant tutor on account of a pamphlet, *Letter on the Admission of Dissenters to Academical Degrees.* He accepted a living at Kirby Underdale in Yorkshire, where he wrote his *History of Greece* (1835-44). In 1840 he was appointed bishop at Saint David's in Wales; in 1874 he resigned his see and retired to Bath, where he died. With J. C. Hare he translated *Niebuhr's History of Rome* (1828-32). His *Remains, Literary and Theological,* and *Essays, Speeches, and Sermons* were edited by J. J. S. Perowne (London, 1877-80); his *Letter to a Friend,* with a memorial sermon, was edited by Dean Stanley (ib., 1882), and his *Letters, Literary and Theological,* by Perowne and Stokes (ib., 1881).

THIRST (AS. *þurst*, *þyrst*, Goth. *þaúrstei*, OHG. *durst*, Ger. *Durst*, thirst; connected with Lat. *torrere*, to parch, Gk. *τέρσεσθαι*, *tersesthai*, to become dry, Skt. *tarṣ*, to thirst). A sensation normally due to a lack of water in the tissues of the body. Although the sensation of thirst is referred principally to the mouth and throat, it is not a purely local feeling and can be satisfied by the introduction of fluid into the circulation through various channels. Water may be absorbed and thirst relieved by transfusion of saline solution into the veins, by injection into the tissues (hypodermoclysis), and to a less extent by absorption from the skin, as well as by drinking. In a state of thirst, the body fluids become reduced in volume, and of higher specific gravity and more saline, and these conditions sufficiently explain the craving for water. Thirst is occasioned physiologically by profuse perspiration from exercise—especially in a warm, dry atmosphere—by a highly seasoned diet, or by salty food. Many morbid conditions give rise to thirst; it is always an accompaniment of fevers and inflammations; diseases which, like cholera asiatica, diabetes, and diarrhœa, are characterized by a great loss of fluid from the body, are productive of thirst. Loss of blood produces a great craving for liquids. As an exception to the rule that fevers demand drink, it may be noted that in typhoid fever thirst is sometimes blunted or suppressed. Thirst is most effectively relieved by slightly acidulated drinks, since these provoke an outflow of saliva. In fevers, cracked ice, effervescing drinks, and fruit juices are grateful and help to reduce the temperature.

THIRTY-NINE ARTICLES OF RELIGION, The. See Articles, The Thirty-Nine.

THIRTY TYRANTS. A body of rulers in Athens, invested with sovereign power after the close of the Peloponnesian War, B.C. 404. They were all native Athenians, but members of the aristocratic party, and chosen by the Spartan conquerors, who, knowing the animosity existing between the democracy and the oligarchy of Athens, hoped to rule the city through the agency of the latter. Their government was a reign of terror, marked by the most infamous cruelties. One of the most rabid and unscrupulous members of the body was Critias (q.v.), while Theramenes (q.v.) headed the more moderate division. The rule of the Thirty Tyrants lasted only one year, when it was overthrown by the return of the Athenian exiles under Thrasybulus (q.v.), and the surviving members were expelled from the city.

THIRTY TYRANTS. The collective title given to a set of military usurpers who sprang up in different parts of the Roman Empire during the fifteen years (A.D. 254-268) occupied by the reigns of Valerian and Gallienus, and, amid the wretched confusions of the time, endeavored to establish themselves as independent princes. The name is borrowed from the Thirty Tyrants at Athens, but, in reality, historians can only reckon nineteen—Cyriades, Macrianus, Balista, Odenathus, and Zenobia, in the East; Postumus, Lollianus, Victorinus (with his mother, Victoria), Marius, and Tetricus, in the West; Ingenuus, Regillianus (more properly Regalianus, as the name appears on coins), and Aureolus, in Illyricum and the countries about the Danube; Saturninus, in Pontus; Trebellianus, in Isauria; Piso, in Thessaly; Valens, in Achæa; Æmilianus, in Egypt; and Celsus, in Africa.

THIRTY YEARS' WAR. The name given to the great European struggle (1618-48) which marked the climax of the Reformation (q.v.), closing the period of distinctively religious politics and opening that in which secular statecraft took the place of ecclesiastical. The Religious Peace of Augsburg (1555) afforded no permanent settlement of the questions that had been stirred up by the Protestant revolution. Its terms recognized only Lutherans and Catholics, and meanwhile the Calvinists had grown strong, and, unfortunately for the Protestant cause, the most violent enmity existed between them and the Lutherans. The relations of the Emperor and the German princes were ill-defined and such adjustment as had been reached was hardly tenable. France had already separated her natural interests from the affiliations of religion and aided the German Protestant princes in their insubordination toward their Imperial Catholic head. The Reformation, by overthrowing the idea of Christ's unity in the Church, broke down the theory of a Holy Roman Empire and put forward in its place the Germanic idea of autonomy for individual States. In the turmoil of sixteenth-century Europe it was inevitable that the solvent for these and many collateral issues should be found in a general war. The outbreak came in an unexpected way. The liberal reign of Maximilian II. (1564-76) was favorable to the growth of Protestantism in the Austrian dominions. His successor, Rudolph II. (1576-1612), brought in the reactionary Jesuit influence and allowed full play to the forces of the Counter-Reformation. Open interference with the practice of the Protestant religion was permitted and numbers of Protestant churches were destroyed. In 1607 Maximilian I., the Catholic Duke of Bavaria, made himself master of the free Imperial city of Donauwörth, whose inhabitants were mainly Protestants. A number of Protestant princes and cities founded in 1608 the Evangelical Union for the defense of their interests and their faith, and this was met by the formation of the Catholic League under the leadership of Maximilian of Bavaria in 1609. In that year the Emperor was forced to publish his *Majestätsbrief*, by which the Protestants of Bohemia were guaranteed the free exercise of their religion. At this time the political state of the Empire was further unsettled by the Jülich-Cleves war of succession. (See JÜLICH.) In 1612 the Emperor Rudolph II. died and was succeeded by his brother Matthias, to whom the Archduchy of Austria, Moravia, Hungary, and Bohemia had previously been transferred as a result of Rudolph's reckless rule. In 1617 the Bohemian estates were called upon to crown, as their prospective King, Duke Ferdinand of Styria, the Hapsburg heir presumptive, in accordance with a custom which had become established. Ferdinand had made himself prominent by the relentless manner in which he had rooted out Protestantism in his paternal Styrian dominions. His attitude encouraged the Catholic Church in Bohemia in its aggressions, and soon a dispute regarding the interpretation of the *Majestätsbrief* brought on an open conflict. On May 23, 1618, a body of Protestants, led by Count Thurn, entered the royal palace at Prague, and hurled two odious representatives of the Crown, Martinitz and Slavata, from its windows. This 'defenestration,' the victims of which escaped with their lives, inaugurated a struggle which was to convulse Europe for thirty years.

The Bohemians rose in arms under Thurn, and the insurrection spread into the adjoining Hapsburg dominions. A body of troops of the Union, under Count Mansfeld, appeared on the scene, and Bethlen Gábor, Prince of Transylvania, prepared to make war on Austria. Matthias was wholly unprepared to meet the onslaught. Spain alone came to his aid, but the Spanish force was too weak to stay the advance of the enemy. The Emperor died in March, 1619, and Ferdinand, who succeeded him as the head of the House of Hapsburg, found himself beleaguered in Vienna by the victorious Thurn. Through his indomitable firmness he succeeded in averting the fall of his capital, and made his way to Frankfort, where he was elected Holy Roman Emperor as Ferdinand II. (August, 1619). The Bohemians, having declared their throne vacant, placed their crown upon the head of the Elector Palatine Frederick V., the son-in-law of James I. of England. Ferdinand, whose capital was in the meanwhile again threatened, this time by the Prince of Transylvania, was enabled to attack Frederick by means of the forces of the Catholic League, whose leader, Maximilian of Bavaria, was offered a rich indemnity. John George, the Lutheran Elector of Saxony, eager for territorial acquisitions, entered the field against the Bohemians, while the Spaniards invaded the Lower Palatinate. The Protestant Union dared not move, and James I. kept aloof from Frederick. On November 8, 1620, a battle was fought at the White Hill, before the walls of Prague, in which the army of the League, under Tilly, was completely victorious. Frederick fled from Bohemia, which was chastised in a fearful manner by the Emperor, and forced back into the fold of the Catholic Church. The dissolution of the Evangelical Union ensued. The cause of the Elector Palatine, however, whose hereditary dominions, the Upper and the Lower Palatinate, were assailed, found independent and intrepid champions in Mansfeld and Christian of Brunswick, lawless partisan leaders. George Frederick, the Margrave of Baden-Durlach, also took up arms for Frederick, and he and Mansfeld gained a victory over Tilly at Wiesloch on April 27, 1622. On May 6th, however, the former was vanquished by Tilly at Wimpfen, and on June 20th a like disaster befell Christian of Brunswick at Höchst. On August 6, 1623, Christian of Brunswick sustained a second defeat at the hands of Tilly at Stadtlohn. Frederick was stripped of his possessions. The Upper Palatinate and the electoral dignity were conferred on Maximilian of Bavaria.

The war might have ended with this local struggle, but the outrageous treatment to which the Protestant States of North Germany were subjected pressed the conflict on to its second phase. Christian IV. of Denmark, aided by a British subsidy, went to the aid of his German co-religionists in 1625, and being joined by Mansfeld and Christian of Brunswick, advanced into Lower Saxony, while the Emperor, hampered by the political jealousy of the Catholic League, was at first unable to oppose him. It was at this juncture that Wallenstein came forward and placed a great army, raised by himself, at the disposal of Ferdinand. This army acted in coöperation with that of the Catholic League under Tilly. Mansfeld was completely defeated by Wallenstein at Dessau (April 25, 1626), and the forces of Christian IV. were routed by Tilly at Lutter (August 27, 1626). Wallenstein marched as far as Hungary in pursuit of Mansfeld, who died in November, 1626. The combined Imperialists and Leaguers overran North Germany and Wallenstein penetrated into the heart of Denmark. The Imperialist commander conceived the design of making Austria a power on the Baltic, but his career in this direction was checked by the heroic defense of Stralsund (1628). King Christian was forced to conclude the humiliating peace of Lübeck (May 12, 1629). Inflamed by his success, Ferdinand had, on March 6, 1629, issued the Edict of Restitution, by which the Protestant titles to all ecclesiastical lands acquired after 1552 were declared void. Thus closed the second period of the war, with the Protestant States infuriated by the edict and the proud city of Magdeburg alone in arms to resist its execution.

Richelieu (q.v.), developing the anti-Hapsburg policy of Henry IV., had promoted, as far as the internal affairs of France would allow, the dissensions in Germany. He now succeeded in bringing into the struggle the able and ambitious Protestant King of Sweden, Gustavus Adolphus (q.v.). This ruler, desirous of promoting Protestantism and of securing the control of the Baltic, took the field, and the Swedish phase of the war began with the landing of the Swedes on the coast of Pomerania in the summer of 1630. Just at this time the princes of the Catholic League, exasperated by the overbearing conduct of Wallenstein and the excesses of his soldiery, forced the Emperor to dismiss him, Tilly being made commander-in-chief of the Catholic forces. Gustavus Adolphus, who in January, 1631, entered into a subsidiary alliance with France, advanced southward into Germany. The electors of Saxony and Brandenburg at first remained neutral, but finally were forced to join him. The obstacles in his path delayed him until it was too late to rescue Magdeburg, which on May 20, 1631, was stormed by Tilly and Pappenheim, whose troops burned the town and massacred the inhabitants. On September 17 (old style, September 7), 1631, the Swedish King, strengthened by the Saxon army under Arnim, overwhelmed Tilly at Breitenfeld, near Leipzig, a victory which completely restored the Protestant cause. He then victoriously traversed the Main and Rhine valleys; forced the passage of the Lech in the front of the army of Tilly, who was mortally wounded (April 15, 1632); entered Munich, and threatened the Hapsburg dominions. Wallenstein, meanwhile, had been recalled to raise and command the Imperialist armies to meet this formidable enemy. He compelled the Swedes by skillful strategy, to return to Saxony. There the Swedes won the battle of Lützen (q.v.), November 16 (old style, November 6), 1632, after an obstinate engagement in which Gustavus was killed. His death was a severe blow to the Protestant cause, but the energy and ability of the Swedish Chancellor, Oxenstierna (q.v.), and the brilliant talents of the Swedish generals, preserved the advantages that had been gained. After the battle of Lützen Wallenstein remained long inactive, engaging in endless negotiations. Bernhard (q.v.) of Saxe-Weimar, one of the ablest of the Protestant leaders, overran Bavaria, and on November 14, 1633, stormed Ratisbon. The behavior of Wallenstein, after a display of activity, inaugurated by a victory over the Swedes at Steinau, October 13, 1633, finally left no doubt in the mind of Ferdinand II. that his general was meditating treason. He was deposed from his command and was assassinated at Eger in Bohemia, on February 25, 1634. His virtual successor, Gallas, inflicted a crushing defeat on Bernhard of Weimar and the Swedish general, Horn, at Nördlingen (September 6, 1634) which again restored to the Emperor a preponderating influence in Germany. Saxony now made peace at Prague (May 30, 1635), the Elector securing important territorial gains. Other Lutheran States withdrew from the conflict, the Calvinists being left to their fate.

Final success now appeared to demand only one more strenuous effort on the part of Austria; but Oxenstierna was determined to preserve to Sweden her German acquisitions, and Richelieu saw that the time had come for France to throw herself into an active struggle against both Austria and Spain. The conflict advanced into its final and most extended phase. At first the Hapsburg side was enabled to make a show of strength, France being invaded by a combined force of Spaniards, Imperialists, and Lotharingians, but with such commanders on their side as Bernhard of Weimar and the Swedish general Banér, the tide soon set in strongly in favor of the Protestants. The victory of Banér over the Imperialists and Saxons at Wittstock (October 4, 1636) restored to Sweden the advantage lost two years before. Bernhard of Weimar, in the pay of France, fought with energy and success, ambitious to found a State for himself. In 1638 he won a victory at Rheinfelden and succeeded in reducing the fortress of Breisach, but in the following year he met with an untimely death. In February, 1637, the Emperor Ferdinand II. died and was succeeded by his son, Ferdinand III. After the death of Banér, in 1641, the Swedish arms were led to fresh triumphs by Torstenson, a general famous for the rapidity of his movements. He defeated the Archduke Leopold William and Piccolomini at Breitenfeld on November 2, 1642; in 1644 he overran Denmark, whose ruler, Christian IV., had been induced to take up arms against Sweden; in the same year he defeated Gallas at Jüterbock; and on March 6, 1645, he won a great victory over the Imperialists, under Hatzfeld, at Jankau, in Southern Bohemia. His repeated invasions carried devastation and ruin into the territories, even to the gates of Vienna, until the Austrians hardly dared appear to the north of the Danube. In the meanwhile, in the west and south, the French were waging war with varying success. In January, 1642, they were successful at Kempen, near Düsseldorf, and in May, 1643, the Duke d'Enghien (the future Condé) won a signal victory over the Spaniards at Rocroi, but on November 24, 1643, the French-Weimar forces suffered a great defeat at Tuttlingen, in Swabia, at the hands of Johann von Werth and Mercy. Condé and Turenne restored the fortunes of the French by a victory at Allersheim, near Nördlingen, August 3, 1645. The Emperor was now deserted by all his allies except the Duke of Bavaria, whose territories were already mostly in the hands of Turenne and the Swedish general Wrangel; and a combined invasion of Austria from the west and north was on the point of being executed, when the diplomatic representatives of the different governments, who had been at work for seven years at Münster, in Westphalia, and at Osnabrück, agreed upon terms of peace which closed the struggle. See WESTPHALIA, PEACE OF.

Aside from the political disintegration of Germany which resulted from the war, the thirty years' struggle had brought desolation upon the country. Scarcely any part of the Empire had escaped the horrors of the conflict, and the people had been made the victims of an unbridled and licentious soldiery whose excesses have remained in popular memory to the present day. Whole regions were laid waste, prosperous towns were wiped out, commerce and industry were destroyed. Germany lost half of her population and two-thirds of her wealth, while in some regions the decrease in population rose to two-thirds, as in Bohemia, or even higher. Religion and morality sank to a low ebb, and the loss entailed on the intellectual side was one which it took generations to make good.

Consult: Gardiner, *The Thirty Years' War* (London, 1874), a convenient and reliable brief account; Gindely, *Geschichte des dreissigjährigen Kriegs* (Prague, 1869-80), trans. by Ten Brook (New York, 1884), by a recognized authority, a Bohemian, who made this his life study. Consult also references under GUSTAVUS ADOLPHUS; RICHELIEU; WALLENSTEIN, etc.

THISBE. See PYRAMUS AND THISBE.

THISTLE (AS. *þistel*, OHG. *distula*, *distil*, Ger. *Distel*, thistle). A popular name for various plants of the natural order Compositæ. They have either stout, spiny herbage or flowering bracts. They are widely distributed, mostly as weeds. In the United States the name applies to the species of Cnicus, Carduus, Onopordon, Centaurea, and Sonchus. By some botanists the first two genera are combined under the name Carduus. The principal distinction between these two is that Cnicus has plumose pappus and hence is often called plume thistle, while Carduus has bristly pappus. The species belonging to the other genera are all introduced from the Old World. The pasture thistle (*Cnicus pumilus*), yellow thistle (*Carduus horridulus*) bull thistle (*Carduus lanceolatus*), and others are common and troublesome in pastures and on roadsides. *Carduus arvensis*, the so-called Canada thistle, a European species, is one of the most troublesome and difficult to eradicate of all. It is a slender perennial, one to three feet high, with rather small, rose-colored flowers. It spreads principally by its spreading rootstocks, but can be eradicated by persistent cultivation. The heads are imperfectly diœcious and not all produce seed. Among the other common European thistles found in the United States is the milk thistle (*Silybum Marianum*), a biennial plant four to six feet tall. The leaves are sometimes used as salads, or as pot herbs. The roots, for which it was formerly cultivated, were used like salsify. The blessed thistle (*Carbenia benedicta*), native of Asia, was formerly considered to have medicinal properties. It resembles the star thistle (Centaurea), of which there are many species, the best-known of which are *Centaurea Calcitrapa* and *Centaurea Cyanus*, the blue-bottle thistle. The cotton or Scotch thistle (*Onopordon Acanthium*) is recognized by its deeply honeycombed receptacle and cottony or woolly leaves. It is said to be the emblem of Scotland, but *Cnicus acaulis*, a stemless thistle common in Scotland, seems more worthy this designation. The Carline thistle (*Carlina vulgaris*) is a rather troublesome weed in poor soils in Europe, and was named Carline thistle because Charlemagne, according to tradition, used its roots as a cure for the plague. Species of Sonchus are called sow thistle, of which three are found in the United States, *Sonchus oleraceus*, the common sow thistle, *Sonchus asper*, the spiny leaved sow thistle, and *Sonchus arvensis*, the field sow thistle. Other plants of different orders are sometimes called thistles, as species of Dipsacus (see TEASEL) and blue thistle (*Echium vulgare*), the latter belonging to the order Boraginaceæ. See Plate of TANSY, ETC.

CANADA THISTLE (*Carduus arvensis*).

THISTLE. A steel yacht built in 1887 at Glasgow. She lost the contest for the America's cup to the *Volunteer*, and afterwards became the property of the German Emperor under the name of *Meteor*.

THISTLE, Order of the; less commonly Order of Saint Andrew. A Scottish order having the year 787 as the mythical date of its foundation. It was established by James V. in 1540, reorganized by James II. of Great Britain in 1687, and a second time reconstituted by Queen Anne in 1703. The statute of 1827 limits the number of knights to sixteen members of the Scottish nobility, in addition to the sovereign and princes of the blood. The star of the order is of silver with a round gold plaque bearing a thistle on a green field. The ribbon is green. The motto runs, *Nemo me impune lacessit.*

THISTLE-BIRD. The American goldfinch (q.v.).

THISTLEWOOD CONSPIRACY, or Cato Street Conspiracy. A plot against the British Government formed in 1819-20 by Arthur Thistlewood (1770-1820). It was planned to murder the Ministers at a dinner given by Lord Harrowby on February 23, 1820, to seize the Mansion House, attack the Bank of England, and to set fire to London in several quarters. All of Thistlewood's intentions were, however, regularly reported to the authorities by one of his confidants, George Edwards. On February 21, 1820, the conspirators hired a loft in Cato Street, and there they were arrested on February 23d. Thistlewood escaped, but was captured the following day. He was found guilty on April 19th, and hanged with four other conspirators on May 1st.

THO′AS (Lat., from Gk. Θόας). (1) The son of Dionysus and Ariadne. He was King of Lemnos and father of Hypsipyle (q.v.), who saved him when the men of the island were killed by the Lemnian women. (2) A King of Tauris. Artemis carried Iphigenia into his dominion after saving her from the sacrifice.

THO′BURN, James Mills (1836—). A Methodist Episcopal bishop. He was born at Saint Clairsville, Ohio; graduated at Allegheny College, 1857; was admitted to the Pittsburg Conference 1858; went to India as a missionary, 1859; was presiding elder of the Calcutta district (Bengal Conference), 1873-88; editor of *The Witness* for six years; represented the India Conference in the General Conference, 1876; the South India Conference, 1880, and the Bengal Conference, 1888. He was elected missionary bishop of India and Malaysia, 1888. He has written *My Missionary Apprenticeship* (1887); *Missionary Addresses Before Theological Schools* (1887); *India and Malaysia* (1893); *The Deaconess and Her Vocation* (1893); *Christless Nations: Addresses Delivered at Syracuse University on the Graves Foundation* (1895); *Light in the East* (1898); *The Church of Pentecost* (1901).

THOLEN, tō′len. An island belonging to the Province of Zealand, Netherlands, 22 miles north by west of Antwerp (Map: Netherlands, C 3). It covers an area of about 47 square miles. The little town of Tholen is in the eastern part. Population, in 1899, 3076.

THOLUCK, tō′lụk, Friedrich August Gottreu (1799-1877). A German theologian, born in Breslau. He became professor extraordinary of theology at Berlin in 1823, and full professor at Halle in 1826, where he spent the remainder of his life with the exception of a sojourn in Rome in 1828-29. Tholuck was an influential preacher, writer, and teacher. His most important work was exegetical. His commentaries on the Psalms, the Sermon on the Mount, John, Romans, Hebrews, have all been translated into English. His best known works are *Die wahre Weihe des Zweiflers* (1823; 9th ed. 1870; Eng. trans., *Guido and Julius*, 1854); *Das Alte Testament im Neuen* (1836; 7th ed. 1877); and *Stunden christlicher Andacht* (1840; Eng. trans., *House of Christian Devotion*, New York, 1875). Among his other works may be mentioned: *Lebenszeugen der lutherischen Kirche, während der Zeit des dreissigjährigen Krieges* (1859); *Geschichte des Rationalismus* (1st part, 1865). Consult his *Life* by L. Witte (Bielefeld, 1884-86). His collected works were published at Gotha (11 vols., 1863-72).

THOM, John Hamilton (1808-94). A Unitarian clergyman and author, born at Newry, in County Down, Ireland, where his father was settled as a Presbyterian minister. He studied at the Belfast Academical Institution with a view to the Presbyterian ministry, but he was won over to Unitarianism by the writings of William Ellery Channing (q.v.). From 1831 to 1866 he was minister of Renshaw Street Chapel, Liverpool. In this long pastorate there was, however, one break—from 1854 to 1857—when his place was taken by William Henry Channing (q.v.). Meanwhile (1838) he became editor of the *Christian Teacher* (afterwards the *Prospective Review*). In company with Martineau he conducted a famous controversy with Anglican divines on the interpretation of the New Testament (1839). Besides a life of Joseph Blanco White, Thom published mainly *Saint Paul's Epistles to the Corinthians* (1861); *Letters, Embracing His Life, by John James Tayler* (1872); *Laws of Life After the Mind of Christ* (1883). After his death appeared *A Spiritual Faith* (1895).

THOMA, tō′mȧ, Hans (1839—). A German painter, illustrator, and lithographer. With Feuerbach, Marées, and Böcklin, he became one of the leaders of modern painting in Germany. He was born at Bernau, in the Black Forest. In 1859 he studied at the Karlsruhe Academy with Schirmer, at Düsseldorf (1867), and then in Paris, where he came under the influence of Courbet. Afterwards he spent four years in Munich with Victor Müller, who also exerted a powerful influence upon him. But his style was eventually formed by study of the fifteenth-century Italians. In 1899 he took charge of the academy and gallery at Karlsruhe. His archaic figure drawing at first blinded the public to the richness of his color, the power and poetry of his imagination, and the depth of his sympathy with German life, but after the Collective Exhibition of German art at Munich in 1890 his true value began to be appreciated. Landscapes, portraits, genre scenes of German life, religious, mythological, and allegorical subjects, have been treated by him, and he has also done some work in lithography, etching, and illustration. His lithographs are full of decorative value. His paintings include: "The Keepers of the Garden of Love" (Breslau); "A Landscape with Children" and a portrait of himself (Dresden); "An Open Valley" (Frankfort); and "A Taunus Landscape" (Munich). Consult Thode, *Hans Thoma* (Vienna, 1891).

THOMAS, tŏm′as (Lat., from Gk. Θωμᾶς, from Heb. *Thōmā*, twin). One of the Twelve Apostles. In each of the Synoptic Gospels and the Acts Thomas is mentioned only in the lists of the twelve disciples (Mark iii. 18; Matt. x. 3; Luke vi. 15; Acts i. 13). In the fourth Gospel he appears as one who was inclined to overestimate difficulties and to be troubled with doubts (John xi. 16; xiv. 5; xx. 24-29). Though nothing more is said of him in the New Testament, he figures prominently in the traditions concerning the spread of Christianity in the Far East. The Syrian Abgar legend relates that Thaddæus, the Apostle of Eastern Syria, was sent thither by the Apostle Judas Thomas. This double name probably has some connection with the fact (see John xxi. 2) that Thomas's Greek name was Didymus, i.e. twin. Who his twin was is unknown. Some have suggested that it was James, the 'Lord's brother,' and that Thomas's real name was Jude or Judas. A tradition older than Eusebius gave Parthia as the mission field of the Apostle Thomas, while another, embodied in the Gnostic Acts of Thomas, made him the Apostle of India and related wonderful stories concerning him. To him the 'Thomas Christians' of Southern India assign their origin. Mount Saint Thomas, near Madras, is the place of his reputed martyrdom. As these Christians were closely connected with East-Syrian Christianity, it is probable that the basis of the whole fabric of tradition is some actual missionary labor of the Apostle Thomas in Eastern Syria. See Christians of Saint Thomas; Apocrypha.

THOMAS the Rhymer, or more correctly Thomas of Erceldoune (c.1220-c.1297). A Scottish seer and poet, about whom very little is positively known. Erceldoune (now called Earlston) was a village in Berwickshire on the river Leader, about two miles above its junction with the Tweed. The earliest extant mention of Thomas as a seer is in the continuation of Fordun's *Scotichronicon*, attributed to Walter Bower (d. 1449). For centuries all sorts of prophecies were connected with his name. A collection of them was published at Edinburgh in 1603 under the title *The Whole Prophesie of Scotland*. To Thomas the Rhymer has been attributed a beautiful fairy story in verse. According to the legend, Thomas was wont to meet a 'lady fair' on Huntly Banks near Eildon Tree. By her he was conveyed to fairyland, where he acquired the knowledge that made him famed. After living there for a period, he was permitted to go to the earth to practice his prophetic skill, on the condition that he should come back at the fairy's bidding. One day, while he was making merry with his friends, the summons came. He instantly arose, and disappeared in the forest never to be seen again on earth. Huntly Bank and the neighboring lands became a part of Abbotsford. The poem, consisting of the minstrel's usual prologue and three fyttes, contains 700 lines. It exists in four complete manuscripts, of which the oldest is the *Thornton* at Cambridge (assigned to 1430-40). Though they are all in English, they point to an older original, which may have been the composition of Thomas. Sir Walter Scott and others also ascribed to Thomas the verse romance of *Sir Tristrem*. It exists in a single manuscript in the Advocates' Library at Edinburgh. It seems to have been copied from a northern original by a southern scribe about 1450. Though the poem contains allusions to Thomas of Erceldoune, his authorship is now questioned. Consult: *The Romance and Prophecies of Thomas of Erceldoune*, ed. by J. A. H. Murray for the "Early English Text Society" (London, 1875); *Thomas of Erceldoune*, ed. by Brandl (Berlin, 1880).

THOMAS, Christians of Saint. See Christians of Saint Thomas.

THOMAS, Gospel of. See Apocrypha, section on *New Testament*.

THOMAS, tō′mä′, Ambroise (1811-96). A distinguished French operatic composer, born in Metz. In 1828 he entered the Paris Conservatory, studied under Zimmermann and Kalkbrenner (piano), and under Dourlen, Barbereau, and Le Suer in counterpoint, harmony, and composition. He won the Grand Prix de Rome in 1832. He succeeded Auber as director of the Conservatory in 1871. He was one of the most noted composers of the modern French school, and ranked second only to Gounod, whom he resembled in style. His chief success lay in opéra comique, the best example of which was *Mignon* (1866). His compositions include: *Le panier fleuri* (1839); *Le Caïd* (1849); *Le songe d'une nuit d'été* (1850); *Psyché* (1857); *Hamlet* (1868); *Françoise de Rimini* (1882); ballets; cantatas; requiems; chamber-music; and choruses for male voices, which are much esteemed.

THOMAS, Arthur Goring (1850-92). An English composer, born in Eastbourne, Sussex. He received his musical education in Paris, and later at the Royal Academy of Music, London, where he won the Lucas prize of 1879. He took up his residence in London, and devoted himself entirely to composition. His works include a grand anthem for soprano solo, chorus, and orchestra (1878); a cantata, *The Sun Worshipers* (Norwich Musical Festival, 1881); operas: *Esmeralda* (1883), *Nadeshda* (1885), and *The Golden Webb* (1893, produced after his death); *Suite de ballet*, an orchestral suite (1887); and many popular songs, of which perhaps the best-known are from the *Swan and the Skylark* cantata, written just before his death in London.

THOMAS, Calvin (1854—). An American educator, born near Lapeer, Mich. He graduated at the University of Michigan in 1874, and studied philology for a time at the University of Leipzig. In 1878 he became instructor in German at his alma mater, where in 1881 he was made assistant professor and in 1886 professor of Germanic languages and literature. In 1896 he accepted the same chair at Columbia University. His publications include *A Practical German Grammar* (1895) and *Goethe and the Conduct of Life* (1886). In addition he edited, among other German works, Goethe's *Faust* (first part, 1892; second part, 1897); *Hermann und Dorothea* (1891); and *Torquato Tasso* (1888).

THOMAS, David (1813-94). An English Congregational minister. He was born at Vatson, near Tenby, Wales; was educated at Newport-Pagnell College; and from 1844 to 1877 was minister of the Independent Church at Stockwell, London. The remainder of his life was spent in retirement. He was greatly admired as a preacher, and had a large circle of readers for his monthly, *The Homilist, or Voice for the Truth* (1852-82), and for his collection of writings called *The Homilist Library* (1882-89). He compiled a liturgy for evangelical churches (1856), and a hymn-book (1866), which contained some fair hymns of his own composition.

THOMAS, EDITH MATILDA (1854—). One of the most widely known of contemporary American poets. She was born in Chatham, Ohio, and was educated at the normal school of Geneva, Ohio. She began writing early for the local newspapers, and was encouraged by Mrs. Helen Hunt Jackson in 1881 to send verse to more important periodicals. Her first volume appeared in 1885, entitled *A New Year's Masque and Other Poems.* Other books are: *The Round Year* (1886), prose; *Lyrics and Sonnets* (1887); *Babes of the Year* (1888), prose; *Babes of the Nation* (1889), prose; *Heaven and Earth* (1889), also prose; *The Inverted Torch* (1890); *Fair Shadow Land* (1893); *In Sunshine Land* (1894); *In the Young World* (1895); and *A Winter Swallow, and Other Verse* (1896).

THOMAS, GEORGE HENRY (1816-70). A distinguished American soldier, born in Southampton County, Va. He graduated at West Point in 1840; served in the Mexican War, and distinguished himself at Monterey and Buena Vista. After the close of the Mexican War he served a year in Florida, three years as cavalry and artillery instructor at West Point, and then for five years in Texas as major in the Second Cavalry. On the outbreak of the Civil War, though he was by birth and associations a Southerner, he adhered to the Union cause; was lieutenant-colonel, and afterwards colonel of the Second Cavalry; commanded a brigade in the first Shenandoah campaign; and on January 19, 1862, he won the battle of Mill Springs, Ky. He was in command of the right wing of the Army of the Tennessee during the siege of Corinth, where he was in full command during a great part of June, 1862. He then commanded the centre of the Army of the Cumberland, and although appointed to supersede Buell as commander of the whole army, asked to be allowed to remain in a subordinate position. He rendered conspicuous service at Perryville and Stone River (q.v.), and commanded the Fourteenth Army Corps in the campaign of middle Tennessee in the summer of 1863. At the Battle of Chickamauga (q.v.), September 19-20, 1863, Thomas stood firm, and resisted the concentrated attack of a victorious enemy, gaining justly the title of 'the rock of Chickamauga.' Soon after he reluctantly succeeded to the post held by Rosecrans, and commanded the Army of the Cumberland at Missionary Ridge, and in the campaign of 1864 up to the capture of Atlanta. When Sherman marched thence to the sea, Thomas was sent into Tennessee, where, in the battle of Nashville, December 15 and 16, 1864, he crushed the army of Hood. He was at once appointed a major-general in the Regular Army, and Congress tendered him a vote of thanks. In 1865-66 General Thomas commanded the Military Division of the Tennessee, including Kentucky, Tennessee, Georgia, Alabama, and Mississippi, and the Department of the Tennessee, including the same States, the following year. From June, 1869, until his death, he was in command of the Military Division of the Pacific, with headquarters at San Francisco. His *Life* was written by Van Horne (New York, 1882).

THOMAS, GEORGE HOUSMAN (1824-68). An English painter and illustrator. He was born in London, where he was a pupil of Bonner. For a time he lived in the United States, and did some work as an illustrator and in designing bank notes. He represented the *Illustrated London News* during the Crimean War (1855-56), and upon his return to England he enjoyed the patronage of the royal family. The best-known of his illustrations are to be found in *Uncle Tom's Cabin* and in Wilkie Collins's *Armadale.*

THOMAS, ISAIAH (1749-1831). An American printer, born in Boston, Mass. He began business as a printer at Newburyport in 1767, and in 1770, in partnership with his former employer, established the *Massachusetts Spy,* becoming the sole editor at the end of three months, and conducting the paper first at Boston and then (after 1774) at Worcester until 1801. His paper soon became the organ of the Whig or Patriot Party, and fearlessly attacked the measures of the British Ministry. At Worcester and later at Walpole, N. H., he engaged in book publishing, issuing a number of reprints of standard English works, besides Bibles, hymn-books, and most of the school books then in general use, and publishing a magazine called *The Farmers' Museum.* In 1788 he opened a bookstore and publishing house in Boston, and from 1789 to 1796 published *The Massachusetts Magazine.* He issued the *New England Almanac* from 1775 to 1801, wrote an excellent *History of Printing in America* (1810), and founded (1812) the American Antiquarian Society, to which he gave a large library and a liberal endowment. Consult the *Memoir* prepared by Benjamin F. Thomas, his grandson (Boston, 1874).

THOMAS, JOHN (1725-76). An American soldier, born at Marshfield, Mass. He studied medicine, and became eminent as a physician. In 1746 he served as surgeon in a regiment sent to Nova Scotia, and in 1747 acted first as surgeon and then as lieutenant under Shirley. In 1759 he became a colonel of provincials, and in 1760 led a regiment at Crown Point and was at the capture of Montreal. He was appointed a brigadier-general in June, 1775, and a major-general in the following March. During the siege of Boston he was stationed on the Roxbury side, and on the night of March 4, 1776, with 3000 men, occupied Dorchester Heights, thus rendering Boston untenable for the British, who evacuated it on the 17th. He then was appointed to succeed Montgomery in Canada, and took command before Quebec on May 1st; but, finding the army small in numbers and weakened by disease, he ordered a retreat. Contracting the smallpox, he died near Montreal on May 30th.

THOMAS, JOHN (1826—). A Welsh harpist, born at Bridgend, Glamorganshire. He early showed remarkable musical talents; was a skillful piccoloist at the age of six years, and at eleven years of age competed as a harpist at the Abergavenny Eisteddfod for one of four triple harps which were offered as prizes. He was the youngest competitor, but was declared the winner of the best harp. He found a patron and friend in Ada, Countess of Lovelace, Byron's only daughter, who made it possible for him in 1840 to enter the Royal Academy of Music, where he remained for nearly six years. During his student days he wrote a harp concerto in B flat with orchestral accompaniment; a symphony; several overtures; quartets; and two operas, all of which were included in the programmes of the Academy concerts. In 1851 he became a member of Her Majesty's Opera House orchestra under Balfe, and in the autumn of the same year began the annual Continental tours which made him famous the world over. In 1862 he published his celebrated collection of Welsh melodies. In 1863 was produced at the Swansea Eisteddfod his dramatic cantata "Llewellyn," which was repeated in 1893 at the World's Fair, Chicago. In 1871 he was appointed harpist to Queen Victoria, and in the same year founded in London the Welsh Choral Union. He was also professor of the harp at the Royal College of Music, and at the Guildhall School of Music.

THOMAS, John Jacob (1810-95). A noted American horticulturist and writer. He was born on the shores of Lake Cayuga, in western New York State, and there spent his life on a farm. For nearly sixty years he exercised a wide influence as an editorial writer for *The Cultivator* and *The Country Gentleman*, his articles dealing with a great variety of practical farm topics. He also published a book, *Farm Implements and Machinery*, and a nine-volume work, *Rural Affairs*, both of which were valuable in their day and serve as records of their time. His fame rests chiefly upon his work as a pomologist and upon his book, *The American Fruit Culturist*, which appeared first in 1846. As revised by W. H. S. Wood in 1897 it reached its twentieth edition.

THOMAS, Joseph (1811-91). An American lexicographer and physician. He was born in Cayuga County, N. Y.; educated at the Polytechnic Institute, Troy, and at Yale College, and then studied medicine in Philadelphia. In 1857-58 in India, and afterwards in Egypt, he made a special study of the Oriental languages and subsequently became professor of Latin and Greek at Haverford College, Pa. In association with Thomas Baldwin he published in 1845 *A Pronouncing Gazetteer*, in 1854 *A New and Complete Gazetteer of the United States*, and in 1855 *The Complete Pronouncing Gazetteer of the World*, which has been repeatedly revised. In 1870-71 appeared his *Universal Pronouncing Dictionary of Biography and Mythology*, a monument of scholarly and painstaking labor. *Webster's Unabridged Dictionary* is supplied with his 'pronouncing vocabulary' of proper names, in which department his work had high authority. Thomas also edited *A Comprehensive Medical Dictionary* (1864; revised 1886).

THOMAS, Lorenzo (1804-75). An American soldier, born in Newcastle, Del. He graduated at the United States Military Academy in 1823, and served in the Florida War. In 1838 he was appointed assistant adjutant-general, in 1839-40 was chief of staff of the forces in Florida, served in the Mexican War as chief of staff of Gen. W. O. Butler, and was brevetted lieutenant-colonel for gallantry at Monterey. From 1861 to 1863 he was adjutant-general with rank of brigadier-general, and during the remaining two years of the war organized colored troops in the Southern States. President Johnson in 1868 appointed him Secretary of War *ad interim*, but as E. M. Stanton refused to vacate his post, he did not assume office. In 1865 he was brevetted major-general, and in 1869 was retired.

THOMAS, M. Carey (1857—). An American educator, born at Baltimore, Md. She was educated at Cornell University, where she graduated in 1877, and at Johns Hopkins University, and the universities of Leipzig and Zurich. She took the degree of doctor of philosophy from the last-named institution in 1883, being the first woman to receive the doctorate of arts at a European university. In 1885 she became professor of English and dean, and in 1894 president of Bryn Mawr College. In 1895 she was elected trustee of Cornell University, and in 1896 she received the degree of LL.D. from the Western University of Pennsylvania. She published in 1883 a study of Sir Gawayne and the Green Knight, and after that time various educational addresses.

THOMAS, Seth (1785-1859). An American manufacturer, born in Wolcott, Conn. After receiving a meagre education, he was apprenticed to a carpenter and joiner in New Haven. Subsequently he settled in Plymouth Hollow (now Thomaston) and with two partners began the manufacture of clocks, finally becoming sole proprietor of an establishment which grew to be one of the largest clock factories in the world.

THOMAS, Sidney Gilchrist (1850-1885). A British metallurgist and inventor. He was born in London and received an elementary education at Dulwich College, but by study after hours spent in a clerkship was able to gain a thorough knowledge of chemistry, especially in its relations to technology. When opportunity offered he attended lectures at the Royal School of Mines and was able to pass the examinations for the degree in metallurgy, which was, however, denied him, owing to lack of attendance on day lectures. From 1870 his attention was directed to the elimination of phosphorus in the Bessemer converter, and in 1875 he reached a practical solution of the problem by employing a 'basic' lining of magnesia or magnesian limestone. He secured the coöperation of his cousin Percy Gilchrist, also a chemist, and after obtaining a first patent in November, 1877, announced the invention in the following year. The process, which is discussed under Iron and Steel, soon came into wide use all over the world, and Thomas received both financial returns and scientific honors, notable among which was the Bessemer medal of the Iron and Steel Institute of Great Britain in 1883.

THOMAS, Theodore (1835—). A distinguished German-American orchestral conductor, born in Esens, East Friesland. He received his musical education from his father, and played the violin at public concerts when only six years of age. He came with his parents to America in 1845, and was a member of the orchestra of the Italian opera in New York. He played first violin in the first American concert tour of Jenny Lind. In 1861 he began the formation of his famous orchestra, and in 1864 gave his first symphony concerts in New York. In 1866 he instituted his summer-night festivals. In 1869 he conceived the idea of traveling during the time unoccupied in New York, and for nine years he made an annual round of the principal American cities. In 1878 he accepted the position of director of the College of Music at Cincinnati, but in the spring of 1880 he resigned his position to return to New York. From 1878 to 1890 he was the conductor of the Brooklyn Philharmonic Society, and in 1890 he went to Chicago. The orchestra which he built up in Chicago became one of the recognized great orchestras of the world, and, notwithstanding the heavy annual deficit which was a feature of many of the years of its existence, its guarantors supported Thomas in his unswerving determination to present nothing but the best in music. He refused to cater to the popular taste, and finally succeeded in winning the public to his own ideals. See Chicago Orchestra.

THOMAS, Theodore Gaillard (1832-1903). An eminent American gynæcologist, born in Edisto Island, S. C., and educated in Charleston. He studied in Europe, principally in Paris and Dublin, in 1853-55, and began the practice of his profession in New York. He was lecturer in the New York University (1855-63), and professor in the College of Physicians and Surgeons, New York City (1863-89), in which he was professor of gynæcology when he retired. He was a finished speaker, a man of great personal charm, a clear thinker, an expert analyst, and an exact and skillful surgeon. Dr. Thomas wrote *Diseases of Women* (Philadelphia, 1868), which passed through six editions in English, and was translated into French, German, Spanish, Chinese, and Italian. See his biography in *Medical Record,* vol. lxiii. (New York, 1903).

THOMAS à BECKET, ȧ bĕk′ĕt. See Becket.

THOMAS à KEM′PIS. See Kempis.

THOMAS AQUINAS. See Aquinas.

THOMASIUS, tȏ-mä′zȇ-ụs, Christian (1655-1728). A German philosopher and jurist, born in Leipzig. He began to lecture in the University of Leipzig. His lectures were free from the pedantry of the schools, and were delivered in the German language instead of the traditional Latin. These innovations brought upon him the hostility of the conservative educators. He also edited the first scientific journal in the German language, but the liberal tone of it excited so much opposition that he was forced to leave Leipzig. He went to Halle in 1690, where he was one of the founders of the university and its first professor of jurisprudence. The great aim of Thomasius was to harmonize and blend science and life. His important works were: *Institutionum Jurisprudentiæ Divinæ Libri Tres* (1688); *Fundamenta Juris Naturæ et Gentium* (1705); and *Geschichte der Weisheit und Thorheit.* For his life, consult Luden (Berlin, 1805), Wagner (ib., 1872), and Klemperer (ib., 1888).

THOMASIUS, Gottfried (1802-75). A German theologian. He was born at Egenhausen, Württemberg, studied at Erlangen, Halle, and Berlin, and was professor of systematic theology at Erlangen from 1842 till his death. His most important publications were: *Origines* (1837); *Christi Person und Werk* (1852-61; 3d ed. 1886-88); *Die christliche Dogmengeschichte* (1874-76; 2d ed. 1886-89).

THOMAS (*Lat. pron.* thō′măs) **MAGIS′TER** (Gk., *Θωμᾶς ὁ μάγιστρος, Thōmas ho magistros,* Master Thomas). A Greek rhetorician and grammarian of the early part of the fourteenth century. He was probably born at Thessalonica, and lived some time at the Court of the Byzantine Emperor Andronicus Palæologus II., where he held important offices. Later he retired to a monastery, and devoted himself to the study of the Greek language. His principal work is a Lexicon of Attic Greek (*'Εκλογαὶ ὀνομάτων 'Αττικῶν*), compiled from other grammarians. The work possesses some value, as it has preserved writings which would otherwise have been lost. Aside from the lexicon, the works of Thomas Magister include scholia to Æschylus, Sophocles, Euripides, and three plays of Aristophanes, which are preserved with the other scholia to those authors, as well as lives of these writers which have come down to us in the manuscripts of their works. Letters and orations of Thomas Magister have been preserved. Especially noteworthy is the oration on Gregory of Nazianzus. The earliest edition of the Lexicon is that of Z. Callierges (1517); the latest, that of Ritschl (1832).

THOMAS OF CELANO, chȧ-lä′nȏ (c.1200-?). One of the first members of the Franciscan Order. He was born at Celano, in the Abruzzi, became acquainted with Francis of Assisi, and was in 1221 sent by him upon a mission to Germany. In 1223 he was placed over the monasteries of Worms, Speyer, Mainz, and Cologne, but in 1230 we find him again in Italy. His intimacy with Francis eminently fitted him to be his biographer, and he wrote two sketches of the saint, which are of primary importance, as well as the *Life* of Saint Clara. Of more universal interest is his claim, now practically admitted by all scholars, to be considered the author of the *Dies Iræ* (q.v.), except perhaps the last six verses. The date of his death is unknown.

THOMAS SLAG, Phosphatic Slag, Basic Slag, Odorless Phosphate, or Thomas Phosphate Powder. A by-product of the manufacture of steel from phosphatic ores by the basic or Thomas process, in which phosphorus is eliminated from the pig iron by means of basic (rich in lime) lining to the Bessemer converters and by adding lime to the molten pig iron. The slag is therefore rich in lime (about 15 per cent. in the free state and 40 per cent. combined with other substances). The phosphoric acid content of the product as found in the market is very variable, ranging from 10 to 25 per cent. Slag of average quality contains 15 to 20 per cent. of phosphoric acid. In good slag 80 per cent. of this phosphoric acid should be available, as shown by the chemical methods of determining availability, i.e. by treatment with a solution of citric acid or ammonium citrate. The phosphoric acid of slag, unlike that of superphosphates, is practically insoluble in water. Recently attempts have been made with some success to prepare a slag in which the phosphoric acid is more available by fusing the product as obtained from the converters at about 900° C. with sufficient silica (quartz) to convert the free lime into silicate. Such slag differs materially from the untreated product not only in containing a higher percentage of available phosphoric acid and of silica, but in being practically devoid of free lime. Basic slag is not suited to the manufacture of superphosphates and is generally used without any treatment except fine grinding. Purchasers of Thomas slag should insist on its being finely ground, as the value of the material depends very largely upon its fineness.

Slag has been used in large quantities for agricultural purposes in Europe for a number of years—in 1899 1,655,000 tons. Of this 895,000 tons were used in Germany and 170,000 in France. In 1885 the use of this material was practically confined to Germany and amounted to only 5000 tons. Since the total consumption of phosphatic fertilizers in Germany in 1899 was 1,864,000 tons, and in France 245,000 tons, nearly half of the phosphatic fertilizers used in these countries was Thomas slag. Slag has not been extensively introduced into the United States. Some has been manufactured at Pottstown, Pa., and put on the market under the name of 'odorless phosphate.' Experiments have shown slag to be a very valuable phosphatic fertilizer, and on account of its high percentage of lime especially suited to use on acid soils and those rich in organic matter. It would not be wise to use it freely on poor sandy soils deficient in organic matter. Experiments have indicated that slag and dissolved boneblack are about equally effective, taking into account the after-effects of the slag, while the cost of the latter is nearly twice that of the former.

Slag appears to be especially suited to leguminous crops. Six hundred to one thousand pounds per acre is considered a liberal dressing. It should not be mixed with ammonium sulphate before use, since its high percentage of free lime is likely to cause a loss of ammonia by volatilization. Mixtures of the slag with other salts, such as muriate of potash and nitrate of soda, cake badly and are difficult to handle and distribute uniformly. See Manures and Manuring.

THOMASVILLE, tŏm′as-vĭl. A city and the county-seat of Thomas County, Ga., 200 miles southwest of Savannah; on the Atlantic Coast Line, and other railroads (Map: Georgia, B 5). It is picturesquely situated on high ground, and has gained considerable prominence as a winter and health resort. There are two large hotels. The South Georgia College is here, and the city maintains a public library. Thomasville is surrounded by a fertile section producing cotton, sugar-cane, tobacco, melons, figs, pears, grapes, and vegetables. Its manufacturing interests are centred mainly in the lumber industry. The government is vested in a mayor, chosen annually, and a council. The water-works are owned and operated by the municipality. Thomasville was settled in 1850 and received its present charter in 1889. Population, in 1890, 5514; in 1900, 5322.

THOMÉ, tô′mâ′, François (commonly called Francis) (1850—). A French composer, born at Port-Louis, Mauritius. From 1866 to 1870 he attended at the Paris Conservatoire, studying pianoforte with Marmontel and theory with Duprato. In 1890 he set *Roméo et Juliette* to music and, in 1891 the mystery *L'enfant Jésus*, besides the symphonic ode *Hymne à la nuit*. He has also set many light stage pieces to music and published both vocal and instrumental pieces.

THOMIST, thō′mĭst. A follower of Thomas Aquinas (q.v.) in philosophy or theology. See Alexandrists.

THOMMEN, tôm′men, Achilles (1832-93). An Austrian engineer, born at Basel, and educated at the university of his native town and in the polytechnic institute of Karlsruhe. He built the railroad over the Brenner Pass in 1861-67. From 1867 to 1869 he was head of the railroad system of Hungary.

THOMPSON, tŏmp′son. A town, including several villages, in Windham County, Conn., four miles northeast of Putnam, on the Quinebaug River, and on the New York, New Haven and Hartford Railroad (Map: Connecticut, H 2). Farming and the manufacture of cotton goods and woolens are the leading industries of the community. Originally a part of Killingly, Thompson became a parish in 1728, and was incorporated as a town in 1780. Population, in 1890, 5580; in 1900, 6442.

THOMPSON. A family of American painters. Cephas Giovanni the Elder (1775-1856), a mediocre portrait painter, born at Middleboro, Mass., practiced mainly in the South, numbering among his sitters John Marshall, John Howard Payne, and Decatur.—Cephas Giovanni the Younger (1809-88), portrait and figure painter, born also at Middleboro and for a short time the pupil of his father, was chiefly self-taught. He painted principally in Boston, Providence, New York, and Philadelphia. In 1852 he visited London, Paris, and Florence, and settled in Rome, where he spent seven years. Upon his return to the United States in 1860 he took up his residence in New York City, and was made an associate of the National Academy. His portraits include those of Longfellow, Charles Fenno Hoffman (New York Historical Society), Sebastien Cabot (after Holbein), Hawthorne, and Dr. Matthews (New York University). Among his best known figure paintings are the "Guardian Angels," "Prospero and Miranda," and "Saint Peter Delivered from Prison." His most celebrated picture is his copy of Guido Reni's "Beatrice Cenci."—His brother Jerome Thompson (1814-86), landscape and figure painter, studied for a short time under his father and then with Morse and Jarvis. He painted chiefly in New York City, where he took up his residence in 1832. In 1850 he was made an associate of the National Academy. Among his paintings are the "Old Oaken Bucket," the "Dakota Cañon" (1880), the "Indian's Prayer" (1884), and a "Study from Nature" (1886).

THOMPSON, Augustus Charles (1812—). A Congregational clergyman. He was born at Goshen, Conn; studied at Yale College (but did not graduate), at Hartford Theological Seminary, and the University of Berlin. He became pastor of the Eliot Congregational Church, Roxbury, Mass. (1842). He visited India with Dr. Rufus Anderson (1854-55) and lectured on foreign missions at Andover Theological Seminary (1877-80), at Boston University (1882), and at Hartford Theological Seminary (1885-86). His publications include memorials of Mrs. Anna J. Waters (1854), of H. M. Mill (1856), of Rev. Dr. Rufus Anderson (1880); *Moravian Missions*

(1882); *Foreign Missions* (1889); *Protestant Missions* (1894); *Eliot Memorial* (Boston, 1900); and numerous works of a popular character.

THOMPSON, BENJAMIN. See RUMFORD, BENJAMIN THOMPSON, Count.

THOMPSON, DANIEL GREENLEAF (1850-97). An American lawyer and psychological writer. He took his B.A. at Amherst College (1869); was admitted to the bar in New York in 1872, but soon devoted his time mainly to the psychology of religion and sociological subjects, and is chiefly known for his *System of Psychology* (London, 1884), *The Problem of Evil* (London, 1887), and *The Religious Sentiments of the Human Mind* (London, 1888), in all of which he takes a position of violent antagonism to various accepted orthodox dogmas.

THOMPSON, DANIEL PIERCE (1795-1868). An American lawyer, politician, and novelist, born at Charlestown, Mass. He graduated at Middlebury College (1820), went to Virginia as tutor; studied law there, and was admitted to the bar (1823). He settled in Montpelier, Vt., in 1824, held various legal offices in that State, compiled, by legislative appointment, *Laws of Vermont from 1824 down to and including the Year 1834* (1835), was Secretary of State for Vermont (1853-55), and editor of a political weekly, *The Green Mountain Freeman* (1849-56). His first novel was a satire on the Anti-Masonic agitation, *The Adventures of Timothy Peacock* (1835). In the same year he wrote a prize story, *May Martin, or the Money Diggers*. Much popularity was achieved by *The Green Mountain Boys* (1840) and *The Rangers* (1850), romances of Revolutionary Vermont. He also wrote a *History of Montpelier, 1781-1860* (1860).

THOMPSON, DAVID (1770-1857). A Canadian explorer, born in Westminster, England. He was educated at Oxford and in 1789 came to America in the service of the Hudson's Bay Company. For several years he was engaged in explorations in the region of the Great Lakes, in 1798 discovered Turtle Lake, one of the sources of the Mississippi, and in 1807-11 crossed the Rocky Mountains and explored the Columbia River from source to mouth. In 1797 he became connected with the Northwest Company. He was engaged in the Canadian-United States boundary survey from 1816 to 1826, and subsequently had charge of extensive surveying and exploring expeditions in the Canadian Northwest. He published *A Map of the Northwest Territory of the Province of Canada* (1814).

THOMPSON, DENMAN (1833—). An American actor, best known for his impersonation of the rustic 'Josh' Whitcomb. He was born in Erie County, Pa., but passed much of his boyhood in Swanzey, N. H., where he found some of the types that he later made famous. He made his début upon the stage at Lowell, Mass., in 1852. *Joshua Whitcomb* was first brought out in 1875. In 1886 Mr. Thompson produced *The Old Homestead*, in which the same leading character appears, and this play became the material of all his subsequent popularity. It ran for four successive seasons in New York (1888-91) and its simple pictures of country life afford perhaps the best example of its type of rural drama. Consult McKay and Wingate, *Famous American Actors of To-Day* (New York, 1896).

THOMPSON, SIR EDWARD MAUNDE (1840—). An English antiquary, born in Jamaica, West Indies. After studying at Rugby and at University College, Oxford, he was called to the bar at the Middle Temple in 1867. In 1861 he was appointed assistant in the British Museum; in 1878 he became keeper of the manuscripts and Egerton librarian; and in 1888 principal librarian. He was Sandars reader in bibliography at Cambridge (1895-96), and was knighted in 1895. Editions by him include: *Chronicon Angliæ*, 1328-88, in the "Rolls Series" (1874); *Letters of Humphrey Prideaux*, for the Camden Society (1875); *Chronicon Adæ de Usk*, 1377-1404, for the Royal Society of Literature (1876); *Correspondence of the Family of Hatton*, for the Camden Society (1878); *Diary of Richard Cocks in Japan*, 1615-22, for the Hakluyt Society (1883); *Handbook of Greek and Latin Palæography* (1893); and, jointly with Professor Jebb, the facsimile of the "Laurentian Sophocles," for the Hellenic Society (1885). He is also joint editor of the publications of the London Paleographical Society.

THOMPSON, FRANCIS (c.1859—). An English poet, the son of a Lancashire physician. He was educated at the Ushaw Roman Catholic College, near Durham, and then studied medicine at Owens College, Manchester. Giving up medicine, he went to London, where, after a sharp struggle with poverty, he suddenly found himself famous. His *Poems* (1893) ran through several editions, receiving high praise from the reviewers and from Browning. This volume was followed by *Sister Songs* (1895) and *New Poems* (1897). In the matter of technique Thompson is one of the most original and daring of the younger generation of English poets; and in poetic quality he reveals an imaginative spirituality lingering near to mysticism.

THOMPSON, GEORGE (1804-78). An English abolitionist. He was born in Liverpool, England, and first became known in 1833 by his lectures in connection with the anti-slavery agitation throughout the British colonies. He was largely instrumental in procuring the freedom of the slaves and the abolition of the apprenticeship system. He was a member of the Anti-Corn Law League, and also took an active part in forming the British India Association, which procured better government for the people of India. He was associated with Garrison, Whittier, and others in the anti-slavery movement in the United States, and a visit which he paid to that country in 1834 led to the formation of upward of 150 anti-slavery societies. He belonged to the National Parliamentary Reform Association of England, and from 1847 to 1852 was a member of Parliament for the Tower Hamlets district, London.

THOMPSON, SIR HENRY (1820—). An English surgeon, born in Framlingham, Suffolk. He was educated at University College, London, and was appointed assistant surgeon of the University College Hospital, London, in 1856; surgeon in 1863; professor of clinical surgery in 1866; and consulting surgeon in 1874. In 1884 he was professor of surgery and pathology in the Royal College of Surgeons, London. His essays on the *Pathology and Treatment of Stricture of the Urethra* (London, 1853), and *The Healthy and Morbid Anatomy of the Prostate Gland* (London, 1860), each won for him the Jacksonian prize of the Royal College of Surgeons. In 1864 he became surgeon extraordinary to Leopold I. (by whom, owing to the success of an operation, he was knighted in 1867) and in 1868 to his successor, Leopold II. In 1864 he was made an officer of the Order of Leopold, and in 1876 was promoted commander. He has studied painting, and frequently exhibited pictures at the Royal Academy (London), the Salon (Paris), and elsewhere. He first brought the question of cremating dead human bodies before the English public, and in 1874 started the Cremation Society of London. He is a voluminous writer. Among his best known works are: *Practical Lithotomy and Lithotrity* (London, 1863); *Clinical Lectures on Diseases of the Urinary Organs* (London, 1868); *Modern Cremation* (London, 1890); and the novels *Charley Kingston's Aunt* and *All But*, which appeared under the pseudonym of "Pen Oliver."

THOMPSON, Jacob (1810-85). An American politician, born in Caswell County, N. C. He graduated at the University of North Carolina and in 1834 he was admitted to the bar, and in the next year removed to the Chickasaw country in Mississippi. From 1839 to 1851 he was a member of the United States House of Representatives, served as chairman of the Committee on Indian Affairs, and advocated non-acceptance of the Compromise of 1850. In 1857 he became Secretary of the Interior, and greatly systematized the work of the department, though the defalcation of a trusted clerk clouded his administration. In January, 1861, he resigned and was appointed aide to General Beauregard, and served with him through the Shiloh campaign. In 1864 he was sent as Confederate commissioner to Canada, and to organize the Confederate sympathizers in Ohio, Indiana, and Illinois. Unsuccessful attempts were made to capture the gunboat *Michigan*, and to organize the escaped Confederate prisoners and to take Camp Douglas, free the prisoners there confined, and take Chicago. After the assassination of President Lincoln Thompson was charged with complicity, and a price was put upon his head. He escaped to Europe, however, and remained there some time. When he returned he was not brought to trial, though for political effect a civil suit was brought in 1876 for the money taken by the dishonest clerk while Thompson was Secretary of the Interior.

THOMPSON, James Maurice (1844-1901). An American novelist, poet, and journalist, born in Fairfield, Ind. His boyhood was spent chiefly in Kentucky and Georgia. He served in the Confederate Army and after the war returned to Indiana, and practiced law and civil engineering at Crawfordsville. From 1885 to 1889 he was State geologist. In 1890 he went to New York and joined the editorial staff of the *Independent*, having already made a name for himself in literature by *Hoosier Mosaics* (1875), *The Witchery of Archery* (1878), *A Tallahassee Girl* (1882), *His Second Campaign* (1882), *Songs of Fair Weather* (1883), *At Love's Extremes* (1885), *By-Ways and Bird Notes* (1885), *The Boys' Book of Sport* (1886), *A Banker of Bankersville* (1886), *Sylvan Secrets* (1887), *The Story of Louisiana* (1888), and *A Fortnight of Folly* (1888). His later writings include: *Poems* (1892); *King of Honey Island* (1892); *The Ethics of Literary Art* (1893); *The Ocala Boy* (1895); *My Winter Garden* (1900), good impressionist descriptions of sub-tropical Louisiana; and *Alice of Old Vincennes* (1900), a very popular novel and his best. Posthumously printed were two immature novels, *Sweetheart Manette* and *Milly* (1901).

THOMPSON, John Reuben (1823-73). An American journalist and poet, born in Richmond, Va. He graduated at the University of Virginia (1844), practiced law in Richmond, became in 1847 editor of the *Southern Literary Messenger*, which for twelve years he made very influential. In it appeared early writings of D. G. Mitchell, John E. Cooke, Phillip P. Cooke, Paul Hayne, and Henry Timrod. In 1859 he moved to Augusta, Ga., to edit *The Southern Field and Fireside*. The Civil War drove him in 1863 to London, where he wrote for English magazines in defense of the Confederacy. After the war he returned to America and was literary editor of the New York *Evening Post* till 1872. His poems enjoyed great local poularity. Most admired among them are "The Burial of Latane" and "The Death of Stuart."

THOMPSON, Sir John Sparrow David (1844-94). A Canadian political leader, born at Halifax, Nova Scotia. He received a common school education and was admitted to the bar in 1865. Here his ability and industry soon placed him in the first rank. He took an active interest in politics and in 1877 was elected to the Provincial Assembly. The next year he was appointed Attorney-General and in 1881 he became Premier. In 1882 he was appointed a justice of the Superior Court of Nova Scotia, but in 1885 he gave up this position to accept the portfolio of Minister of Justice in the Dominion Government, and in 1886 he brilliantly defended the conduct of the Administration in regard to Louis Riel (q.v.). The next year he was chosen legal adviser to the British plenipotentiaries who negotiated the fisheries treaty of 1887 with the United States, and as a reward for his services was made a knight commander of Saint Michael and Saint George. In 1892 he became Prime Minister of Canada and in 1893 one of the arbitrators on the Bering Sea Controversy (q.v.). He died the next year while in Windsor Castle, where he had just taken the oath as a member of the Queen's Privy Council.

THOMPSON, Joseph (1858-95). A Scottish traveler. He was born in Dumfriesshire, and after studying at Edinburgh under Sir Archibald Geikie, joined Keith Johnson's African expedition (1878), and after the former's death became leader. He headed an expedition to Masai land in 1882; went to Sokots in behalf of the Royal Niger Company in 1885, when he secured a part of the Central Sudan to Great Britain, and, after exploring the Atlas Mountains in Morocco (1888), visited the region between lakes Nyassa and Bangweolo. In all his journeys he avoided serious conflict with the natives. He published *To the Central African Lakes and Back* (1881); *Through Masai Land* (1885); *An African Romance* (1888, with Miss Harris-Smith); *Travels* *in the Atlas and Southern Morocco* (1889); and *Life of Mungo Park* (1890).

THOMPSON, Joseph Parrish (1819-79). An American clergyman and scholar, born in Philadelphia. He graduated at Yale in 1838, was ordained a Congregational minister in 1840, was pastor in New Haven (1840-45) and New York (1845-71), lecturer on Egyptology at Andover 1871), and engaged in Oriental studies, chiefly in Berlin, from 1872 till his death. Thompson aided in establishing the New York *Independent.* Among his publications the more noteworthy are: *Egypt, Past and Present* (1856); *Man in Genesis and Geology* (1869); *Church and State in the United States* (1874); *The United States as a Nation* (1877); *The Workman, His False Friends and His True Friends* (1879). His political and social essays are gathered in *American Comments on European Questions* (1884).

THOMPSON, Launt (1833-94). An American sculptor. He was born in Abbeyleix, Queen's County, Ireland, but came to America in 1847, settling at Albany. He studied anatomy for a short time, and then became a pupil and assistant of Erastus Palmer, the sculptor. In 1858 he opened a studio in New York City, where he was first brought into public notice by his exquisite medallion heads. Later he executed some striking portrait busts and statues. He was made a member of the National Academy in 1862. In 1868 he went to Rome for a year, and in 1875-87 again visited Italy, residing principally at Florence. Among his works are a medallion portrait of John A. Dix; portrait bust of William Cullen Bryant (Metropolitan Museum); a colossal statue of Napoleon (Metropolitan Museum), of John Sedgwick (West Point), Winfield Scott (Soldier's Home, Washington), and one of Abraham Pierson, first president of Yale College (1874).

THOMPSON, Mortimer (1832-75). An American journalist and humorist, born at Riga, Monroe County, N. Y. He studied at the University of Michigan, contributed humorous articles to the *Advertiser* of Detroit, and afterwards was a writer for the New York *Tribune,* in which were published his series of letters from Niagara Falls and his account of the Pierce-Butler slave-auction at Savannah, printed by the Anti-Slavery Society as a tract. For several years he was a popular lecturer. He published under the pseudonym 'Q. K. Philander Doesticks, P.B.'—interpreted by him as 'Queer Kritter, Philander Doesticks, Perfect Brick'—a number of volumes, including *Doesticks—What He Says* (1855); a parody of *Hiawatha, Plu-ri-bus-tah: A Song That's by No Author* (1856); and *Nothing to Say, Being a Satire on Snobbery* (1857).

THOMPSON, Richard Wigginton (1809-1900). An American political leader, born in Culpepper County, Va. In 1831 he removed to Louisville Ky., but soon afterwards went to Lawrence County, Ind., where in 1834 he was admitted to the bar. In 1840 he was elected to Congress, and in 1847 was again elected. He was appointed judge of the Fifth Indiana Circuit in 1867, and in 1877 was Secretary of the Navy in the Cabinet of President Hayes. His publications include: *The Papacy and the Civil Power* (1876); *History of Protective Tariff Laws* (1888); *Personal Recollections of Sixteen Presidents* (1894); and *Footprints of the Jesuits* (1894).

THOMPSON, Robert Ellis (1844—). An American educator, born near Lurgan, Ireland. At an early age he emigrated to the United States, and in 1865 graduated at the University of Pennsylvania. Two years later he was licensed to preach by the Reformed Presbytery of Philadelphia, but from 1868 until 1892 was a professor in the University of Pennsylvania. In 1894 he became principal of the Philadelphia Central High School. He edited the *Penn Monthly* from 1870 to 1881, and the *American Weekly* from 1881 to 1892; edited vols. i. and ii. of the *Encyclopædia Americana,* supplement to the *Encyclopædia Britannica* (1884-85); and published a number of books, including: *Social Science and National Economy* (1875); *A History of the Presbyterian Churches of America* (1895); and *Political Economy for High Schools* (1895).

THOMPSON, Silvanus Phillips (1851—). An English physicist. He was born at York, and was educated at the Royal School of Mines and the University of London, where he received the degrees of B.A. (1869), B.Sc. (1876), and D.Sc. (1878). After serving as science master at Bootham School, York, he was lecturer and professor of experimental physics in the University College, Bristol, and in 1885 he became principal and professor of physics in the City and Guilds Technical College, Finsbury. Professor Thompson has done much to spread knowledge of electricity, while at the same time he has carried on original researches. His books on electricity and physics have passed through numerous editions. Of these, *Elementary Lessons in Electricity and Magnetism* (1st ed. 1881), *Dynamo Electric Machinery* (1st ed. 1885), *Light, Visible and Invisible* (1897); and *Polyphase Electric Currents and Alternate-Current Motors* (1895) are well known, as is his *Michael Faraday: His Life and Work* (1898).

THOMPSON, Smith (1768-1843). An American jurist and statesman. He was born in Stanford, Dutchess County, New York; graduated at Princeton College in 1788, and was admitted to the bar in 1792, having studied under Chancellor Kent. After serving as a member of the New York Legislature (1800) and of the State Constitutional Convention (1801), and receiving other political honors, he became associate justice of the State Supreme Court (1802-14), and Chief Justice (1814-18). In 1818 he became Secretary of the Navy in Monroe's Cabinet, and in 1823 was appointed to the United States Supreme Court, of which he remained a justice until his death.

THOMPSON, Thomas Perronet (1783-1869). An English general and political reformer. He was born in Hull and was educated at Queen's College, Cambridge. He took part in the Buenos Ayres campaign, 1807, and in 1808 was made Governor of Sierra Leone. His recall to England in 1810 was due to the influence of the slave-traders, against whose traffic he had taken active measures. He was with the British army in the Peninsular and French campaigns of 1813 and 1814, and in the Indian Pindari campaign of 1818. In 1820, with a small force, he was defeated at Sur, on the Arabian coast, by a band of Arabs, whom he was attempting to punish for piracy. He returned to England and in 1824 became one of the founders, and later proprietor, of the *Westminster Review*, to which he was a versatile and prolific contributor. His best known publications are the *Catechism on the Corn Laws* (1827), and *The Catholic State Waggon* (183?), in favor of Catholic emancipation. A collection of his miscellaneous writings was published with the title *Exercises, Political and Other* (6 vols., 1842). He was elected to Parliament in 1835, 1847, and 1857. He became general in 1868.

THOMPSON, Waddy (1798-1868). An American legislator and diplomat, born in Pickensville, S. C. He graduated at the South Carolina College in 1814 and in 1819 was admitted to the bar. From 1835 to 1841 he was a member of the National House of Representatives as a Whig, and in 1840 was chairman of the Committee on Military Affairs. In 1842-44 he was Minister to Mexico, and secured the release of 200 Texan prisoners. He published *Recollections of Mexico* (1846).

THOMPSON, William (1725-81). An American soldier. He was born in Ireland, emigrated to Pennsylvania, served (1759-60) as captain of militia in the French and Indian War, and in June, 1775, was placed in command of eight Pennsylvania companies, with the rank of colonel. In January, 1776, he took the same rank in the regular Continental Army, and on March 1st became brigadier-general. On March 19th he relieved General Charles Lee at New York, and in April led fourteen regiments to Canada to reinforce General John Thomas, assuming chief command during Thomas's illness and holding it until the arrival (June 4th) of General Sullivan. He led the Americans in the unsuccessful attack on the English at Three Rivers (June 6th), and was taken prisoner. Though immediately paroled, he was not exchanged until October 25, 1780.

THOMPSON, William Tappan (1812-82). An American journalist and humorist, born at Ravenna, Ohio. He removed to Philadelphia, subsequently to Florida, and thence, in 1835, to Augusta, Ga., where he was attached to the staff of several literary weekly papers and to the *Miscellany*, of Madison, Ga., he began to contribute the "Major Jones Letters," upon which his fame as a humorist rests. They were published in book form as *Major Jones's Courtship* (1840). In 1850 he established at Savannah the *Morning News*, which he continued to edit during the remainder of his life. In the Civil War he served in the Confederate Army as a private and on the staff of General J. E. Brown. He published *Major Jones's Chronicles of Pineville* (1843) and *Major Jones's Sketches of Travel* (1848).

THOMPSON, Wordsworth (1840-96). An American genre and historical painter. He was born in Baltimore, Maryland, and studied at Paris under Gleyre and Pasini. In 1868 he opened a studio in New York City, and was made a member of the National Academy in 1875, and of the Society of American Artists two years later. He is best known as a painter of American historical subjects. Among his paintings are the "Review at Annapolis, Maryland, 1776" (Buffalo Academy); "Passing the Outpost" (Union League Club, New York); a "New England Homestead," which won a gold medal at the Paris exhibition, 1889; and his last and best work, "Old Bruton Church, Virginia, in the time of Lord Dunmore" (Metropolitan Museum).

THOMS, tŏmz, William John (1803-85). An English antiquary, born in London. For several years, up to 1845, he was a clerk at Chelsea Hospital, and then was appointed clerk of the House of Lords; and from 1863 to 1882 he was its deputy librarian. In recognition of his scholarship he was elected a fellow of the Society of Antiquaries (1838) and secretary of the Camden Society (1838-73). Thoms is most widely known as the founder of *Notes and Queries*. Thoms published a large number of books of great value to the student and to the curious. Among them are *Early Prose Romance* (1827-28; revised by another hand, 1858); *Lays and Legends of Various Nations* (1834); *Anecdotes and Traditions Illustrative of Early English History and Literature* (Camden Society, 1839); *Hannah Lightfoot* (1867); the *Death of Charles I.* (1872); and *Human Longevity* (1873). Consult Thoms's reminiscences under the title, "Gossip of an Old Bookworm" (*Nineteenth Century*, London, July and December, 1881).

THOMSON, tôɴ′sôɴ′, César (1857—). A Belgian violinist, born at Liège. He made successful tours through Spain and Italy and became a member of Bilse's orchestra at Berlin. He gave instruction on the violin at the Liège Conservatory from 1883 to 1897. In 1894 and 1895 he made trips to the United States, and became Ysaye's successor as professor of violin-playing at the Brussels Conservatory in 1898. He is noted for his double-stop technique and for his clean-cut bowing.

THOMSON, tŏm′son, Charles (1729-1824). An American patriot. He was born in County Derry, Ireland, and in 1740 was brought to New Castle, Del. He was educated at New London, Pa., and when very young assumed charge of the Friends' Academy at New Castle. He took an active interest in all the controversies between the colonies and the British Ministry, and, removing to Philadelphia in 1774, was chosen secretary of the Continental Congress, in which capacity he served until 1789, keeping a careful record of all the proceedings and making copious notes of the debates. John Adams (in his diary for September 30, 1774) speaks of him as "the Sam Adams of Philadelphia, the life of the cause of liberty." In 1789 he was delegated to announce to Washington, at Mount Vernon, his election to the Presidency. He published *An Enquiry into the Causes of the Alienation of the Delaware and Shawanese Indians* (1759); an able translation of the Bible, containing the first English version of the Septuagint (4 vols., 1808); and a *Synopsis of the Four Evangelists* (1815). He also prepared a history of the Revolution, which, however, he destroyed in manuscript. Consult Harley, *The Life of Charles Thomson* (Philadelphia, 1900).

THOMSON, Charles Edward Poulett, Baron Sydenham (1799-1841). A British Governor-General of Canada, born at Wimbledon, Surrey. He was chosen a member of Parliament from Dover in 1826, and attracted attention by his discussion of economic questions. He was appointed Governor-General of Canada in 1839, and effected the union of the provinces in spite of the conflicting interests and jealousies. The adoption of the Constitution, February 10, 1841, led to the confederation of 1867. In recognition of his services Thomson was raised to the peerage as Baron Sydenham of Kent and Toronto, August 19, 1840, and was created Knight of the Grand Cross of the Bath. While preparing to return to England he was fatally injured by being thrown from his horse.

THOMSON, Sir Charles Wyville (1830-82). A British naturalist, born in Scotland as Wyville Thomas Charles, which name was changed when he was knighted. He was educated in medicine, but turned his attention to botany, and afterwards to a broader consideration of natural history, and became in 1853 professor of natural history in Queen's College, Cork. In 1860 he became professor of natural science at Belfast, and in 1870 at the University of Edinburgh. He early became interested in problems relating to life in the deeper parts of the sea, and in 1868, with Dr. W. B. Carpenter, made investigations north of Scotland in the gunboat *Lightning.* Other ocean voyages for scientific sounding and dredging were conducted subsequently, and their results were popularly explained in *The Depths of the Sea* (1873), a volume which attracted much attention. The interest thus aroused was influential in causing the British Government to undertake the renowned *Challenger* (q.v.) exploring expedition, the scientific conduct of which was given to Professor Thomson. The successful and brilliant outcome of this undertaking was recognized at its close, in 1876, by the conferring of knighthood upon Thomson and by scientific honors from all parts of the world. Sir Wyville resumed his lectures at the university, and began to superintend the disposal of the scientific material from the expedition, placing it in the hands of specialists to be exhaustively studied. He prepared at once a general narrative, *The Voyage of the Challenger* (2 vols., 1877), but became ill in 1879 and died in 1882. Besides the books mentioned, he was the author of more than forty papers of importance published in scientific periodicals, relating largely to marine zoölogy and especially to echinoderms, recent and fossil. He devised many of the methods and invented much of the apparatus used in deep-sea exploration (q.v.).

THOMSON, Edward (1810-70). A Methodist Episcopal bishop. He was born at Portsea, England; came to America in 1818 and settled in Wooster, Ohio. He graduated from the medical department of the University of Pennsylvania in 1829, and practiced medicine in Jeromeville and Wooster. He joined the Ohio Conference in 1833 and was stationed at Norwalk and Sandusky. In 1836 the Michigan Conference was formed and by the division of territory he became a member of that body, and was stationed at Detroit. He was principal of Norwalk Seminary, 1838-1843; editor of the *Ladies' Repository,* 1844-1845; president of Ohio Wesleyan University 1846-1860; editor of the *Christian Advocate and Journal,* New York, 1860-64. He was elected bishop in 1864; soon after his election he made a world-wide survey of Methodist missions, among many other things organizing the India Mission into an annual conference. He published *Moral and Religious Essays* (1856); *Educational Essays* (1856); *Sketches, Biographical and Incidental* (1856); *Letters from Europe* (1856); *Our Oriental Missions* (1870); *Evidences of Revealed Religion* (1872);

THOMSON, Elihu (1853—). An American electrician. He was born in Manchester, England, and came to the United States in 1858. He was educated in the Philadelphia public schools and was professor of chemistry and mechanics in the Central High School there from 1870 to 1880. Meanwhile he devoted much attention to the study of electricity, and lectured on that science at the Franklin Institute. In 1880 he became electrician to the American Electric Company, and thereafter devoted his attention to invention, especially as relating to arc lighting, incandescent lighting, motor work inducting systems, and especially electric welding. He organized the Thomson-Houston Electric Company for the development of his inventions, and subsequently became associated with the General Electric Company.

THOMSON, George (1757-1851). A Scottish composer, born at Limekilns, Fife. He was a constant and untiring collector of Scotch, Welsh, and Irish melodies and had the most celebrated musicians of that period engaged in writing accompaniments for them. Each song contained a prelude, code, and ad libitum parts throughout for violin, flute, or 'cello. Among his works are *A Select Collection of Original Scottish Airs; A Collection of Songs of Robert Burns, Sir Walter Scott, etc.* (1822); *Select Collection of Original Welsh Airs* (1809); and a *Select Collection of Original Irish Airs* (1814 to 1816); besides twenty Scottish melodies (1839). He died at Leith.

THOMSON, James (1700-48). A Scottish poet, born at Ednam, a village in Roxburghshire, where his father was minister. After attending school at Jedburgh Abbey by the Tweed, he was sent to the University of Edinburgh (1715) with a view to the Church. Forsaking all thought of the ministry, he went to London to seek fame and fortune in poetry (1725). Though poor, he was well received by the Duke of Montrose and others, who helped him bring out *Winter* (1726). This poem was followed by *Summer* (1727) and *Spring* (1728). In 1730 appeared *Autumn,* bound with the previous poems, under the title of *The Seasons.* These poems, issued separately and collectively, were from the first successful, and were exceedingly popular for a full century. They marked the return of blank verse, and a feeling for nature, of which there had been very few traces since Milton. With *The Seasons* the literary historian dates the beginning of the romantic movement in English literature. Appointed in 1730 tutor to the son of Sir Charles Talbot, afterward Lord Chancellor, Thomson traveled for three years in France and Italy. On the death of his pupil (1733), he returned to London and was immediately appointed by the Lord Chancellor secretary of briefs, a sinecure, at a salary of £300 a year. He was now able to settle in a pretty cottage at Richmond. The death of his patron in

1737 put an end to his sinecure; but through Lyttleton he obtained from the Prince of Wales a pension of £100 (1738). At this time he revised *The Seasons*, enlarging greatly each poem. The new edition was published in 1744. In 1740 appeared *The Masque of Alfred*, written by Thomson and David Mallet and containing Thomson's famous ode, "Rule Britannia," the national patriotic hymn of England. At Richmond, too, was written Thomson's finest poem, *The Castle of Indolence* (1748). For it he employed the Spenserian stanza. The poem is exquisitely colored and reveals here and there rare gleams of imagination. Besides these significant and beautiful poems, Thomson was the author of several tragedies, of which *Sophonisba*, produced at Drury Lane (February 28, 1830), was the first, and *Tancred and Sigismunda*, produced at Drury Lane by Garrick (March 18, 1745), was the most successful. A cenotaph to his memory was erected in Westminster Abbey by the side of Shakespeare's.

The Seasons had a wide vogue in both France and Germany, where translations and imitations were numerous. Thomson was thus a forerunner of the romantic revival, not only for England, but also for the Continent. The best edition of his *Works* is the Aldine (London, 1897), edited with a biography of Rev. D. C. Tovey. The best studies are *James Thomson, sa vie et ses œuvres*, by Léon Morel (Paris, 1895); and the essay in *Célébrités Anglaises*, by Lefèvre Deumier (Paris, 1895). An account of Thomson's influence in France is given in *Cosmopolitisme litteraire au XVIIIème siècle*, by Joseph Texte (Paris, 1895: Eng. trans. by J. W. Matthews, New York, 1899). Consult also Dr. Johnson in *Lives of the Poets;* and the *Life* by W. Bayne, in the "Famous Scots" series (Edinburgh, 1898). See ROMANTICISM.

THOMSON, JAMES (1822-92). A Scotch professor of engineering and elder brother of William Thomson, Lord Kelvin, born at Belfast and educated at the University of Edinburgh. He settled as a civil engineer in Belfast, where in 1857 he was appointed professor of civil engineering in Queen's College. In 1873 he was elected professor in Glasgow University, succeeding W. J. M. Rankine (q.v.). He made many improvements in hydraulic machinery and predicted from theory the effect of pressure in lowering the freezing point of water. See REGELATION.

THOMSON, JAMES (1834-82). An English poet, born at Port Glasgow, Scotland. In 1840 his father was disabled by a paralytic stroke and two years later his mother died. He was educated at the Royal Caledonian Asylum (1842-1850) and then entered (1850) the Military Asylum, Chelsea, to qualify as an army schoolmaster. The next year he was sent as a teacher to Ballincollig, near Cork, where he fell in love with a beautiful girl, who died in 1853. After serving as schoolmaster at various other places, he was discharged from the service in 1862 for a trivial offense against discipline. Through the influence of his friend Charles Bradlaugh, he obtained a clerkship in London; and under the pen-name of Bysshe Vanolis, or shortened to B. V. (Bysshe, the middle name of Shelley and Vanolis, an anagram of Novalis), he began writing for the radical magazines. Except for a short period in the United States and as correspondent for the New York *World* in Spain (1873), he passed the last sixteen years of his life in a narrow London lodging. He died an inebriate in University College Hospital. Thomson was a thorough-going pessimist wholly out of joint with the ways of men. He first attracted attention as a poet with his *City of Dreadful Night* (in the *National Reformer*, 1874. reprinted with other poems in 1880), a lurid poem of great imaginative power. Hardly less impressive is the volume entitled *Vane's Story, Weddah and Om-el-Bonain, and Other Poems* (1881). The same year he collected some of his prose writings under the title *Essays and Phantasies*. After his death appeared *A Voice from the Nile, and Other Poems* (1884); *Satires and Profanities* (1884); and *Poems, Essays, and Fragments* (1892). Consult *Poetical Works*, ed. with memoir by Bertram Dobell (London, 1895); id., *Biographical and Critical Studies* (ib., 1896); and *Life* by H. S. Salt (ib., 1889).

THOMSON, JOSEPH JOHN (1856—). An English physicist and Cavendish professor in the University of Cambridge. He was born at Manchester and was educated at Owens College in that city and at Trinity College, Cambridge, where he graduated with honors in 1880. In 1884 he became professor of experimental physics in the University of Cambridge. He visited Princeton University on the occasion of its sesquicentennial in 1896 and delivered there a series of lectures which have since been published, upon the Discharge of Electricity in Gases. In 1903 he again visited the United States, where he was received with high honors by the leading universities. To Professor Thomson, more than to any one else, is due the development of the modern ionic theory of electricity, the theoretical and experimental discussion of radio-activity, and the electrical theory of inertia of matter. Professor Thomson's papers on these subjects have been epoch-making. He is also the author of the following books: *On the Motion of Vortex Ring* (1883); *The Application of Dynamics to Physics and Chemistry* (1888); *Recent Researches in Electricity and Magnetism* (1893); *Elements of the Mathematical Theory of Electricity and Magnetism* (1895).

THOMSON, THOMAS (1773-1852). A Scotch chemist. He was educated at Saint Andrews and at Edinburgh. In 1796 he began to contribute to the *Encyclopædia Britannica* a series of articles on chemical subjects, which subsequently formed the basis of his *System of Chemistry* (1802). In 1817 he was appointed lecturer, and in 1818 regius professor of chemistry at the University of Glasgow. Thomson was the first to publish (*System of Chemistry*, 3d ed., 1807) a detailed account of Dalton's atomic theory, which had been communicated to him in a private interview (1804) and which Dalton himself did not publish until 1808. He was also the first English chemist to give laboratory instruction to students. His works include: *Elements of Chemistry* (1810); *An attempt to Establish the First Principles of Chemistry by Experiment* (1825; the analytical data of the elements were shown by Berzelius to be far from accurate); *Chemistry of Organic Bodies* (1838); *History of Chemistry* (1830-31); *History of the Royal So-*

ciety (1812); *Outlines of Mineralogy and Geology* (1836).

THOMSON, William, first Baron Kelvin (1824—). An English mathematician and physicist, born at Belfast. He graduated in 1845 from Saint Peter's College, Cambridge, and shortly afterwards was elected to a fellowship. He became professor of natural philosophy in the University of Glasgow in 1846, in which position he continued until 1899. While an undergraduate he published a paper *On the Uniform Motion of Heat in Homogeneous Solid Bodies and Its Connection with the Mathematical Theory of Electricity,* which was favorably received by scientists. He was for some time editor of the *Cambridge Mathematical Journal* and was the first editor of the *Cambridge and Dublin Mathematical Journal* which succeeded it, some of his most brilliant discoveries having appeared in these journals. He also contributed to the *Comptes Rendus,* the *Transactions and Proceedings* of the Royal Societies of London and Edinburgh, and various other journals. In the mathematical theories of elasticity, vortex-motion, heat, electricity, and magnetism, he made remarkable discoveries. Lord Kelvin was the electrical engineer for the Atlantic cables of 1857-58 and 1865-66, and made many improvements in signaling apparatus and theoretical observations of the greatest value. He invented the mirror galvanometer used for cable signaling, and then devised the siphon recorder still in use for receiving the signals. He also studied the properties of the cable, and his observation that a limit to the speed of operation would early be reached owing to the effect of the statical capacity has been borne out in a half century of practice. Lord Kelvin acted as engineer for several other cable companies and has invented many pieces of electrical apparatus and methods for measurement. He also developed an improved form of mariners' compass which is free from the magnetic action of the iron of the ship, and a deep-sea sounding apparatus, both of which are in wide-spread use. Lord Kelvin's work in thermodynamics is also of the greatest value. It was he who first appreciated the importance of the doctrine of the conservation of energy as enunciated by Joule and who developed Carnot's work on heat so that it would harmonize with the new theory then being generally accepted. A paper *On an Absolute Thermometric Scale* contains much that is now considered fundamental in thermodynamics. Lord Kelvin's many scientific papers, contributed to various scientific journals, have been collected in book form as follows: *Electrostatics and Magnetism,* 1 vol.; *Mathematical and Physical Papers,* 3 vols.; and *Popular Lectures and Addresses,* 3 vols. In conjunction with Professor P. G. Tait, Lord Kelvin is the author of *A Treatise on Natural Philosophy.* He received many honors from scientific societies. universities and governments, and is a member of the most important academies and learned organizations of Europe and America. Lord Kelvin visited America in 1884, and after attending the meeting of the British Association in Montreal, he visited Baltimore and delivered a course of lectures before the Johns Hopkins University, published under the title *Baltimore Lectures.* In 1897 he attended the Toronto meeting of the British Association and visited several of the leading universities of the United States. He came once more in 1902. For his work in connection with the Atlantic cable he was knighted in 1866, and in 1892 he was raised to the peerage. Four years later he celebrated his jubilee as professor of natural philosophy at Glasgow. Lord Kelvin may be said to represent the highest type of physicist, since he combines the powers of mathematical reasoning with the inventive faculty and manipulative skill of the experimentalist.

THOMSON, William McClure (1806-94). A Presbyterian missionary and writer. He was born in Springfield, Ohio, and graduated at Miami College, 1826; studied at Princeton Theological Seminary; and went as a missionary of the American Board to Syria and Palestine, 1832. The next year he went to Beirut and there resided till his return to America, 1877. His reputation rests upon his familiar work, *The Land and the Book, Biblical Illustrations Drawn from the Manners and Customs, the Scenes and the Scenery of the Holy Land* (1859; 2d ed. 1880-85).

THOMSON, Sir Wyville. See Thomson, Sir Charles Wyville.

THOMSON EFFECT. A thermal effect in an electric circuit where the temperature of the wire carrying the current varies from point to point. When the current is flowing in one direction along such a conductor, heat will be liberated at a given point, whereas if the current is reversed the heat at this point will be absorbed. The relative direction of the current and the absorption or liberation of heat depend upon the metal. In the case of iron the current passing from the hot to the cold portion absorbs heat, making the cold part cooler, while in the case of copper this takes place when the current flows from the cold portion to the hot. If the current is reversed, heat will be liberated under these circumstances. See Thermo-Electricity.

THOR, thôr. In Scandinavian mythology, the god of thunder. He was the son of Odin and Frigga, while his wife was Sif, or Love. His palace, where he received the warriors who had fallen in battle, was called Bilskirnir. Thunder was caused by the rolling of his chariot, which was drawn by he-goats. He was in the vigor of youth, had a red beard, and was the strongest of all the gods. He was a terror to the giants, with whom he was perpetually at strife, and whom he struck down with his hammer Mjolnir, or the smasher, which returned to his hand after being hurled. In the contest at the twilight of the gods, Thor slew the serpent of Midgard, but fell at the same time poisoned by the venom exhaled from its mouth. The name of Thor was widespread. The Saxons worshiped him as Thunar, and Torden, the wrathful deity dreaded by the Lapps, is evidently the Scandinavian Thor. The Gallic god Tarannis, or Tanarus, appears also to be indentical. Of all the Æsir (q.v.), Thor had unquestionably the most worshipers. In Norway he was the national god, and there, as in Iceland, temples were almost exclusively erected to him. Offerings were made to him, particularly in times of pestilence. See Ragnarök; Scandinavian and Teutonic Mythology.

THORACIC DUCT (from Lat. *thorax,* from Gk. *θῶραξ,* breastplate, part of the body covered by the breastplate, thorax). A canal equal in diameter to a goose-quill, proceeding from the *receptaculum chyli* (into which the contents of the lacteals are collected, and which is situated in the front of the body of the second lumbar vertebra), which ascends along the front of the vertebral column, between the aorta and ascending vena cava, as high as the fourth dorsal vertebra; it then inclines to the left, and passing behind the arch of the aorta, ascends as high as the seventh cervical vertebra, when it bends forward and downward, and empties into the subclavian at its junction with the internal jugular vein of the left side, where it is provided with a pair of semilunar valves, which prevent the admission of venous blood into it. It is also provided with other valves on its upward course. This duct is not liable to any special diseases, but if its function of conveying chyle from its source into the general circulation be interfered with, as, for example, by the pressure of a tumor, nutrition is impaired and there is often at the same time an accumulation of chylous fluid in the peritoneal cavity.

THORAH. See TORAH.

THORAX. See CHEST.

THORBECKE, tōr′bĕk-*e*, HEINRICH (1837-90). A German Arabic scholar. He was born at Meiningen, and studied at Munich and Leipzig. He was appointed professor at Heidelberg (1873) and at Halle (1875). He is especially noted for his knowledge of Arabic poetry. He published: *Antarah, ein vorislamitischer Dichter* (1867); *Al-Harīrī's Durrat-al-gawwas* (1871); *Al-A'schā's Lobgedicht auf Mahammed* (1875); *Ibn Duraid's Kitāb al-malāhin* (1882); *Die Mufaddalī-jāt* (1885); *Mihail Sabbag's Grammatik der arabischen Umgangssprache in Syrien und Aegypten* (1886).

THOREAU, thō′rô *or* thô-rō′, HENRY DAVID (1817-62). An American naturalist and author. He was of French and Scotch extraction and was born at Concord, Mass., where his father was a manufacturer of lead pencils. At this trade the younger Thoreau worked at intervals. He graduated from Harvard College in 1837, and was for five or six years engaged in school teaching and tutoring in Concord and in Staten Island, N. Y. Preferring, however, to live a life of contemplation, he soon abandoned teaching and proceeded, during the rest of his days, to demonstrate how simply and agreeably a man might live. He was for a time an inmate of Emerson's house, but his most characteristic act was his residence, from July, 1845, to September, 1847, in a hut on the shores of Walden Pond, a beautiful body of water on the outskirts of Concord. Here he lived, doing what little work was necessary to supply the necessaries of life, and devoting the major part of his time to the study of nature and to the society of friends. On leaving Walden Pond, he again became an inmate of Emerson's house, 1847-48, and passed the remainder of his life, after 1849, with his parents and sister at Concord. During the entire period at Walden Pond and elsewhere in Concord, he supported himself by odd jobs of gardening, land surveying, carpentering, etc., but without more exertion than he needed to keep himself in food and clothing. His large amount of leisure time he devoted to the study of nature, to the reading of Greek, Latin, French, and English classical literature, to excursions, to pondering metaphysical problems, and to friendly chat with his neighbors, by whom he was beloved.

From 1837 till his death he kept a journal, and this furnished the source and basis of his writings, and gave them uniformity of character. Of the ten volumes which comprise his works in the standard Riverside edition (11 vols. with the *Familiar Letters* of Thoreau edited by F. B. Sanborn), but two appeared in his lifetime. The first of these, *A Week on the Concord and Merrimac Rivers* (1849), is the narrative of a boating trip taken in August, 1839; it is full of admirable description and minute observation of nature, not unmingled with divagations into transcendental philosophy. The second book records the experiences, physical and moral, of the two years' residence at Walden Pond: *Walden, or, Life in the Woods* (1854), perhaps his most popular volume, and now recognized as one of the most original and sincere productions in American letters and as one of the most genuine of woodland books. It gives a plain unaffected statement of the reasons for the author's life as a hermit, and an admirably specific account of the main details of that life. The other volumes, not much different in quality, were posthumously edited from his journal, and are, chiefly: *Excursions* (1863); *The Maine Woods* (1864); *Cape Cod* (1865); *Early Spring in Massachusetts* (1881); *Summer* (1884); *Winter* (1888); and *Autumn* (1892). Their publication indicated an increasing interest in Thoreau and a sense of the permanent value of his work—that of a sincere thinker and an observer of nature. The literary quality of the writing was high; he had a marked gift for style, and wrote with great care and unfailing freshness. His best essays, to be found in the volumes entitled *Miscellanies and Excursions*, are perhaps not excelled in American literature, whether for substance or for style, and it may be doubted whether the work of any of his contemporaries is wearing so well. His poems are interesting, but occupy a minor place in his writings, which are being increased by such publications as the *Essay on Service* (1902). There is a *Life* by F. B. Sanborn in the "American Men of Letters Series" (1882), and an admirable sketch by Emerson in *Biographical Sketches.* Channing's suggestive *Thoreau, the Poet-Naturalist* (1873-1902), biographies by A. H. Japp (1877) and H. S. Salt (1896), and essays by Lowell and Stevenson should also be mentioned; considerable space is given to Thoreau in the histories of American literature, and the list of books specially devoted to him is growing steadily.

THORENBURG, tō′ren-bo͞ork (Hung. *Torda*). A town of the County of Torda-Aranyos, Hungary, 235 miles east-southeast of Budapest (Map: Hungary, H 3). Its salt mines and baths, still used, were known to the Romans. The modern town has a large manufactory of cellulose. Population, in 1900, 12,117.

THORESBY, thôrz′bĭ, RALPH (1658-1725). An English antiquary and topographer, born at Leeds. In 1679 he was left by his father's death in possession of a moderate fortune and the responsibilities of a business, which he somewhat neglected for his antiquarian studies and religious duties as a Presbyterian. He held several municipal offices at Leeds, but after 1705, when he retired from business with a competence, he devoted himself to his collections and writing. Though he was not an accurate scholar, his two chief works, *Ducatus Leodiensis* (1715) and *Vicasia Leodiensis* (1724), are important compilations. Consult: Hunter, *Thoresby's Diary and Correspondence* (London, 1830-32); Atkinson, *Ralph Thoresby the Topographer* (Leeds, 1885).

THORESEN, tō'rå-sen, Anna Magdalena (Kragh) (1819—). A Norwegian poet, born at Fridericia, in Jutland. She married a Norwegian clergyman and gained opportunity to study the peasant life and wilder nature of that country. Her sympathetic observations found literary expression in *Fortællinger* (Tales, 1863); *Signes Historie* (1864); *Solen i Siljedalen* (1868); *Billeder fra Vestkysten af Norge* (Pictures from the West Coast of Norway, 1872); *Nyere Fortællinger* (1873); *Herluf Nordal* (1879); she published also a volume of poems (1860); a drama, *Et Rigt Parti* (1870), and a final volume of tales (1891). Her earlier fiction was translated into German by Reinmar: *Gesammelte Erzählungen* (1878-1883).

THORITE. A mineral thorium silicate crystallized in the tetragonal system. It has a vitreous lustre, and is orange-yellow to dark brown in color. It is found at various places in Norway and in the Champlain iron region in northern New York, where, owing to the uranium oxide that it contains, it is called *uranothorite.*

THORIUM (Neo-Lat., from *Thor*, Scandinavian god of thunder). A metallic element discovered by Berzelius in 1828. It occurs in monazite, orangite, thorite, and other rare minerals containing the cerium group of metals, and found in Norway and in North Carolina. The metal may be obtained by decomposing the chloride with potassium or sodium. Thorium (symbol, Th; atomic weight, 232.63) is a gray powder which assumes an iron-gray lustre when burnished. It has a specific gravity of 10.96 and takes fire when heated in air, burning with a bright flame. It combines with oxygen, forming a white dioxide called thoria, and probably a peroxide or heptoxide. None of the compounds of this metal have any important commercial value except the dioxide, which has been used with zirconia in the mantle of the Welsbach burner.

THORN. See Cratægus.

THORN, tōrn. A strongly fortified town of Prussia, in the Province of West Prussia, on the right bank of the Vistula, which here divides into two branches, 87 miles northeast of Posen (Map: Prussia, H 2). There are many antique houses with striking architectural features. The ruins of a castle of the Teutonic Order, the Church of Saint John (1231-60), the Gothic Saint James (1309), and the Marienkirche (1367) are worthy of notice. There is a fine town hall containing a museum, library, and archives. In the market place stands a bronze statue of Copernicus, who was born here. There are iron foundries, and machine, tobacco, and soap works. The town carries on an active trade by water and by rail in corn, lumber, mineral waters, chocolate, and alcohol. Thorn was founded in 1231 by the Knights of the Teutonic Order. It became an important member of the Hanseatic League. It was annexed in 1454 to Poland. In 1466 a famous treaty of peace was concluded here between Poland and the Teutonic Knights (q.v.). The town became a part of Prussia in 1793. Population, in 1900, 29,626. Consult Kestner, *Beiträge zur Geschichte der Stadt Thorn* (Thorn, 1883).

THORNABY (thôr'nȧ-bĭ) **ON TEES**, formerly South Stockton (Map: England, E 2). A municipal borough in the North Riding of Yorkshire, England, suburban to Stockton (q.v.), with which its manufacturing industries and public works are identified. It is mentioned as Thormodby in Domesday. It was incorporated in 1892. Population, in 1891, 15,637; 1901, 16,053.

THORN ACACIA. See Locust Tree.

THORN-APPLE (*Datura Stramorium*). A coarse-growing, ill-smelling green-stemmed weed of the natural order solanaceæ. It is well known locally in the United States as jimson weed or Jamestown weed, and is popularly feared for its reputed poisonous properties. See Stramonium.

THORN'HILL. A town in the West Riding of Yorkshire, England, 1½ miles south of Dewsbury. Its gas and water works, a modern system of sewerage, and electric street railway, are municipally owned industries. Population, in 1901, 10,290.

THORNHILL, Sir William. In Goldsmith's *Vicar of Wakefield*, the eccentric and kindly landlord of Dr. Primrose. He rescues the Vicar's daughter Sophia from his nephew, Squire Thornhill, when the latter had abducted her, and eventually marries her.

THORN'TON, Sir Edward (1817—). An English diplomat. He was born in London and was educated at King's College, London, and at Pembroke College, Cambridge. He entered the diplomatic service as attaché to the mission at Turin in 1842; filled the same position in Mexico in 1845, and was made secretary of legation in that capital in 1851. During 1848 he did much to forward the conclusion of the important Treaty of Guadalupe Hidalgo. In 1852 he was appointed secretary of legation at Buenos Ayres; chargé d'affaires to Uruguay (1854); Minister to the Argentine Republic in 1859; to Brazil in 1865; and from 1867 to 1881 to the United States. He was knighted in 1870; in 1871 was a member of the commission on the Alabama Claims, and was appointed Privy Councilor; and in 1873 was arbitrator in the commission on the Mexican and United States claims. He was appointed Ambassador at Saint Petersburg in 1881; Ambassador at Constantinople in 1884, and retired into private life in 1887.

THORNTON, John Wingate (1818-78). An American historian, born at Saco, Me. He graduated at the Harvard Law School in 1840, and became a practicing lawyer. His great interest, however, lay in genealogical and historical work, and he published a number of books along these lines, including: *The Landing at Cape Ann* (1854); *The First Records of Anglo-American Colonization* (1859); and *The Pulpit of the American Revolution* (1860). He was the founder of the New England Historical and Genealogical Society (1844). Consult Amory, *Memoir of J. W. Thornton* (Boston, 1879).

THORNTON, Matthew (1714-1803). A signer of the Declaration of Independence. He was born in Ireland; came to America in 1717, lived first at Wiscasset, Me., and then at Worcester, Mass., where he was educated; settled as a physician at Londonderry, N. H., and served as surgeon under Sir William Pepperell in the Louisburg expedition of 1745. He was chosen president of the provincial convention of 1775, and in 1776 was sent as a delegate to the Continental Congress, taking his seat in November, when he was allowed to sign the Declaration of Independence, though he had not been elected until some time after its passage. He was Chief Justice of the Court of Common Pleas prior to 1776, and from 1776 to 1782 was a judge of the New Hampshire Supreme Court.

THORN′WELL, James Henley (1812-62). A Southern Presbyterian theologian. He was born in Marlborough District, South Carolina, and graduated at South Carolina College, Columbia, 1831. He held several pastorates; was for a time president of South Carolina College, and held professorships in the theological seminary, Columbia. He published *Arguments of Romanists Discussed and Refuted* (1845); *Discourses on Truth* (1854); *On the Rights and Duties of Masters* (1861); *The State of the Country* (1861), and was one of the most orthodox and conservative of theologians. Consult his *Life and Letters* by B. M. Palmer (Richmond, 1875) and J. L. Girardeau (1871-73).

THORN′YCROFT. A family of English sculptors. Mary (1814-95), born in Thornham, Norfolk, was a pupil of her father, John Francis, the sculptor, and exhibited her first work at the Royal Academy in 1835. In 1840 she married Thomas Thornycroft, a fellow-pupil in her father's studio, with whom she went to Italy. At Rome she made the acquaintance of John Gibson, and upon his recommendation she received a commission from the Queen, after her return to London, to execute various statues and busts. Among these are the nine life-size statues of the royal children in the drawing-room at Osborne, and the royal children in a group, characterized as the "Four Seasons." Her ideal figures include the "Flower Girl," "Sappho," and the "Skipping Girl," which last is her best work. Her husband, Thomas Thornycroft (1815-85), devoted most of his time to mechanical schemes, but occasionally produced good sculpture, often assisted by his son Hamo. Among these are the statue of Charles I. (Westminster Hall), the group of "Commerce" on the Albert Memorial (Hyde Park), and equestrian statues of the Prince Consort at Liverpool and Wolverhampton.

Their son, William Hamo Thornycroft (1850—), was born in London, and was educated at University College School. In 1869 he entered the schools of the Royal Academy, exhibiting his first work in 1871, and the same year went to Italy. The careful study of the Elgin marbles and of Italian masters greatly influenced his work, and resulted in his vigorous "Teucer" (South Kensington Museum); "Putting the Stone," Artemis (Eaton Hall); "Medea," and "Lot's Wife." His athletic "Mower" (Liverpool Gallery) and the "Sower" are suggestive of the Barbizon school, although the spirit that pervades them is English. Other works include the national monument to General Gordon in Trafalgar Square; a statue of Queen Victoria in the Royal Exchange; and the Cromwell statue at Westminster. Thornycroft is likewise renowned for his portrait busts and bas-relief. A bust of Coleridge (1885) is in Westminister Abbey. He was made a Royal Academician in 1888, and received gold medals at the Royal Academy in 1875, and at the Paris Exposition, 1900.

THORNYCROFT, John Isaac (1843—). An English naval architect. He was born in Rome and was the son of Thomas and Mary Thornycroft. He early showed a decided aptitude for mechanics, and when only eighteen years old built a steam launch, the *Nautilus*, which was the fastest boat of its kind on the Thames. Some time before this he had constructed a little model steamer which contained several important innovations later introduced by him into his torpedo boats. About 1864 he entered the University of Glasgow, and after completing the engineering course there he opened a shipyard at Chiswick in 1866, and, in particular, achieved a remarkable success as a builder of torpedo boats. Among the improvements introduced by him are the closed stop-hole and jaw, a special indicator, a water-tube boiler, and the turbine propeller. He contributed frequently to the *Transactions of the British Association* and to the publications of the Institution of Naval Architects and the Institution of Civil Engineers.

THÓRODDSEN, thôr′ŏd-sen, Jón Thór Tharson (1819-68). An Icelandic novelist, born at Reykhólar. After studying law at the University of Copenhagen, he took part in the war against the Schleswig-Holstein insurgents and in 1850 returned to Iceland. He died at Borgarfjartharsysla. In point of both time and excellence, Thóroddsen is the first Icelandic novelist. His best known works are *Piltur og Stúlka* (Lad and Lass), his first novel, and *Mathur og Kona* (Man and Wife), published posthumously. These books are characterized by a faithful delineation of Icelandic life and by a quaint and pleasing humor. Thóroddsen also wrote a number of satirical poems.

THOR′OLD, Anthony Wilson (1825-95). An English bishop. He was born at Hougham, in Lincolnshire, and educated at Queen's College, Oxford, taking his degree in 1847; he entered the ministry and filled prominent positions in London from 1857, till he became Bishop of Rochester, 1877. In 1890 he was transferred to Winchester. He is best known as the author of the devotional works, of rare spirituality, *The Presence of Christ* (1869), *The Gospel of Christ* (1882), *The Yoke of Christ* (1884), *Questions of Faith and Duty* (1892), and *The Tenderness of Christ* (1894). Consult his *Life* by Simpkinson (London, 1896).

THOROUGH BASS. See Figured Bass.

THOROUGHWORT. See Eupatorium.

THORPE, Benjamin (1782-1870). An English philologist who studied at Copenhagen under the famous philologist Rasmus Christian Rask (q.v.). While there he published a translation of Rask's *Anglo-Saxon Grammar* (1830; rev. 1865). Returning to England in 1830, he continued his extensive studies in Old English and Old Norse. Now most widely known is his

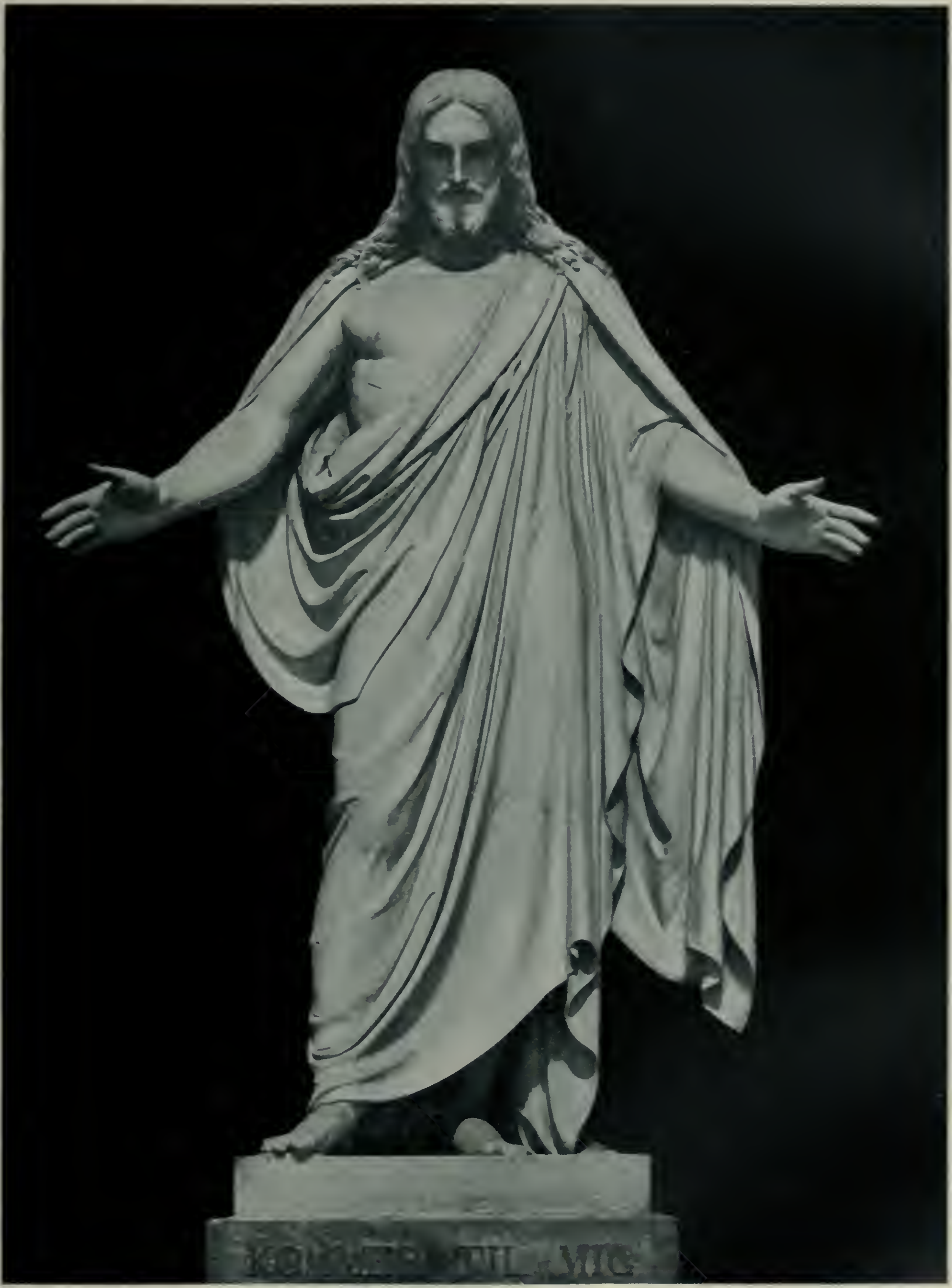
Northern Mythology, comprising the principal popular Traditions and Superstitions of Scandinavia, North Germany, and the Netherlands (3 vols., 1851). This work was supplemented by *Yule Tide Stories: a collection of Scandinavian Tales* (1853) and a translation of the *Edda of Sæmund the Learned* (1866). Thorpe's pioneer work in Old English translation, philology, and history, though in part superseded, is still of very great value. Among his publications in this department are *Cædmon's Metrical Paraphrase* (1832); *Analecta Anglo-Saxonica* (1834; 3d ed. 1868); *Ancient Laws and Institutes of England* (1840); *Codex Exoniensis, a Collection of Anglo-Saxon Poetry, with English Translation and Notes* (1842); *Anglo-Saxon Poems of Beowulf, with a Literal Translation, Notes, and Glossary* (1855); *The Anglo-Saxon Chronicle, according to the several Original Authorities* (2 vols., 1861); and *Diplomatarium Anglicum Ævi Saxonici: a Collection of English Charters* from 605 to 1066 (1865).

THORPE, Francis Newton (1857—). An American lawyer and historian, born at Swampscott, Mass. He was educated at Syracuse University and at the Law School of the University of Pennsylvania. From 1885 until 1898 he was fellow professor of American constitutional history at the University of Pennsylvania. He published several careful and scholarly works on subjects of American history, including: *The Government of the People of the United States* (1889); *The Story of the Constitution* (1891); *The Constitution of the United States, with Bibliography* (1894); *A Constitutional History of the American People, 1776-1850* (2 vols., 1898); *A History of the United States for Junior Classes* (1900); *The Constitutional History of the United States, 1765-1895* (3 vols., 1901); and *A History of the American People* (1901).

THORWALDSEN, tŏr′vȧld-zen (Dan., Thorvaldsen), Bertel (1770-1844). An eminent Danish sculptor, the chief exponent in the nineteenth century of antique tendency in the plastic arts. He was born at Copenhagen, November 19, 1770, the son of an Icelandic carpenter and carver of figures used upon galleons. Bertel's early successful attempts at his father's craft caused the latter to send the boy to the Academy at the age of eleven. After winning several other medals, he received, in 1793, the great gold medal, and with it a stipend for three years' study at Rome. It was not, however, until 1796 that the stipend for sculpture became available and Thorwaldsen set out on his journey as passenger in a royal frigate, reaching the Eternal City in March, 1797. There he was primarily less influenced by the master works of antiquity than by Carstens, who had already been his model during his adolescence at Copenhagen. Although he worked diligently, his earnings were scant, and after his stipend had been prolonged three times he was on the point of returning home, in 1803, when a commission came to him from Sir Thomas Hope to execute in marble the colossal statue of "Jason with the Golden Fleece," the plaster cast of which had called forth the admiration of all connoisseurs and critics, and even of Canova. Orders now came to him in abundance, especially after he had finished the spirited relief of the "Abduction of Briseis," following close upon his Jason. It ranks among his most perfect creations in the realm of relief sculpture, which became his favorite medium of expression. In 1804 he produced the famous group of "Cupid and Psyche," and the relief of "Dance of the Muses on Mount Helicon," and in 1805 the statues of "Apollo," "Bacchus," and "Ganymede," which was later followed by a "Ganymede Filling the Cup," and the graceful group of "Ganymede Watering the Eagle of Zeus." With his increasing reputation came new distinctions and honors; in 1804 the Florence Academy appointed him professor and in 1808 he was elected a member of the Accademia di San Luca in Rome, sending as his reception-piece the relief "A Genio Lumen." About 1809 Thorwaldsen won a new patron in Crown Prince Louis of Bavaria, who sought his advice in purchasing antique works of art and commissioned him to execute a statue of "Adonis" (completed in 1832, Glyptothek, Munich).

During the years 1809-11 he originated so many works, some of them among his best, that he felt obliged to avail himself of the coöperation of his pupils and assistants. To the year 1809 belong four of his most attractive reliefs, the group of "Hector, Paris, and Helena," and three other mythological subjects, and in 1810-11 he wrought the life-size statue of "Psyche," one of the master's creations approaching nearest to the spirit of antique art, and a heroic-sized "Mars Weighing Cupid's Arrows." About this time Napoleon had planned a visit to Rome, and the French Academy there, being charged with the decoration of the Quirinal for the conqueror's reception, intrusted Thorwaldsen with the execution of a frieze representing the "Entry of Alexander the Great into Babylon," with which he achieved prodigious success. Its execution in marble found a permanent home in the Villa Carlotta on Lake Como, and a modified replica was acquired by the Danish Government for Kristiansborg Castle. From a purely artistic point of view the "Memorial to Baroness Schubart" (1814) is nearest akin to the Greek reliefs of the fourth century B.C., and of his compositions dating from 1814-15, the medallions of "Morning" and "Night" have probably given him the widest reputation. In 1816-18 he produced "Venus with the Apple," "Hebe," "Cupid Triumphant," "Bacchante Dancing," "Shepherd Boy Resting," "Mercury Slayer of Argus," and "The Three Graces." The latter subject he treated even more successfully in the high relief for the tomb of the Milanese painter Appiani. A series of charming reliefs with Cupid as the central figure date from the same period, and the year 1819 saw the realization of the unique "Lion Monument," at Lucerne, chiseled out of the natural rock by the Swiss sculptor Ahorn after Thorwaldsen's model.

Arriving at Copenhagen in October of the same year, he was fêted and overwhelmed with honors, and besides works of less importance he obtained a commission for the plastic decoration of Vor Fruekirke (Church of Our Lady), with figures, groups, and reliefs, executed subsequently in Rome. They comprise the colossal statue of "Christus Consolator," one of his masterpieces, the statues of the "Twelve Apostles," and the reliefs of the "Institution of Baptism" and of the "Institution of the Holy Communion." He left



THORWALDSEN

"CHRIST," FROM THE STATUE IN THE FREE CHURCH AT COPENHAGEN

Copenhagen in 1820 and, having arranged at Warsaw for the erection of his equestrian statue of Prince Poniatowski and the Copernicus Monument, returned to Rome, where he devoted himself zealously to his new commissions. To these were added the "Monument to Pope Pius VII." (completed and placed in Saint Peter's in 1831), and the statue of Lord Byron (completed 1835 and since 1845 in the library of Trinity College, Cambridge). A statue of "Hope," ordered in 1818 and completed 1829, adorns the tomb of the Humboldt family in the park at Tegel, near Berlin.

In 1825 Thorwaldsen was elected president of the Academy of San Luca in Rome, notwithstanding the objections to him as a Protestant. When, in 1830, he went to Munich to superintend the erection of his statue of "Duke Eugene of Leuchtenberg," in Saint Michael's Church, he was received by King Louis with the greatest distinction and at once given the commission for an equestrian statue of the "Elector Maximilian I.," the first instance in which he represents an historical personage in the costume of the time. This was done most successfully in the statue of "Conradin, Last of the Hohenstaufen," in Santa Maria del Carmine, at Naples. Besides some reliefs of antique subjects, he produced in the thirties the figure of a "Young Dancer" (1837, Palazzo Torlonia) and a colossal statue of "Vulcan," one of his last works done in Rome.

In 1838, at the invitation of the King, he returned to his native country. The simple woodcarver's son was conducted thither like a reigning sovereign in a royal Danish frigate. Besides his monumental tasks for the Fruekirke, it was principally reliefs from Greek mythology that now claimed his attention, and in the spring of 1841 he repaired once more to Rome to finish some subjects he had left behind. His journey through Germany was a triumphal progress, and after one year in Rome he returned to Copenhagen, devoting himself to work in relief. The pieces known as "Christmas Joy in Heaven," "The Rape of Hylas," and the famous "Four Seasons" are the most remarkable. He died at the theatre, on March 24, 1844, and was escorted to his burial place with princely honors, the entire royal family attending the funeral. His native city erected to her great son a worthy monument in the Thorwaldsen Museum, in which all his works, in the original or in plaster models, his sketches and studies, and his art collections are preserved, and in the court of which his earthly remains have, according to his wish, found their last resting place.

BIBLIOGRAPHY. For his life and works consult Andersen (Berlin, 1854); Thiele, collated from the Danish by Barnard (London, 1865); id., *Thorvaldsen and His Works*, trans. by Sinding (New York, 1869), with 365 engravings; Plon, trans. by Mrs. Cashel Hoey (London, 1874), and by Luyster (Boston, 1874); Lücke, in Dohme, *Kunst und Künstler des neunzehnten Jahrhunderts*, i. (Leipzig, 1886); Sigurd Müller (Copenhagen, 1893); and Rosenberg (Bielefeld, 1901); also Kestner, *Rōmische Studien* (Berlin, 1850); Springer, *Bilder aus der enueren Kunstgeschichte* (Bonn, 1867); Lübke, *Geschichte der Plastik* (Leipzig, 1880); Lange, *Sergel og Thorvaldsen* (Copenhagen, 1886); and id., *Thorwaldsens Darstellung des Menschen*, trans. by Mann (Berlin, 1894).

THOS, thōz. A tall, non-Mongoloid people of Tonking, in the valley of the Claire River, with subbrachycephalic head-form, whom some ally with the Indonesians, others with the Lolos. They are husbandmen, living in houses on piles, and wearing a very picturesque costume. The Thos and the Muongs (q.v.) of the valley of the Black River in Tongking may be regarded as one of the principal groups of the Thai stock, to which belong the Shans (q.v.), the Laotians (see LAOS), and the Siamese. Consult Garcin, *Un an chez les Muongs au Tonkin* (Paris, 1891); De Lanessan, *L'Indo-Chine française* (ib., 1889); Pinabel, *Sur quelques peuples sauvages dépendant du Tong-King* (ib., 1884).

THOTH, thŏth *or* tōt (Gk. Θώθ, *Thōth*, Θωίθ, *Thōyth*, Θείθ, *Theyth*, from Egypt. *Dhutī*). An Egyptian deity identified by the Greeks with Mercury (q.v.). See also HERMETIC.

THOTHMES, thŏth′mēz *or* tōt′mĕs (Egyptian *Dhutī-mose*, son of Thoth; Gk. Τοίθμωσις, *Touthmōsis*) or TAHUTIANES. The name of four kings of Egypt of the Eighteenth Dynasty.

THOTHMES I. was the son and successor of Amenophis I. (q.v.) and ascended the throne about B.C. 1560. According to Manetho, as cited by Africanus, he reigned for 22 years, though no date higher than his ninth regal year has as yet been found upon the monuments. The first recorded military expedition of Thothmes I. was directed against the Nubians, whom he defeated, returning in triumph to Thebes with the body of their chief hanging from the bow of his ship. In his third year he found it necessary to chastise the Nubian tribes in another expedition. Not long after this he invaded Asia and, marching as far as the Euphrates, set up a stele which was later seen and mentioned by Thothmes III. The remainder of his reign seems to have been peaceful and was largely devoted to building operations. At Karnak (q.v.) he built two pylons and two hypostyle halls, and erected two obelisks, one of which (76 feet high) is still standing. (See OBELISK.) He also constructed buildings in the necropolis of Thebes, at Abydos, at Ibrim (a rock-hewn chapel), and at other places. The coffin of Thothmes I. was found in 1881 at Deir el-Bahri, but whether the mummy it contained is that of the King is not altogether certain.

THOTHMES II., the son and successor of Thothmes I., reigned for at least nine years, according to the monuments, and according to Manetho for twelve or thirteen years. An inscription at Assuan, dated in the first year of his reign, states that he sent an expedition against the Nubian tribes who had raided his territory, and he seems to have fought against the Asiatic Bedouin, but he undertook no extensive wars. He made additions to the great Temple of Ammon at Karnak, and his name is inscribed upon buildings in many parts of Egypt. The mummy of the King, found in 1881 at Deir el-Bahri, is that of a young man, apparently not over thirty years of age. His sister and wife, the able and energetic Hatshepset (see HATASU), was coregent with him throughout his reign, and was the real ruler of the kingdom.

THOTHMES III. was one of the greatest of all the Egyptian monarchs. The evidence as to his parentage is not altogether clear, but in all probability he was the son of Thothmes II. by a wife named Iset, and the nephew of the great Queen Hatshepset (Hatasu). He was a mere child when he succeeded his father about B.C. 1538, and he reigned for nearly 54 years. For more than 21 years he was coregent with his aunt Hatshepset, who seems to have allowed him merely a nominal share in the government. As soon as her death left him sole ruler (about B.C. 1516) he entered upon a career of conquest unrivaled in the annals of Egyptian history. Assembling an army for the invasion of Syria, he celebrated the twenty-third anniversary of his accession at Gaza. Marching thence through the passes of Mount Carmel, he signally defeated the allied Syrian forces on the plain of Esdraelon and forced them to take refuge in the city of Megiddo, which capitulated after a brief siege. The captive Syrian chiefs were restored to their dignities as vassals of Egypt, and Thothmes, after receiving messages of congratulation from a number of foreign princes, among them the King of Assyria, returned home laden with booty. The conquest was, however, not yet complete. Some of the Syrian and Phœnician cities offered a stubborn resistance and there were frequent revolts, the opponents of Egypt being encouraged and supported by the powerful State of Mitanni (see AMARNA LETTERS), which at that time occupied Northern Syria and Northern Mesopotamia. A war with this State soon followed, in the course of which Thothmes ravaged the Mitannian territory and captured a number of cities, including the important city of Carchemish, on the Euphrates. He gained no permanent possessions in this quarter, but the result of the war enabled him to extend his dominions, undisturbed by Mitannian interference, over Northern Palestine and Phœnicia. At the city of Ni, near the Lower Orontes, he set up a stele to mark the limit of the Egyptian Empire in that quarter. In the course of his reign Thothmes conducted at least fourteen Asiatic campaigns, and the large booty and tribute he obtained were lavished freely upon the Egyptian temples. In the 50th year of his reign he caused the old canal at the first cataract of the Nile to be cleared and sailed through it on an expedition against the Nubians. As a builder Thothmes was hardly less energetic than as a warrior, and his monuments occur throughout Egypt and Nubia. He made important additions to the great Temple of Ammon at Karnak and caused the annals of his reign to be inscribed upon its walls, and he also built at Heliopolis, Memphis, Abydos, Hermonthis, Edfu, Esneh, Ombos, and other places. In Nubia, where he built or restored many temples, he was the founder of the large temple at Soleb, near the third cataract. Of the numerous obelisks erected by him, one is now on the hill of the Lateran at Rome; another is in Constantinople; a third stands on the Thames embankment in London; and a fourth is in Central Park, New York. (See OBELISK.) Thothmes III. died about B.C. 1485; his mummy was among those found at Deir el-Bahri in 1881.

THOTHMES IV., the son of Amenophis II. (q.v.) and the grandson of Thothmes III., ruled for nine years from about B.C. 1460. He conducted military expeditions to Nubia and to Phœnicia, collecting booty and tribute in both countries, and an inscription at Ghizeh records that he cleared away the sand from the great Sphinx (q.v.). From the Amarna tablets it appears that he maintained friendly relations with Babylonia and with Mitanni, and that he married the daughter of Antatama, King of the latter country.

Consult: Wiedemann, *Aegyptische Geschichte* (Gotha, 1884-88); Meyer, *Geschichte des alten Aegyptens* (Berlin, 1887); Petrie, *A History of Egypt* (New York, 1897); Budge, *A History of Egypt* (ib., 1902); Müler, *Die alten Aegypter als Krieger und Eroberer in Asien* (Leipzig, 1903).

THOU, tōō, JACQUES AUGUSTE DE (1553-1617). A French historian, born in Paris October 8, 1553. He studied jurisprudence at Orleans and Valence and in 1576 became an ecclesiastical councilor of the Parlement of Paris. He was an active member of the *Politiques* (q.v.), who were largely instrumental in establishing on the throne Henry of Nevarre, by whom De Thou was made keeper of the royal library and vice-president of the Parlement. In 1591 he began his great work, the *Historia Sui Temporis*, which covered the period from the death of Francis I. to that of Henry IV. (1547-1610), and which occupied him during the remainder of his life. He took an important part in the drawing up of the Edict of Nantes. The history was completed by Rigault from materials left by De Thou and comprises in its full form 143 books. The work is marked by striking fairness and a faithful adherence to fact, remarkable in a history dealing with a period of bitter partisan spirit, civil war, and anarchy. The history was published in 11 volumes (Paris, 1609-14) and 4 volumes (Frankfort, 1625), both in Latin. A French translation appeared in 10 volumes (Paris, 1740), and one in English by Buckley in 7 volumes (London, 1773). After De Thou's death appeared his memoirs, *Thuani Commentarii de Vita Sua* (Orleans, 1620). Consult: Collinson, *Life of Thuanus, with some account of his writings* (London, 1807); Chasles, *Discours sur la vie et les ouvrages de J. A. De Thou* (Paris, 1824).

THOUGHT. See CONCEPT; IMAGINATION; INFERENCE; JUDGMENT; LANGUAGE; LOGIC; MEMORY; RATIOCINATION.

THOUSAND AND ONE DAYS. An imitation of the *Thousand Nights and One Night*, or *Arabian Nights* (q.v.), written by Pétis de la Croix, a French Orientalist and traveler, in 1710. The work purports to be a translation of a Persian collection called *Hazar u yak rūz*, which Mukhlis, a Persian friend of De la Croix, alleged he had made from a Turkish book *Al-Faraj ba'd ash-Shiddah*, or *Joy After Sorrow*. So far as is known, however, the *Hazar u yak rūz* does not exist, although the Turkish work is extant, and is well known to scholars. The first edition of the *Thousand and One Days* was made by De la Croix (Paris, 1710-12).

THOUSAND AND ONE NIGHTS. See ARABIAN NIGHTS.

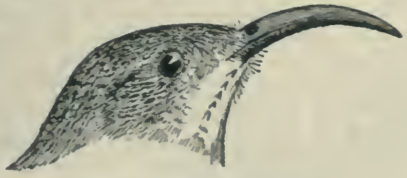
THOUSAND ISLANDS, THE. A collection of small islands, numbering about 1700, situated in an expansion of the Saint Lawrence River, about 40 miles long and from 4 to 7 miles wide, between Ontario, Canada, and Jefferson and Saint Lawrence counties, New York (Map: Ontario, G 3). They are favorite resorts for summer tourists on account of their picturesque beauty. Many are private property and contain the summer homes of wealthy Americans and Canadians.

THRACE, thrās (Lat. *Thracia*, from Gk. Θράκη, *Thrakē*, Thrace, from Θρᾶξ. *Thrax*, Thracian). The ancient name of an extensive region in the eastern part of the Balkan Peninsula, whose boundaries varied at different periods. At first the designation seems to have included part of Macedonia, where early story knows of Thracians in Pieria, with whom was connected the worship of the Muses, mythical bards, and Dionysus. In later times, however, the name was applied to the great district northeast of Macedonia bounded on the north by the Danube, on the east by the Euxine, on the south by the Bosporus, Propontis (Sea of Marmora), Hellespont, the Ægean, and Macedonia, and on the west by Illyria and Macedonia. Under the Romans it designated the region south of the Hæmus Mountains (Balkans), the region to the north being the Province of Mœsia. From the Hæmus three lesser chains stretch toward the south. The three most important rivers of Thrace were the Strymon (mod. *Struma*), which during the Greek period formed the boundary between Thrace and Macedonia; the Nestus (mod. *Kara-Su*); and the Hebrus (mod. *Maritza*, q.v.), the largest—all of which flow southward into the Ægean Sea. The climate was considered by the Greeks very severe—even that of Ænos, on the shores of the Ægean, being described by Athenæus as "eight months of cold and four months of winter." The country was in great measure uncultivated, and covered with forests, but the river valleys were fertile. The chief products were corn, millet, wine, and hemp. Cattle, sheep, horses, and swine were raised in great numbers. The minerals were a great source of wealth, especially the rich gold mines of Mount Pangæus, which attracted the Thasians, and led the Athenians to the foundation of Amphipolis.

While the exact relation between Thracians and Greeks is still uncertain, it is clear that the former belonged to the great Indo-European family, and were probably closely akin to the Phrygians of Asia Minor, whose language indicates a somewhat near connection in the past with the Hellenic race. In historic times the Thracians appear as a wild and barbarous race, fond of war and plunder, and ruled over by many petty kings. In the sixth century B.C. they were subdued by the Persians, but after the retreat of Xerxes resumed their independence, of which they had probably been only nominally deprived by their conquerors. In the fifth century a king, Teres, seems to have secured a decided supremacy and under his rule and that of his son Sitalces, with whom the Athenians contracted an alliance, it is possible to speak of a Thracian kingdom. After the death of Sitalces his territory was divided into three parts, and the old internecine strife was resumed. Thrace thus fell an easy prey to Philip of Macedon (after B.C. 359), who incorporated the western portion of the country, as far as the Nestus in Macedonia, while Macedonian garrisons held the rest of the country in subjection. After the fall of Macedon before the power of Rome (B.C. 168) Thrace was for a short time independent, but in B.C. 133 came under the Roman rule. Mœsia was formed into a province in B.C. 29, but Thrace continued under dependent kings until A.D. 46, when it was organized as a province. After the division of the Roman Empire (395) it shared the history of the Eastern Empire. The natural resources of the country and the opportunities for profitable trade led to the establishment of Greek colonies along the coast at an early period. The earliest were naturally along the waters leading to the Black Sea, among them Byzantium, Selymbria, Perinthus, Sestus, and Elæus, while before the end of the sixth century B.C. Miltiades had secured the Thracian Chersonese (the modern Peninsula of Gallipoli) for Athens. Along the Ægean coast were Amphipolis, Abdera, Mesembria, Ænus, and many others, while on the Black Sea were Istrus, Tomi, Odessus, and Apollonia. These colonies, however, never attempted to control the interior, and though they submitted to the Persians, and later to the Macedonians and Romans, their history belongs to Greece rather than to Thrace. In A.D. 334 a colony of Samatians was planted in Thrace by Constantine, and in 376 another of Goths by permission of Valens. In 395 it was overrun by Alaric, and in 447 by Attila. Soon after the middle of the fourteenth century Sultan Amurath I. obtained possession of all its fortresses, except Constantinople, and it has ever since remained subject to Turkey. Consult: Hiller von Gaertringen, *De Græcorum Fabulis ad Thraces Pertinentibus* (Göttingen, 1886); Kalopathakes, *De Thracia, Provincia Romana* (Berlin, 1894); Tomaschek, *Die alten Thraker* (Vienna, 1893-95). See BALKAN PENINSULA; BULGARIA.

THRALE, HESTER LYNCH. An English author. See PIOZZI.

THRASHER (variant of *thrusher*, from thrush). A name given in the United States to the various species of thrush-like wrens of the genus Harporhynchus. They have generally a rather long decurved bill, not notched near the tip; short concave wings, much shorter than the tail. In color they are brown or ash above, usually spotted on the breast. Their names are brown thrasher (*Harporhynchus rufus*); Cape Saint Lucas thrasher (*Harporhynchus cinereus*); gray curvebill thrasher (*Harporhynchus curvirostris*); California thrasher (*Harporhynchus redivivus*); crissal thrasher (*Harporhynchus crissalis*); and Arizona thrasher (*Harporhynchus Bendirii*); besides which there are several subspecies. Only the brown thrasher is widely distributed; all the others are confined to the Southwestern United States, especially Arizona and Mexico. The brown thrasher, often improperly called 'brown thrush,' is common in the Eastern United States, ranging north to Canada and west



HEAD OF CRISSAL THRASHER.

to the Rockies. It is migratory in the North, but winters in the Southern States. It is about a foot long, rich ferruginous above, creamy, spotted with brown beneath. It is one of the finest songsters native to America and is also a very fine mimic, thus resembling the mocking bird, to which it is nearly related. Its nest is placed in a low bush or on a brush heap, and the eggs are profusely peppered with brown specks. See Plate of EGGS OF AMERICAN SONG BIRDS. Consult Coues, *Birds of the Colorado Valley* (Washington, 1878).

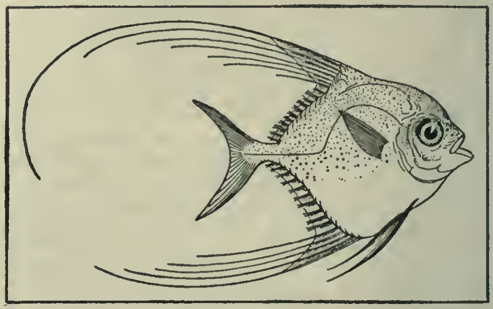
BROWN THRASHER.

THRAS′YBU′LUS (Lat., from Gk. θρασύβουλος, *Thrasyboulos* (?-B.C. 390). An Athenian general and a prominent member of the democratic party at Athens during the last years of the Peloponnesian War. In company with Thrasyllus at Samos, in B.C. 411, he vigorously opposed the establishment of the Four Hundred, and was instrumental in securing the recall of Alcibiades from exile. In the same year he, with Thrasyllus, defeated the Peloponnesian admiral Mindarus at Cynossema, and in B.C. 407, in command of a fleet of thirty vessels, he compelled the submission of the revolted cities in Thrace. He held a subordinate command in the battle of Arginusæ (B.C. 406), and afterwards concurred with Theramenes in the accusation of the generals therein engaged. Being banished by the Thirty Tyrants (B.C. 404), he went to reside at Thebes, where he planned the overthrow of the Thirty and the reëstablishment of the democracy. With a hundred men, refugees like himself, he seized the deserted fort of Rhyle, and, being here joined by others, advanced on the Piræus itself. In the battle that ensued the Thirty were worsted, and, as a result, the democratic form of government was soon reëstablished at Athens. In B.C. 395 Thrasybulus commanded a force sent to assist Thebes against the Spartans. In B.C. 391 he was dispatched, in command of forty triremes, to the assistance of Rhodes, but, first sailing to the Hellespont, succeeded in extending the alliances of Athens in those regions. When his fleet reached Pamphylia he was slain by night in his tent by the people of Aspendus, in consequence of some misdeeds committed by his soldiers.

THRASYL′LUS (Lat., from Gk. Θράσυλλος), MONUMENT OF. A choragic monument at Athens erected in B.C. 320, by Thrasyllus, in a cave above the Theatre of Dionysus. An ornamental architectural front closed the cave and was surmounted by a statue of Dionysus, now in the British museum. The monument is almost entirely destroyed with the exception of an inscribed architrave, and two columns designed for votive tripods, on the face of the rock above the cave.

THREAD. An exceedingly small twine made by twisting several thicknesses of yarn so as to produce a strong and well-rounded line for sewing with, either of cotton, flax, or silk.

THREADFISH, COBBLER-FISH, or SUNFISH. A well-known fish (*Alectis ciliaris*) allied to the pompanos, of both coasts of tropical America, where it has some commercial importance. It is of moderate size, has the curious shape shown in the illustration, and owes its names to the long filaments (becoming shorter with age) into which the first few rays of the dorsal and anal fins are prolonged.



THREADFISH.

THREAD-HERRING, or MACHUELO. A small fish (*Opisthonema oglinum*), closely related to sardines and menhaden, common along the Southern coast; it is 12 inches long, bluish above and silvery below, with an indistinct bluish shoulder-spot, and has a long dorsal fin-filament, from which the fish receives its name.

THREADNEEDLE STREET. A London street, on which stands the Bank of England, hence popularly called the "Old Lady of Threadneedle Street." The origin of the name is said to be the three needles as the escutcheon of the Needlemaker's Company.

THREAD-WORMS. The thread or roundworms are members of the class Nematelminthes, order Nematoidea, and are so called from their slender round thread-like body. The dense skin is not segmented, and the body-cavity (cœlome) is not lined with epithelium, but is directly bounded by the muscles of the body. There is a definite digestive canal. Two excretory canals open in front on the ventral side of the body, while the nervous system consists of a ring around the pharynx, from which two main nerve cords pass backward. The true thread-worms undergo no metamorphosis. They are mostly parasitic and usually bisexual. Some of them are free, living coiled up under stones between tide-marks; certain minute species occur in fresh water or damp earth or mud. A few live in plants, and *Tylencha tritici* damages wheat.

The more common parasitic forms are species of Ascaris, Trichina, Oxyuris, etc. Of Ascaris, the human roundworm (*Ascaris lumbricoides*) is remarkable for its great size, being 5-6 inches long, and about a tenth of an inch in diameter; it has three papillæ around the mouth and is milk-white. The common pin-worm (*Oxyuris vermicularis*) lives in the rectum of children; the palisade-worm (*Eustrongylus gigas*), one female of which was 39 inches in length and the thickness of a quill, the male being one-third as long, has been found living in man; allied species occur in the brain or brain-cavity of birds. Among the most formidable human parasites of this group are the Trichina (q.v.), the guinea-worm (q.v.), and the species of Filaria. *Filaria sanguinis-hominis*, a microscopic thread-worm found living in the blood of the mosquito in India and China, is thought to occasion the disease known as elephantiasis. The formidable disease called *beri-beri* is supposed to be due to a nematode worm, whose eggs and embryos swarm by millions in the soil and dirty puddles around the villages. In certain species of the family Anguillulidæ there is an alternation of generations (see PARTHENOGENESIS), from an hermaphroditic internal parasitic to a free diœcious generation. Thus *Rhabditis* (*Rhabdonema*) *nigrovenosa* lives in mud, and gives rise to a second form living in the lungs of frogs.

THREATS. See such titles as BLACKMAIL; FALSE IMPRISONMENT; CONSPIRACY; INTIMIDATION; and consult the authorities referred to under CRIMINAL LAW and CONSPIRACY.

THREE CHAPTER CONTROVERSY. See CHAPTERS, THE THREE.

THREE CHOIRS FESTIVAL. An English musical festival which had its first regular organization in 1724, when the three cathedral choirs of Gloucester, Worcester, and Hereford joined for the performance of a cathedral service, and an oratorio performance given in the Shire Hall. The proceeds have always been devoted to a fund for the relief of the widows and orphans of the poorer clergy of the three dioceses. In 1753 the festival was extended to three days, and in 1724 to four days, the period which still prevails. The festivals are held alternately in each of the three cities, and the conductor is always the organist of the cathedral of the city in which the festival is held.

THREE-COLOR PROCESS. A photo-mechanical process of reproducing in color applicable either to stone or metal. The general process consists in first making three photograph negatives of the same subject through three different color screens representing the three primary colors, red, yellow, and blue. From these three negatives printing blocks are made and the result is obtained by making three printings, one from each block, with three different pigments, each pigment representing as nearly as possible the color originally used in the color screen. The accuracy of the finished picture depends, therefore, to a great extent, upon the correctness of the pigments selected. The process is largely mechanical and the result is only approximately correct, though increased care is being taken in the manipulation and better results are constantly obtained. The Colored Plate shown in the article on LITHOGRAPHY (q.v.) was prepared in this manner. Reference should also be made to the article COLOR PHOTOGRAPHY, where the underlying principles are explained. The method of making the metal 'half-tone' plates is discussed under PHOTO-ENGRAVING.

THREE KINGS OF COLOGNE. The three wise men of the East or Magi who followed the star to the birthplace of the infant Jesus. Their names are usually given as Gaspar, Melchior, and Balthazar. Their bones are supposed to be preserved in Cologne Cathedral.

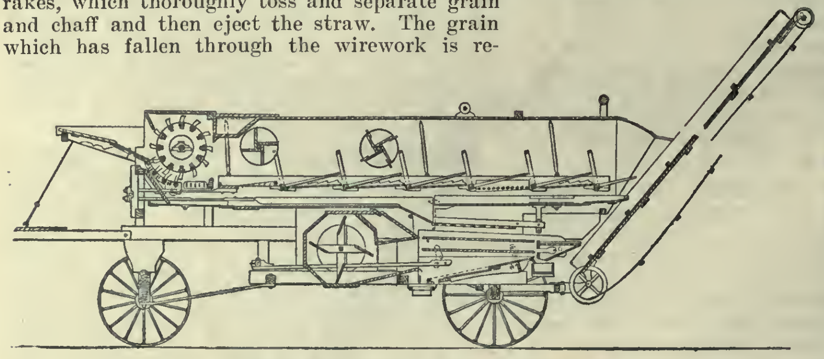
THREE MUSKETEERS. See TROIS MOUSQUETAIRES.

THREE RIVERS. A port of entry and the capital of Saint Maurice County, Quebec, Canada, at the junction of the Saint Lawrence and Saint Maurice rivers, and on the Grand Trunk and the Canadian Pacific railroads, midway between Montreal and Quebec (Map: Quebec, D 4). It was founded in 1634 by Champlain, and is within a short distance from the famous falls of Shawanegan. It has a cathedral, a college, saw mills, iron foundries, machine shops, and a shoe factory, and the water power of the falls has been utilized for the manufacture of wood pulp. Here on June 8, 1776, an American force of about 2000 men under General Thompson attacked a British force of about 6000 men, and was disastrously defeated, both General Thompson and Colonel Irvine, his second in command, being captured. Population, in 1891, 8334; in 1901, 9981.

THRESHER-SHARK, or SWINGLETAIL. An extraordinary shark (*Alopias vulpes*) abounding in all warm seas, especially in the Mediterranean and the Atlantic, and distinguished by its long tail. (See Plate of GREAT SHARKS.) This is an extension of the upper lobe of the heterocercal tail to a length equal or exceeding that of the body, and is used in obtaining the food. This shark follows the herring, menhaden, and other gregarious fishes in their migrations, and, rushing into their schools, threshes about with its tail, killing or stunning many. It is reported to attack whales, but there is no scientific evidence of this. It is about 15 feet long, lead color above, and whitish beneath, and contains some oil, but not enough to compensate for the trouble its capture causes.

THRESHING (from *thresh*, AS. *þerscan*, *þærscan*, Goth. *þriskan*, OHG. *drescan*, Ger. *dreschen*, to thresh; connected with Lith. *traszkéti*, to rattle, OChurch Slav, *thryeshtiti*, to strike) and THRESHING MACHINES. Threshing is the separating of the grain or seeds of plants from the straw or haulm, a process which has been accomplished in various ages and countries by sundry means more or less effective. The first method known to have been practiced was the beating out of the grain from the ears with a stick. An improvement on this method was the practice of the ancient Egyptians and Israelites of spreading out the loosened sheaves of grain on a circular piece of hard ground and driving oxen over it, so as to tread the grain out; but as this mode was found to damage a portion of the grain, it was partially superseded in later times by the threshing-sledge, a heavy frame mounted on three rollers, which was dragged over the heaps of sheaves. The method of treading out the grain or seed, however, is still used to a limited extent on small farms in the United States, especially in case of buckwheat, clover, beans, etc. Similar methods of threshing were employed by the Greeks and Romans, the stick (*fustis*, *baculum*, *pertica*), the treading by men or horses, and the threshing-sledge (*tribulum*) being found in common use among them; but their threshing-sledge, which is still to be seen in operation in Greece, Asia Minor, Georgia, and Syria, differed from the Eastern one by having pieces of iron or sharp flints fastened to the lower side, in place of rollers. The primitive implement in Northern Europe was the stick, and an improved modification of it, the flail, is still used to a limited extent in Europe and America. The flail consists of two sticks loosely fastened together at one end by stout thongs; one stick is used as a handle by the workman, and by a circular swing around his head he brings down the other stick horizontally on the heads of the loosened sheaves spread out on the barn-floor.

Early but unsuccessful inventions to supersede the flail by a machine, both in England and America, were largely of the rotary beater or flail type In 1786, however, Andrew Meikle, an ingenious Scotch mechanic, produced a threshing machine so perfect that, despite nearly a century of improvers, it is essentially the machine of its inventor. In Meikle's machine the mode of operation is as follows: A sheaf is loosened and spread out on the feeding-board, with the ears toward the machine; it is then pushed forward till caught between two revolving fluted rollers of cast iron, a new sheaf taking its place as soon as the first has disappeared. Behind the rollers is a rapidly revolving drum or cylinder, having four beaters or spars of wood armed with iron placed along its surface parallel to its axle; and these beaters, striking the heads as they are protruded from between the rollers, detach the seeds and husks. Grain and straw then pass together over the cylinder, the grain falling through wirework, the straw being passed forward by circular rakes, which thoroughly toss and separate grain and chaff and then eject the straw. The grain which has fallen through the wirework is received into a winnowing machine, where the chaff is blown out, etc., and is then either discharged or, as in the most improved machines, is raised by a series or buckets fixed on an endless web, and again winnowed, to separate the perfect grains from the light and small seeds. Previous to the second winnowing, barley is subjected to the process of hummeling, by which the awns are removed.


LONGITUDINAL SECTION OF MODERN THRESHER.

Modifications of Meikle's drum in which the two grooved cylinders were dispensed with were employed to some extent in threshing machines in England and America, but have been almost entirely superseded in modern machines by a high-speed cylinder with radial teeth playing between inwardly projecting teeth set in a fixed concave or section of a cylinder. Prior to 1840 little progress was made in perfecting the threshing machine in America. Since that date improvement has been rapid and the modern American machine with a capacity of 1000 bushels per day is a marvel of ingenuity and efficiency. In its most advanced form it cuts the bands of the sheaves and feeds itself; thoroughly separates the grain from the straw, winnows the grain and deposits it in sacks or loads it into wagons; removes the straw and stacks it. The figure shows the interior construction of a modern thresher. The concave is open and has in rear an open grate so that the larger part of the grain is separated from the straw at this point and is conveyed directly to the fan. A considerable portion, however, still remains in the straw and can be separated only by further agitation, which is secured by the vibrating separator, revolving pickers or beaters, and shaking forks shown in the centre of the machine to the rear of the cylinder. These devices beat the straw thoroughly, at the same time conveying it to the rear of the machine, where it is taken by the stacker, which consists either of an elevator or tube with blast. The separated grain drops through the perforated bottom of the separator and with the grain coming directly from the drum is carried to the fanning mill by means of a vibrating platform or conveyor located immediately beneath the separator. The parts of the modern thresher are in large measure adjustable, so that the machine may be adapted to different kinds of grain and to a variety of conditions, but separate machines for special purposes are also made, as, for instance, for threshing rice, peas and beans, peanuts, clover, and for husking maize and shredding the fodder. Inventive genius is also being largely exercised in devising ingenious accessories to the thresher proper, such as automatic band cutters and feeders, stackers, and grain measurers and loaders. The motive power most commonly used for driving threshing machines is horse power or steam. The former was most common in the earlier days of the threshing machine, but has been largely superseded by the portable steam engine. Engines with straw-burning furnaces have been used in Hungary and in the rice regions of the United States.

THRIFT (Icel. *þrift*, from *þrĭfa*, to thrive, clutch, grip; so called from the rapid growth of the plant), *Armeria*. A genus of plants of the natural order Plumbaginaceæ, having the flowers collected into a rounded head, a funnel-shaped dry and membranous calyx, five petals united at the base, five distinct styles, and five stamens attached to the base of the petals. By many botanists it has been regarded as a subdivision of the genus Statice, from which it is distinguished chiefly by having the flowers in heads. The common thrift (*Armeria maritima*) is a European seacoast plant which grows in turf-like form, with linear leaves, scapes a few inches high, and beautiful rose-colored flowers in midsummer. Being hardy and easily cultivated, it is often planted in gardens as a border, but it must be renewed every two or three years, the smallest rootless sets growing, however, with great readiness in the moist weather of spring. A number of other species, for instance, *Armeria elongata*, *Armeria plantaginea*, are planted as ornamentals.

THRIPS (Lat., from Gk. θρίψ, wood-worm). Any one of the minute insects of the order Thysanoptera. They are slender insects with four wings, which are also very slender and short, perfectly transparent, and without veins. They are fringed with long, delicate hairs, and when at rest lie along the back of the abdomen. The metamorphosis is incomplete, and the mouthparts function in sucking, but are intermediate between true biting and true sucking mouthparts. The feet bear each a little bladder-like vesicle at the tip, from which an old name of the order (Physapoda) was derived. Thrips are found in flowers, and do some damage to the essential organs. They also occur upon the leaves of plants, and one species damages onions (q.v.) and tobacco. Another species (*Limothrips poaphagus*) works in the joints of timothy grass, causing the heads prematurely to turn yellow and die. Some species have been observed feeding upon other insects and others undoubtedly have some beneficial effect as fertilizers of flowers. Parthenogenesis sometimes occurs with these insects. Rather more than thirty species occur in the United States. The name 'thrips' has been erroneously applied by vine-growers to some of the leaf-hoppers of the family Jassidæ. Consult Hinds, *Contribution to a Monograph of the Insects of the Order Thysanoptera Inhabiting North America* (Washington, 1902).

THROAT (AS. *þrotu*, OHG. *drozza*, Ger. *Drossel*, throat; connected with MHG. *strozze*, throat, Ger. *strotzen*, to swell, Eng. *strut*), AFFECTIONS OF THE. The throat includes those structures lying behind and below the anterior pillars of the fauces. In the common acceptation of the term it also means the anterior portion of the neck, containing the windpipe, gullet, and a number of large blood-vessels and nerves. The throat may be divided anatomically into the pharynx and the larynx, the latter being the upper part of the windpipe and the principal organ of the voice. Into the pharynx open the nasal passages and the Eustachian tubes. The entrance to the pharynx is nearly surrounded by a ring of lymphoid tissue, comprising the faucial, lingual, and pharyngeal tonsils. The first of these are usually known as the tonsils, are always present, and often enlarged, and are situated at the sides of the fauces between the anterior and posterior pillars. The lingual tonsil, when it exists, lies between the base of the tongue and the epiglottis. The pharyngeal tonsils, more often referred to as adenoid growths, spring from the roof and sides of the pharyngeal vault. They are often present in children and when in any amount constitute a pathological condition, giving rise to obstructed nasal breathing, nasal catarrh, and general poor health. Any or all of these structures may be involved in diseases of the throat, and expert examination of them is often necessary. Inspection is usually conducted by light reflected into the throat from a head mirror, a circular, concave reflector pierced with a hole for vision. The light is projected through the open mouth upon the back of the throat. From this point the rays of light may be reflected by means of a small mirror introduced into the pharynx either downward to examine the larynx (laryngoscopy) or upward to inspect the posterior nares and the vault of the pharynx (rhinoscopy), the tongue being meanwhile held out or depressed. In direct examination the tonsils, soft palate, uvula, posterior wall of the pharynx, and often the top of the epiglottis may be seen. Laryngoscopy shows the whole of the epiglottis, the root of the tongue, lingual tonsil, the true and false vocal cords, the opening of the glottis, and even the bifurcation of the trachea. The throat is lined with mucous membrane, plentifully supplied with blood-vessels, glands, and nerves, and is often the seat of acute or chronic catarrhal inflammation. Acute inflammation of either the pharynx or larynx is due to exposure, sudden change of temperature, the inhalation of dust, steam, or irritating vapors, indigestion and constipation, and certain diseases such as rheumatism, gout, and tuberculosis. Chronic catarrh arises also from the causes named when long continued, and may be due to excessive use or straining of the voice. Specific inflammations of the throat accompanying scarlatina and diphtheria are described under these titles. Catarrhal inflammation of the throat is marked by a sense of dryness, or of a foreign body in the pharynx, a slight but annoying cough, and the expectoration of viscid, tenacious mucus, sometimes tinged with blood. The voice is hoarse, easily fatigued, or entirely absent. In the treatment of catarrrhal conditions in this region, alkaline and antiseptic douches are given to remove the mucous accumulations, and stimulating and astringent applications, such as tannin, iron, and nitrate of silver, used to reduce congestion and restore the membrane to its normal action. Naso-pharyngeal catarrh is frequently caused by intra-nasal abnormalities and may as often be remedied by restoring natural respiration through the nose. General tonic treatment is always necessary. Internally iron, quinine, and strychnine are the best remedies.

Abscesses sometimes occur in the throat either in the region of the tonsils (see QUINSY) or at the base of the tongue. An acute and alarming inflammation of the loose tissues about the larynx is found in connection with abscess, acute laryngitis, the injecting of scalding fluids or irritant poisons, and as a complication of certain diseases such as smallpox, scarlatina, or Bright's disease. In this condition, known as œdema of the glottis, the swollen and dropsical tissues fill up or overlap the opening of the glottis, preventing the ingress of air and threatening immediate suffocation. If not speedily relieved, œdema of the glottis causes death by asphyxiation. This affection is treated by puncture or scarification of the dropsical sac, the application of leeches over the sides of the larynx, and the administration of pilocarpine. Sometimes intubation, laryngotomy, or tracheotomy may be necessary. Intubation consists in the introduction of a metal or hard rubber tube between the vocal cords, with a flange resting above them to prevent slipping into the trachea. Laryngotomy or tracheotomy is employed when intubation is not feasible. The former consists in opening the larynx from the outside through the cricothyroid membrane, and introducing a tube through which the patient breathes. In tracheotomy the opening is made lower down, in the trachea.

Tuberculous laryngitis occurs in many phthisical patients. There is swelling, ulceration, and destruction of the vocal cords and adjacent structures, with hoarseness, loss of voice, great pain, and inability to swallow solid food.

Syphilis, particularly in its tertiary stage, often attacks the throat, producing fibrous tissue which gradually contracts, and narrows, distorts, and partially destroys the larynx.

Foreign bodies not seldom find their way into the larynx, and if small are apt to pass into the trachea or bronchial tubes, and if not removed may produce death by suffocation or set up a fatal pneumonia. In children it is often possible by inverting and shaking the patient to dislodge a foreign body; in other cases these have to be removed by specially devised instruments or a cutting operation.

Cancer and other tumors of a polypoid or fibrous character may develop in the larynx or its neighborhood. Cancer is nearly always fatal. See Catarrh; Diphtheria; Quinsy; Tonsils.

THROMBOSIS (Neo-Lat., from Gk. *θρόμβωσις*, the state of being curdled, from *θρόμβος*, *thrombos*, curd, clot). A term originally suggested by Virchow, and employed to designate an affection of the blood vessels (either veins or arteries) which essentially consists in a coagulation of blood (forming a true clot) at a certain fixed spot, owing to disease of the blood vessel, pressure against its side or laceration of it, or microbial infection. It is a common cause of sudden death in persons who appear to be in robust health. If death does not result, after the detachment of a thrombus and its lodgment, as an embolism, in a cerebral artery, softening of the brain follows. See Apoplexy; Embolism.

THROMBUS. A stratified clot formed within a blood vessel by coagulation at a bifurcation of a vessel or upon a surface roughened, for example, by sclerotic changes. See Thrombosis.

THROOP, Montgomery Hunt (1827-92). An American lawyer, nephew of Enos T. Throop, late Governor of New York. He was born in New York State, and, after studying at Hobart College, practiced law in partnership with Roscoe Conkling. In 1870 he was appointed a commissioner to revise the statutes of the State; afterwards was chairman of the commission that prepared the Code of Civil Procedure, and after 1878 devoted himself to legal writing. His publications include a *Treatise on the Validity of Verbal Agreements* (1870); an *Annotated Code of Civil Procedure* (1880); and the *Revised Statutes of New York* (1888).

THROSTLE. See Spinning.

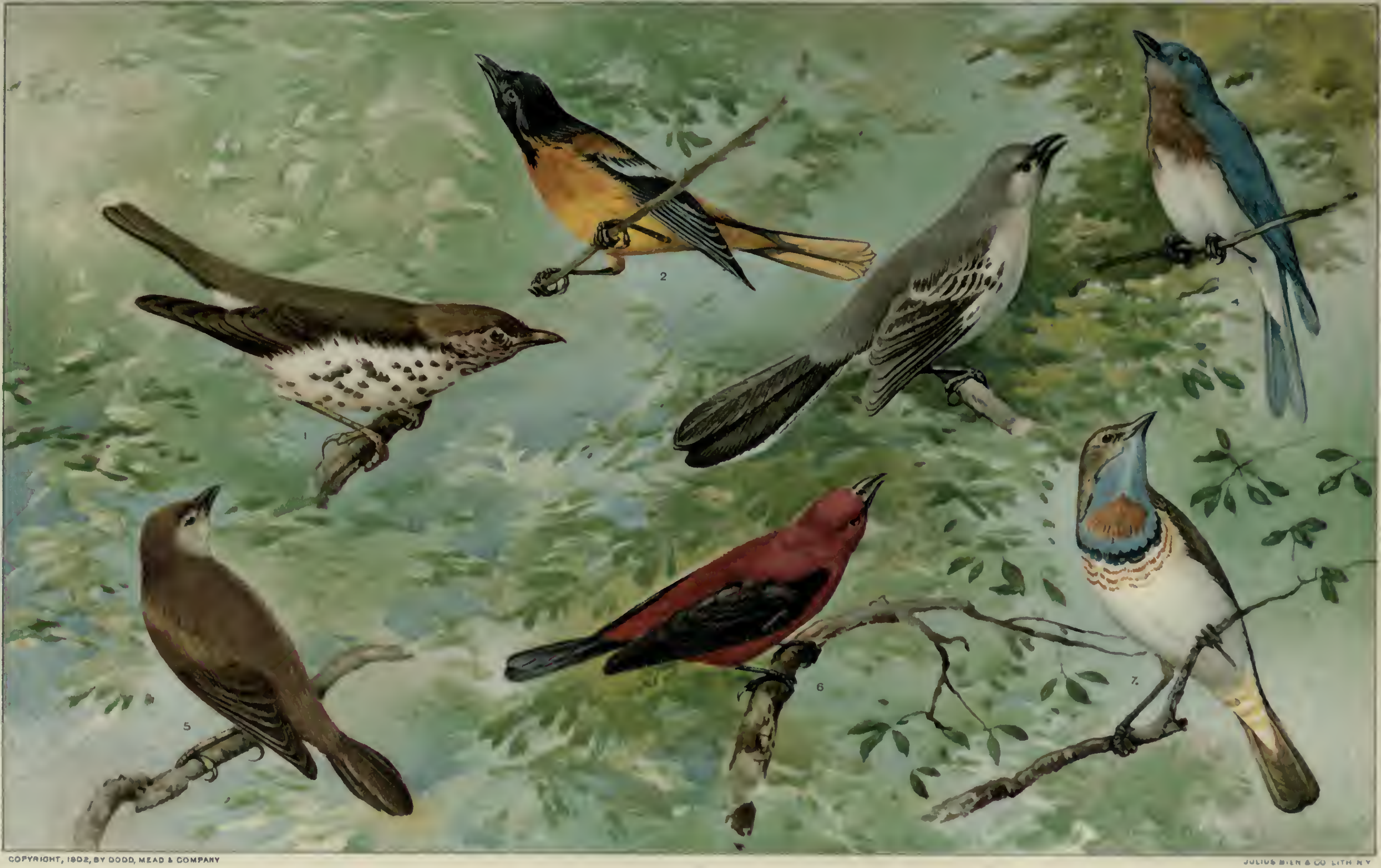
THROW (AS. *þrāwan*, OHG. *drāhan*, *drājan*, Ger. *drehen*, to turn, twist; connected with Lat. *terebra*, borer, Gk. *τερεῖν*, *terein*, to bore). The term applied in mining to the amount of dislocation (q.v.), in a vertical direction, produced by a fault in the strata. That side of the fracture which has moved downward relatively is spoken of as the downthrow side, the opposite one as the upthrow. See Faults.

THRUSH (AS. *rysce*, OHG. *drōsca*, *drōscea*, *drōscela*, Bavarian *Droschel*, thrush; connected with AS. *prostle*, *prosle*, Eng. *throstle*, Ger. *Drossel*, thrush, and ultimately with Lat. *turdus*, Lith. *strázdas*, Lett. *strazds*, thrush). The thrushes comprise the subfamily Turdinæ of the family Turdidæ, usually ranked as the highest group of birds. They have a bill of moderate size, straight, shorter than the head, and provided at the base with rictal bristles; the nostrils are oval and bare; the tarsi are long, slender, and 'booted;' ten primaries are present, but the outermost is exceedingly small; tail shorter than wings. About 150 species, all of moderate size, are known, and they are widely distributed, and most of them are migratory. A few species are gregarious, but the majority live singly or in pairs. Their food is mainly insects and worms, of which they destroy incalculable numbers, but in winter they eat berries and seeds, and in spring small fruits. All are excellent singers, and some are counted the best of bird songsters.

In America, north of Mexico, there are about a dozen species of thrush, of which the best known is the common robin (q.v.), which ranges over the whole continent. In Lower California there is an allied species; and in the Northwest occurs the 'varied thrush.' (See Oregon Robin.) Our more distinctive 'thrushes' are considerably smaller than the robin and all of them are birds of the woods.

The best known are the Wilson's thrush or veery (*Turdus fuscescens*), the song or wood thrush (*Turdus mustelinus*), the olive-backed thrush (*Turdus ustulatus*), and the hermit thrush (*Turdus Aonalaschkæ*), the two latter having several 'varieties.' All these are seven or eight inches long, olive or brown above, white, more or less creamy and spotted below. The wood-thrush or 'wood-robin' is a less retiring bird, not infrequently seen on lawns and in orchards. He is larger than the veery, with the head bright cinnamon brown, changing gradually into light olive brown toward the tail. Moreover, he is thickly marked with large round black spots underneath. The song of this thrush, especially as evening approaches, is remarkably sweet and has made him a great favorite with bird-lovers. The ordinary calling note has been likened to striking pebbles together; it is utterly unlike the clear whistle of the veery. The nest is usually in a bush or on a tree-limb or a stump, five or ten feet from the ground, and is distinctively characterized by always having a foundation of dead leaves, often with some mud. The eggs are clear blue. The olive-backed thrush is a more northerly species than either of the preceding, and occurs in the United States chiefly as a migrant, while it winters in the tropics. It is readily distinguished by the uniform olive upper parts, and the bright buff lores and rings around the eyes. The only species with which it is at all likely to be confused is the gray-cheeked thrush (*Turdus Aliciæ*), a bird of similar range and habits, without the buff lores and eye-rings, and formerly regarded only as a variety. The eggs of both are blue, spotted and speckled with bright brown. The hermit thrush may be easily recognized by the fact that the tail is rufous, brighter than the back. It is also a somewhat smaller and more slender bird than either the veery or wood-thrush. It is

AMERICAN SONG BIRDS



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JULIUS BIEN & CO LITH N Y

1 WOOD THRUSH - TURDUS MUSTELINUS
2 BALTIMORE ORIOLE - ICTERUS GALBULA
3 MOCKING BIRD - MIMUS POLYGLOTTUS
4 BLUEBIRD - SIALIA SIALIS
5 NIGHTINGALE - DAULIAS LUSCINIA
6 SCARLET TANAGER - PIRANGA ERYTHROMELAS
7 RED-SPOTTED BLUETHROAT - CYANECULA SUECICA

distributed over the whole of North America, but breeds mainly north of the United States. There are several varieties recognized by names, as in the preceding species, and, like that also, the Pacific Coast form is considered typical, while the bird occurring in the eastern part of the continent is counted a variety. Thus the olive-backed thrush of the East is the sub-species *Swainsonii* and the hermit thrush of the same region is the subspecies *Pallasii*. The latter is one of the most renowned songsters of America, although, on account of its northern breeding grounds and retiring habits, few persons hear it. While some regard the notes as not essentially superior to those of the wood-thrush, most writers on bird music agree that for "purity and sweetness, of tone and exquisite modulation" the hermit is unequaled. The nest and eggs are very similar to those of the veery.

The thrushes of the Old World are numerous and well-known birds, of which several are common in Great Britain, as the song-thrush or 'mavis,' the mistle-thrush, blackbird, song-ouzel, fieldfare, and redwing (qq.v.).

The name thrush is sometimes given to birds of other families, which are exceptional songsters. Thus in the United States the thrasher (q.v.), one of the finest singers we have, is often called 'brown thrush,' although more nearly a wren. On the other hand, various members of the family are known by other names, as the bluebird, robin redbreast, stonechat, and various small Oriental genera.

The Turdinæ, characterized by the fact that the young are constantly spotted, although they may become concolorous when adult, is only one of the five subfamilies into which the great thrush family (Turdidæ) is divided. The other subfamilies are the Myiodectinæ, a small group of brownish flycatcher-like birds; the Sylviinæ, or Old World warblers (see WARBLER); the Polioptilinæ, or gnatcatchers and wren-tits (qq.v.); and the Miminæ, or American mocking-birds, including the incomparable mocking-bird of our Southern States. It should be added that some ornithologists object to this widely inclusive use of the family name. Consult authorities cited under BIRD. See Colored Plate of SONG BIRDS.

THRUSH (dialectic Swed. *trösk*, Swed. *torsk*, tongue-thrush; perhaps connected with *torr*, OHG. *durri*, Ger. *dürr*, Goth. *þaúrsus*, AS. *þyrre*, dry, and ultimately with Eng. *thirst*), or THRUSH. An inflammation and ulceration of the sensitive surfaces within the frog of horses' feet, giving rise to a fetid discharge, constituting unsoundness, and usually causing lameness. Want of cleanliness is the chief cause. The disease is most common in draught horses. The term thrush is often applied to foot and mouth disease (q.v.).

THRUSH; SPRUE; INFANTILE SORE MOUTH. A disease of early infancy, characterized by the presence of small, roundish, white specks or patches on the lining membrane of the cavity of the mouth and throat, on the surface of the tongue, the angles of the lips, etc. These patches, which are termed *aphthæ*, look like minute drops of tallow or fragments of curd, and are formed by elevated portions of epithelium covering a drop of serous fluid; and as the dead epithelium falls off, a red, usually a raw, surface is left exposed. The cause is a fungus, the *Oidium* (or *Saccharomyces*) *albicans*, which combines with cast-off epithelial cells and with food (milk) to form the spongy, fragile membrane. In thrush crops of these little patches commonly succeed one another. These spots render the mouth hot and tender, in consequence of which the act of sucking is accompanied by difficulty and pain. In association with these local symptoms are indications of general constitutional disturbance, such as feverishness, drowsiness, sickness, flatulence, colicky pains, diarrhœa, etc. The stools are green and slimy, and not unfrequently acrid, as may be inferred from redness of the anus being a common symptom. The vomited matters are also green, and have a strongly acid smell, as also has the breath. The complaint sometimes seems to be the result of improper diet, if the child is being brought up by hand, or of unwholesome milk from a diseased or intemperate nurse; of bad ventilation, etc.; but in some cases the cause of the disease is not evident. The disorder usually lasts eight or ten days, and is attended with danger only when the local affection becomes gangrenous. In older children thrush is an indication of more serious import, appearing in those who are already ill. Nutrition is then still further impaired and the membrane may be a very unfavorable symptom. The treatment is absolute cleanliness of the nursing bottle and nipple, cleansing of the child's mouth with boracic acid and glycerin or a 50 per cent. solution of borax in water, or a weak solution of potassium permanganate. The diet must be corrected, and sugar must be withdrawn entirely.

THUCYDIDES, thû-sĭd'ĭ-dēz (Lat., from Gk. Θουκυδίδης, *Thoukydidēs*) (?-c.399 B.C.). A famous Greek historian, son of Olorus and Hegesipyle, born in the Attic deme Halimus. The date of his birth is unknown, but was certainly not earlier than B.C. 470 nor later than 454. Conservative opinion now favors a date near the latter year. By descent he belonged to an ancient aristocratic family on one side, and on the other was connected with a line of Thracian princes. From this Thracian side of his family he possessed gold mines in Thrace opposite the island of Thasos. He was well educated; tradition says that he was the pupil of Antiphon and Anaxagoras. In politics he favored the aristocratic party, but his views are all marked by moderation and fairness. When the Peloponnesian War broke out, Thucydides was of an age to enable him to discern the importance of the contest and to form plans for recording its course and result. In 424 he was appointed to command a portion of the fleet off the Thracian coast, and in the same year he failed to arrive in time to relieve Amphipolis, which was besieged by Brasidas. For this failure he was condemned to death for treason, but left Athens and lived the next twenty years in exile. This period he spent partly on his estates in Thrace and partly without doubt in examination of the scenes of the war in Italy and Sicily. He also resided for a time at the Court of King Archelaus in Macedonia. After the defeat of the Athenians and the restoration of the democracy in 403, Thucydides was recalled from exile. His death apparently took place about 399. Thucydides's history, which covers twenty-one years of the Peloponnesian War, was not completed by him;

it breaks off in the middle of the year 411. It is also evident that the last book did not receive its final form, but there is no reason to doubt that it comes from his hand. The present division into eight books was not made by the author, but by later grammarians.

Thucydides is now regarded by all as the first critical historian and the greatest historian of antiquity. He brought to his undertaking a practical acquaintance with politics and military science, his natural endowments fitted him to pass impartial judgment on the events that he narrates, and he emphasizes more than once the care with which he endeavored to find out the truth. His sources were for the main part obtained by personal observation or by questioning those who had been upon the ground; but for the earlier period he depended upon his predecessors. His purpose being to narrate the war, he clung closely to his subject and made few digressions, so that we have to regret that he has nothing to say of literature, art, or the conditions of the people. But the military movements of the time are portrayed with a vividness which has never been equaled. In form, his history is strictly annalistic, the account being given by summers and by winters, so that his work suffers from his failure to group events effectively. His style is the older Attic. His periods are not polished or rounded out, and in his effort after brevity he often makes his meaning obscure and hard to reach. Yet his style was greatly admired in antiquity, and became the model of many historians in the following centuries. In his characterization of the leaders in the struggle between Athens and Sparta he was most successful, and frequently employs with great skill speeches which he puts into their mouths. Of critical editions the most important are by Bekker (3 vols., Berlin, 1821); Haase (Paris, 1846); Hude (2 vols., Leipzig, 1898-1901). There are annotated editions by Thomas Arnold (3 vols., 3d ed., Oxford, 1847-54); Bloomfield (2 vols., London, 1842-43); Krüger (2 vols., 3d ed., Berlin, 1861); and Classen (8 vols., Berlin, 1862-78; frequently reedited). English translations have been made, single volumes of the Classen edition, by Morris, Fowler, and Smith for the College Series of Greek Authors (Boston). The editions of single books are very numerous. Consult, also: the *Lexicon Thucydideum* by Bétant (Geneva, 1843); *Index Thucydideus* by Von Essen (Berlin, 1887). The best English translations of the history are by Bloomfield (3 vols., London, 1829); Dale, in the Bohn Classical Library; and Jowett, with introduction and historical notes (2 vols., London, 1881; Boston, 1883). On the speeches see Wilkins's translation (3d ed., London, 1881), and Jebb's essay in Abbott's *Hellenica* (London, 1880).

THUG (Hind. *ṭhag*, cheat, from Skt. *sthága*, rascal). The name in Northern India of a religious fraternity which committed murders in honor of Kali, the wife of Siva (q.v.), and lived chiefly upon the plunder obtained from its victims. In the south of India they used to live under the protection of the native chieftains in consideration of a settled contribution, and probably also of a share in their booty. The Thugs were first generally known about 1800, although they existed as early as 1290. Although at the beginning of the nineteenth century they had become little more than murderers, the original religious character of their deeds survived in many ways, particularly in the bloodless character of their assassination, which points back to an unbloody sacrifice in honor of the female aspect of the destructive power of nature. They really formed a caste, as the profession was in the main hereditary, and the young Thugs were trained most carefully, although a few recruits were admitted from without, and a considerable number of Mohammedans joined the order. When they learned through some of their gang that persons of property were about to undertake a journey, they usually proposed to them, under the plea of safety, or for the sake of society, to travel in their company; or else they followed them. Usually they threw around the neck of the victim a cloth called the *romal*, or handkerchief, with a knot in the left end, which one of the gang held at one end, while the other was seized by an accomplice. While the two Thugs drew the noose tight and pressed the head of their victim forward, a third seized him by the leg and thus threw him to the ground. If properly strangled, the sacrifice was dead before he touched the ground. The utmost care was taken to commit the murder in an unfrequented spot, and the body was buried at a spot where it was not likely to be found.

Another class of Thugs murdered those in charge of children, whom the assassins then sold into slavery. Castes or classes exempt from the Thugs were washermen, sweepers, musicians, poets, blacksmiths, carpenters, oil-venders, sweepers, cripples, lepers, bearers of the holy Ganges water, and those who had with them a cow. Neither would a true Thug kill a woman. A portion of the plunder was usually devoted to the expenses of religious ceremonies, and a part was often allotted for the widows and families of deceased Thugs.

Kali was believed to have formerly coöperated with the Thugs, and to have assisted them in the disposing of the bodies of their victims by devouring them. But through an indiscretion of one of the fraternity, who looked back, she became displeased, and condemned them to bury their victims. But though she refused her assistance, she presented her worshipers with one of her teeth for a pickaxe, a rib for a knife, and the hem of her lower garment for a noose. On the faith of this legend the pickaxe was the instrument which was held in the highest estimation by all the Thugs. Its fabrication was superintended with the greatest care, and it was the subject of other ceremonials. After every murder the Thugs performed a special solemnity called *tapuni*, which was celebrated in honor of Kali. Another feast observed by the Thugs throughout India was called *Kurhae Karna* or *Kote*, likewise in honor of Kali. The superstitions of the Thugs were of Hindu origin; but they were adopted also by Mohammedan Thugs, who sometimes identified Kali and Fatima.

At various periods steps were taken by the native and English governments to suppress the Thugs, but it was only after 1831 that energetic measures against them were adopted by the British authorities. By 1840 they were practically suppressed.

Consult: Sleeman, *Ramaseeana* (Calcutta, 1836); Thornton, *Illustrations of the History* *and Practices of the Thugs* (London, 1837); Meadows-Taylor, *Confessions of a Thug* (ib., 1839; new ed. ib., 1879); Wright, *India and Its Inhabitants* (Cincinnati, 1855); Hutton, *Popular Account of the Thugs and Dacoits* (London, 1857).

THUGUT, tōō'gōōt, Franz Maria, Baron (1736-1818). An Austrian statesman, born at Linz. He was admitted to the Oriental Academy in Vienna in 1752, went to Constantinople in 1754, and became Court interpreter at Vienna in 1766. He was appointed diplomatic representative at Constantinople in 1769 and obtained the cession of Bukowina to Austria in 1771. In 1780 he was made Austrian Ambassador at Warsaw and in 1787 at Naples. He negotiated the Peace of Sistova with Turkey in 1790; was made Director-General of Foreign Affairs in 1793, in which capacity he continued the anti-Prussian policy of Kaunitz, but sought also to advance Austrian interests at the expense of France. This plunged the country into the disastrous war with Revolutionary France, which ended with the Peace of Campo-Formio (q.v.) in 1797. After acting for some time as administrator in the newly acquired Italian provinces, he took up his old post in the Ministry. He retired in 1800 and devoted the rest of his life, at Pressburg and Vienna, to the study of Oriental literature.

THULE, thū'lē (Lat., from Gk. Θούλη, *Thoulē*). The name generally given by the ancients to the most northerly part of Europe known to them, and in the description of which fancy played a conspicuous part. According to Pliny it was an island in the northern ocean, discovered by the navigator Pytheas (q.v.), who reached it after six days' sail from the Orcades. Many modern geographers identify Thule with Iceland. Some, however, prefer to seek for it in that part of Norway called *Thile* or *Thilemark*, or in Jutland, the extremity of which is known as *Thy* or *Thyland*. But it seems that Mainland, the principal member of the Shetland group, has the best claim to being regarded as the Thule of Pytheas. The Romans used the phrase *Ultima Thule* to denote the most distant unknown land.

THUMANN, tōō'män, Paul (1834—). A German illustrator and painter, born in Tschacksdorf, Brandenburg. He studied in Berlin, Dresden, and Weimar, and taught successively in the academies of Weimar, Dresden, and Berlin. He illustrated Chamisso's *Frauenliebe und -Leben* and *Lebenslieder und-Bilder*, Goethe's *Dichtung und Wahrheit*, Hammerling's *Amor und Psyche*, Heine's *Buch der Lieder*, Tennyson's *Enoch Arden*, etc. His paintings include five scenes from the life of Luther (1872-73), in the Wartburg, near Eisenach, and two large mural paintings, "Return of Arminius from the Teutoburg Forest" and "Baptism of Wittekind," in the Aula of the Gymnasium at Minden.

THUMB, Tom. See Stratton, Charles Sherwood.

THÜMMEL, tụ'mel, Moritz August von (1738-1817). A German statesman and humorous writer, born at Schönefeld. In 1768 he became minister to Duke Ernest Frederick of Saxe-Coburg, from whose service he retired in 1783. He wrote a humorous prose epic *Wilhelmine* (1764); a story in verse, *Inokulation der Liebe* (1771); and a partly autobiographical and once very popular novel, *Reise in die mittäglichen Provinzen von Frankreich* (1791-1805). *Der heilige Kilian* was posthumously published in 1818. His works (in 6 vols., 1812) were edited by himself with a biography (1820) by Gruner, and reëdited (8 vols., 1854-55).

THUN, tōōn. A town of Switzerland, situated on the Aar, near where it issues from the Lake of Thun, 19 miles southeast of Bern, 1845 feet above sea level, and one mile from the Lake of Thun (Map: Switzerland, B 2). The old castle of the twelfth century with its corner towers and the Gothic church are the chief buildings. There is a military institution for army officers, as the town is the chief artillery arsenal of Switzerland. The chief manufactures are pottery and bricks. Many tourists visit the town on their way to the Bernese Oberland. Population, in 1900, 6100.

THUN, Lake of. A lake in the Canton of Bern, Switzerland, between the town of Interlaken on the east and that of Thun on the northwest (Map: Switzerland, B 2). It is 10½ miles long and 2½ miles wide. The scenery, though scarcely grand, is very attractive. The railway from Thun to Interlaken skirts the southern shore.

THUNBERG, tōōn'bĕrk, Karl Peter (1743-1828). A Swedish botanist. He studied with Linnæus at Upsala; sailed with a Dutch ship as surgeon (1771-73), cruising at the Cape of Good Hope; lived six years in Java and Japan, returning in 1779 to Sweden, where he was appointed successor to Linnæus in 1781 as professor of botany at the University of Upsala. A genus of about fifty species of the natural order Acanthaceæ and numerous Oriental species of other genera are named in his honor.

THUNDER. See Lightning.

THUNDERING LEGION. The name given to a body of Christian troops under Marcus Aurelius, from the tradition that a thunderstorm, sent in response to their prayers, caused great destruction in the opposing army.

THÜNEN, tụ'nen, Johann Heinrich von (1783-1850). A celebrated German economist, born in Oldenburg. After receiving a thorough education in the theory and practice of agriculture and passing two semesters at Göttingen, he bought in 1810 an estate called Tellow, in Mecklenburg-Schwerin, which under his skillful management became famous as a model farm. His fame rests on his work *Der isolirte Staat in Beziehung auf Landwirtschaft und Nationalökonomie*, the first volume of which appeared in 1826, the second in 1850 and 1863, and the third in 1863. In this work Thünen simplified the complex conditions of economic life by imagining an isolated State, circular in form, with land of equal fertility, laborers of equal productivity, and with the sole city and market at the centre. Having so simplified his premises, he proceeded to investigate, principally, the effect of distance from the market upon the agricultural economy of the several zones of the territory surrounding the market. In the second volume Thünen struck a new note in the political economy of his time by protesting against the common treatment of wages as the price of an inanimate commodity, and insisting upon the introduction of ethical factors. His treatment here, as generally, was highly abstract, and with the aid of the differential calculus he arrived at the conclusion that natural wages $= \sqrt{ap}$, where a is the amount required to support the laborer and his family and p is the product of the labor of one man, this product being defined as that part of the gross product remaining after deduction of profits, insurance, and cost of management. This law of wages expresses in a highly interesting way the modern theory that wages vary as the productivity of the laborer. At Thünen's request it was engraved on his tombstone. Consult: Schumacher, *J. H. von Thünen, ein Forscherleben* (Rostock, 1883); Moore in the *Quarterly Journal of Economics*, vol. xiv., pp. 291, 388. See POLITICAL ECONOMY.

THUN UND HOHENSTEIN, tōōn ụnt hō'en-stīn, LEO, Count (1811-88). An Austrian statesman, born at Tetschen, in Bohemia. Before the Revolution of 1848 he was secretary in the Imperial Chancery, and in that year became Governor of Bohemia. From 1849 to 1860 he was Minister of Public Worship and Instruction. In spite of his reactionary tendencies, he introduced many reforms in the system of secondary and higher education, which he reorganized on the German model. He concluded the Concordat of 1855, which gave the Church great power in educational affairs. In 1861 he was elected to the Bohemian Diet, where he became the leader of the Feudalists, and he continued this attitude in the Austrian House of Peers, which he entered in the same year. In 1867 he strenuously opposed the Ausgleich with Hungary. He retired from the Bohemian Diet in 1871, and reëntered it in 1883.

THUR'BER, GEORGE (1821-90). An American botanist, naturalist, and editor. He was born at Providence, R. I., where he obtained his early education. From 1850 to 1853 he was botanist, commissary, and quartermaster of the United States Boundary Commission upon the Mexican and United States borders, where he collected a large number of new species of plants. In 1856 he became lecturer upon botany and materia medica in the Cooper Union and College of Pharmacy of New York, and in 1859 professor of botany and horticulture in the Michigan Agricultural College, which institution he left in 1863 to become editor of the *American Agriculturist*, a post which he held until shortly before his death. In addition to his editorial writings he also edited all the horticultural and agricultural books published by the Orange Judd Company, and revised and in part rewrote Darlington's *Agricultural Botany*.

THURET, tụ'rā', GUSTAVE (1817-75). A French botanist, born in Paris. While attached to the French embassy at Constantinople he collected plants in the Balkan Peninsula, and returned to France in 1844. His specialty was algæ and his *Recherches sur les zoospores des algues et les anthéridées des cryptogamis* (1851) were crowned by the Academy. Other publications include: *Recherches sur la fécondation des fucacées* (1855-57), and numerous monographs, such as *Essai de classification des nostochinées* (1875). He established a splendid botanical garden at Antibes, where he planted the first eucalyptus trees in Europe, and which he bequeathed to the State. He died at Nice.

THURGAU, tōōr'gou. A canton in the northeast of Switzerland, separated from Germany by Lake Constance (Map: Switzerland, D 1). Area, 388 square miles. The surface is elevated but not mountainous, and is cut by the valley of the Thur, the chief river of the canton. Almost the entire area of the canton is productive, and the chief occupations of the inhabitants are agriculture and viticulture. Stock-raising and cheese-making are also important industries. The principal manufactures are cotton and woolen goods, knit goods, machinery, leather, etc. The constitution of the canton is purely democratic, the members of the legislative assembly as well as of the executive council being elected directly by the people. The obligatory referendum and the initiative are in force. Population, in 1888, 104,678; in 1900, 113,221, largely German-speaking Protestants. Capital, Frauenfeld (q.v.).

Prior to the ninth century the country known as Thurgau comprised almost the entire region bounded by Lake Lucerne, the Rhine, the Reuss, and Lake Constance. With the extinction of the house of Kyburg, Thurgau, reduced almost to its present size, passed in 1264 to the House of Hapsburg. In 1460 the country was seized by the Confederates and occupied the position of a 'subject district' until 1798, when it was made a canton of the Helvetic Republic. In 1803 it was constituted a canton of the reorganized Swiss Confederation. Consult: Pupikofer, *Geschichte des Thurgaus* (Frauenfeld, 1884-89); Meyer, *Thurgauisches Urkundenbuch* (ib., 1881 et seq.).

THURIFER (Lat., incense-bearer). The attendant in the Roman Catholic Church, at solemn mass, vespers, and other ceremonies, whose duty it is to carry the thurible, or incense vessel, and either to minister incense himself, or to present the thurible for that purpose to the officiating priest. The office of thurifer originally belonged to the so-called 'minor order' of acolyte, but is now commonly exercised by laymen. See INCENSE; CENSER.

THÜRINGER WALD, tụ'rĭng-ẽr vält (Ger., Thuringian Forest). A mountain range of Central Germany, extending from the banks of the Werra near Eisenach in a southeasterly direction to the northern boundary of Bavaria, where it joins the Frankenwald, a ramification of the Fichtelgebirge (Map: Germany, D 3). It forms the southwestern boundary of the highland of Thuringia, and passes through Saxe-Weimar, Coburg-Gotha, Prussia, Saxe-Meiningen, and the neighboring small States. Length, about 70 miles; highest summit, Gross-Beerberg, 3238 feet. The range falls steeply toward the northeast and is covered to the summits with magnificent pine forests. It is composed mostly of granite, porphyry, and schists protruding through the surrounding Permian strata, and is rich in minerals, among which iron ore, copper, manganese, and gypsum are the most important. The range passes through a well-populated industrial region.

THURIN'GIA (Ger. *Thüringen*). A picturesque region of Germany, traversed by the Thüringer Wald (q.v.), lying between the Prussian Province of Saxony on the north and Bavaria on the south, and between the Kingdom of Saxony on the east and the Prussian Province of Hesse-Nassau on the west. It embraces a number of duchies and principalities together with some Prussian districts. The so-called Thuringian States are Saxe-Weimar-Eisenach, Saxe-Coburg-Gotha, Saxe-Meiningen, Saxe-Altenburg, Schwarzburg-Rudolstadt, Schwarzburg-Sondershausen, and the two Reuss principalities. The largest city is Erfurt, in the Prussian Province of Saxony. The region took its name from the Thuringians, who at the time of the great migration of nations established an extensive kingdom near the centre of the present Germany. In the early part of the sixth century the Franks overthrew this kingdom, of which the northern part was joined to the country of the Saxons, and the southern to Franconia. The name Thuringia came to be applied to the country between the rivers Werra and Saale, and the Harz and Thuringian mountains. Under the weak Merovingian rulers dukes arose in this Thuringia, which for a time was virtually independent. Christianity was introduced in the eighth century. Under the Carlovingian sovereigns Thuringia constituted an important frontier province or march, whose governor was charged with the lack of repressing or keeping down the Slavic Sorbs. In the tenth century the country was under the rule of the dukes of Saxony. In the twelfth and thirteenth centuries the landgraves of Thuringia held a prominent place among the German princes. They had their seat at the famous Castle of Wartburg. (See EISENACH.) Landgrave Hermann I. (1190-1216) is noted as a patron of the minnesingers. The old dynasty of landgraves became extinct in 1247. The landgravate of Thuringia then passed to the House of Wettin, which ruled in the margraviate of Meissen, and which in the fifteenth century came into possession of the electoral duchy of Saxony. On the partition of the Saxon dominions in 1485 between the Ernestine and Albertine lines the bulk of the Thuringian possessions passed to the Ernestine or electoral branch. After the War of the Schmalkald League (1546-47) the Ernestine house was stripped of its possessions outside of Thuringia. Here arose the various modern Saxon (Thuringian) duchies. See SAXE-WEIMAR-EISENACH, etc. Consult: Knochenhauer, *Geschichte Thüringens in der karolingischen und sächsischen Zeit* (Gotha, 1863); id., *Geschichte Thüringens zur Zeit des ersten Landgrafenhauses* (Gotha, 1871).

THURLOE, thûr′lō, JOHN (1616-68). An English Puritan statesman. After Cromwell was proclaimed Protector, Thurloe was appointed chief of the intelligence department, a position which he managed with striking fidelity and success. He continued as Secretary of State under Richard Cromwell until May, 1659, and in spite of royalist opposition in 1660, was reappointed prior to the Restoration. After Charles II.'s return he was arrested on a charge of high treason, but soon afterwards was freed on condition of attending on the secretaries of State whenever they should require his service. His large collection of State papers and correspondence, comprising the most authentic materials respecting the period of the Civil War and Cromwell's Protectorate, were discovered in a secret recess in his chambers at Lincoln's Inn during the reign of William III., and are now in the Bodleian Library at Oxford. Dr. T. Birch issued a *Collection of State Papers; containing authentic memorials of the English affairs from the year 1638 to the Restoration of King Charles II., published from the originals, etc.,* prefixed by a Life of Thurloe (London, 1742).

THUR′LOW, EDWARD, Baron (1731-1806). An English lawyer. He was born at Bracon-Ash, Norfolk, was educated at Caius College, Cambridge, and was admitted to the bar in 1754. At this time he formed an intimate friendship with the poet William Cowper. Through the patronage of the Viscount Weymouth, Thurlow was elected to Parliament in 1768. In 1770 he was appointed Solicitor-General, and the next year Attorney-General. He attracted the favorable notice of George III. by zealously supporting the governmental policy of coercing the American colonies, and in 1778 was made Chancellor of the Exchequer, which office he retained under the Rockingham Administration. In this position he caused great embarrassment by opposing measures brought in by that Government. Under the Coalition Ministry he was compelled to retire; but he was restored as Chancellor when Pitt came to power. For a time he supported the Government; but, relying on the favor of the King, he finally ventured to oppose the measures of his colleagues. Pitt then intimated that he or Thurlow must retire, and the King consented to the removal of Thurlow (1792). There is little to justify the great reputation for ability he had among his contemporaries. Consult Foss, *Judges of England, with Sketches of Their Lives* (London, 1848-64).

THUR′MAN, ALLEN GRANBERY (1813-95). An American political leader and legislator, born in Lynchburg, Va. In 1819 he was taken by his parents to Chillicothe, Ohio. He studied law in the office of his uncle, William Allen (q.v.); became private secretary to Governor Robert Lucas in 1834, and in the following year was admitted to the bar and was taken into partnership by his uncle. In 1845-47 he was a Democratic member of Congress, then resumed his law practice, and from 1851 to 1856 was on the bench of the Ohio Supreme Court, after December, 1854, as Chief Justice. In 1867 he was the Democratic candidate for Governor of Ohio, but was defeated by Rutherford B. Hayes. From 1869 to 1881 he was a member of the United States Senate, and the leader of the small party of Democrats in that body. In the Forty-sixth Congress he was elected president *pro tempore* of the Senate. He was active as an advocate of a liberal reconstruction policy, was one of the authors of the bill creating the Electoral Commission in 1876, and was a member of that body. He was also the author of the well-known 'Thurman Act,' designed to compel the Pacific railroads which had received Government aid to fulfill their obligations to the Government, and secured the passage of the bill. In 1881 he was appointed by President Garfield a member of the International Monetary Conference at Paris. In 1888 he was nominated by acclamation for Vice-President on the Cleveland ticket, which was defeated by Harrison and Morton. Consult Hensel and Parker, *Lives and Public Services of Grover Cleveland and Allen G. Thurman* (New York, 1888).

THURN, tōōrn, HEINRICH MATTHIAS, Count (1580-1640). A leader of the Bohemian Protestants in the Thirty Years' War. For his services in the Turkish wars, the Emperor Rudolph II. made him Burgrave of Karlstein in Bohemia. He was among those who wrung from Rudolph the *Majestätsbrief* of 1609, an edict of toleration, and was named by the Bohemian estates one of the 'Thirty Defenders of the Faith.' He was deprived of his estates and title soon after. On May 23, 1618, he gave the signal for the Protestant uprising in Bohemia by the 'defenestration' of the Imperial legates at Prague. (See THIRTY YEARS' WAR.) At the head of the Protestant forces he besieged the Emperor Ferdinand II. in Vienna (1619), but was finally compelled to withdraw. After the battle of the White Hill in 1620, in which the army of Frederick, the Protestant King of Bohemia, was vanquished, sought refuge with Bethlen Gábor, ruler of Transylvania. In 1626 he commanded a corps in Silesia. Later he joined Gustavus Adolphus, and fought at Leipzig (1631) and Lützen (1632). He was captured by the Imperialists in 1633 at Steinau, but was soon released.

THURNEYSEN, tōōr′nī-zen, RUDOLPH (1857—). A German philologist. He was born in Basel, and studied at the universities of Basel, Leipzig, and Berlin. From 1882 to 1887 he was successively privat-docent and assistant professor of Romance philology in the University of Jena, and after 1887 professor of comparative philology at the University of Freiburg in Baden. Among his more important publications are: *Ueber Herkunft und Bildung der lateinischen Verba auf -io* (1879); *Das Verbum être und die französische Conjugation* (1882); *Keltoromanisches* (1884); *Der Saturnier und sein Verhältnis zum späteren römischen Volksverse* (1885); *Mittelirische Verslehren* (1891); *Sagen aus dem alten Irland* (1901).

THURS′BY, EMMA (1857—). An American singer, born in Brooklyn, N. Y. She studied under Julius Meyer and Erani, and sang in the Plymouth Church choir, Brooklyn, 1870, after which she went to Italy to study in 1873, and returned to complete her musical education under Erani and Mme. Ruderstdorf. She made a successful tour of the United States and Canada (1875), and was warmly received in England and France (1878-79), afterwards being engaged by Maurice Strakosch as prima donna of his company (1880). A subsequent tour of the United States with Theodore Thomas was especially successful, and she frequently appeared in concert with Annie Louise Cary (q.v.). Her concerts in Europe were noteworthy, and gave her high rank as a concert singer.

THURSTON, JOHN MELLEN (1847—). An American politician and lawyer, born in Montpelier, Vt. He removed to Wisconsin, where he was educated at Wayland Academy, Beaver Dam, and in 1869 was admitted to the bar. In the same year he settled in practice in Omaha, Neb. He allied himself with the Republican Party, and was elected to the State Legislature in 1875. In 1895 he was elected to the United States Senate. Upon the termination of his Senatorial term in 1901 he was appointed one of the United States Commissioners for the Louisiana Purchase Exposition at Saint Louis.

THURSTON, ROBERT HENRY (1839-1903). An American engineer and educator, born in Providence, R. I. He graduated at Brown University in 1859. During the Civil War he served in the Federal Navy as an engineer, and in 1865 he was appointed assistant professor of natural and experimental philosophy at the United States Naval Academy. He was professor of engineering at the Stevens Institute of Technology from 1871 to 1885, and in the latter year, for a committee of the American Institute, conducted a series of important experiments on steam boilers. He was a member of the United States Scientific Commission to the Vienna Exhibition in 1873, and edited the *Report* of the Commissioners, which included his individual report on machinery and manufactures (1875-76). From 1885 he was director of Sibley College of Cornell University. His thoroughness, organizing ability, and energy placed him in the very front rank of educators in his field, while his admirable personality excited the respect and regard of his students. Hardly less important in their influence upon the engineering world are Professor Thurston's writings, not alone because of their thorough reliability, but because of their clearness and comprehensibility, this being particularly true of such works as *A History of the Growth of the Steam Engine* ("International Scientific Series," 1878, 1901, translated into German and French), a treatise which is at once popular in form of presentation, and exact and authoritative in its subject matter. His other works include: *Manual of the Steam Engine* (1890, 1901); *Materials of Engineering* (1882, 1900); *Materials of Construction* (1884, 1900); *Stationary Steam Engines* (1885, 1889); *Treatise on Friction and Lost Work in Machinery and Mill Work* (1885, 1898); *A Manual of the Steam Boiler* (1888, 1901); *A Handbook of Engine and Boiler Trials, and the Use of the Indicator and the Pony Brake;* and *Life of Robert Fulton* ("Makers of America Series," 1891). Professor Thurston's inventions include a magnesium-ribbon lamp, a magnesium-burning naval and army signal apparatus, an autographic recording and testing machine, a form of steam-engine governor, and an apparatus for determining the value of lubricants.

THWAITES, REUBEN GOLD (1853—). An American historical writer, born in Dorchester, Mass. In 1866 he removed to Wisconsin. From 1876 to 1886 he was managing editor of *The Wisconsin State Journal*, at Madison. In 1886 he was elected secretary of the State Historical Society of Wisconsin, and editor of the society's *Collections*. He edited the *Wisconsin Historical Collections* (vols. ix. to xv.); *Chronicles of Border Warfare* (1895); a new edition of Kinzie's *Wau Bun* (1901); and *The Jesuit Relations* (73 vols., 1896-1901), his work on the last being one of the most careful and scholarly pieces of historical editing ever done in America. He also published: *Historic Waterways* (1888); *The Story of Wisconsin* (1890), in "Story of the States Series;" *The Colonies, 1492-1750* (1891), in "Epochs of American History Series;" *Afloat on the Ohio* (1897); *Stories of the Badger State* (1900); *Daniel Boone* (1902) and *Père Marquette* (1903), the last two in the "Pioneers of America Series," of which he is editor; and *George Rogers Clark* (1903).

THWING, twĭng, CHARLES FRANKLIN (1853—). An American clergyman and educator, born at New Sharon, Maine. He graduated from Harvard in 1876, and from the Andover Theological Seminary in 1879; was pastor of the North Avenue Presbyterian Church at Cambridge, Mass., in 1879-86, and of Plymouth Church, Minneapolis, in 1886-90; and in 1890 became president of Adelbert College and Western Reserve University. He published: *American Colleges* (1878); *The Reading of Books* (1883); *The Family* (in collaboration with his wife, Carrie F. Butler Thwing, 1886); *The Working Church* (1888); *Within College Walls* (1893); *The College Woman* (1894); *The American College in American Life* (1897); *American College Administration* (1900).

THYESTES, thī-ĕs'tēz (Lat., from Gk. Θυέστης). The son of Pelops and Hippodamia. Having seduced Ærope, the wife of his brother Atreus, he was banished from Mycenæ, and in revenge sent Plisthenes, the son of Atreus, whom he had brought up, to slay his father. Atreus, not recognizing Plisthenes, killed him, and summoning Thyestes to Mycenæ, placed before him at a feast the flesh of his two sons.

THYME, tīm (OF., Fr. *thym*, from Lat. *thymum*, from Gk. θύμον, θύμος, thyme, sweetbread, warty excrescence; connected with θύος, *thyos*, incense, Lat. *fumus*, OChurch Slav. *dymŭ*, Lith. *dúmai*, OHG. *toum*, Skt. *dhūma*, smoke), *Thymus*. A genus of humble half-shrubby plants, of the natural order Labiatæ, having a two-lipped calyx and four diverging stamens. Gar-lipped calyx and four diverging stamens. Garden thyme (*Thymus vulgaris*) is 6 to 10 inches high, with narrow, almost linear leaves, and whitish or reddish flowers, which grow in separate whorls, six in a whorl. It is common upon dry hills in Southern Europe, and is very commonly cultivated in gardens, on account of its fragrance and as a culinary herb. Wild thyme (*Thymus Serpyllum*) has a procumbent stem with many branches, 2 to 3 feet long, oval leaves, and purplish flowers, arranged in whorls, which are united in a head. It is abundant on hills and mountains in all parts of Europe and Northern Asia. It is less fragrant than garden thyme, but both species contain an aromatic essential oil. The lemon thyme, or lemon-scented thyme, is a variety of *Thymus Serpyllum*. It is generally of still lower growth than the common garden thyme. No species of thyme is indigenous in America.

GARDEN THYME.

THYMUS GLAND (Neo-Lat., from Gk. θύμος, thyme, so called from its fancied resemblance to a branch of sweet thyme). A ductless gland, peculiar to infantile life. In the human being it occupies a space in the neck below the thyroid gland and in the chest beneath the sternum in the anterior mediastinal space, on the level of the fourth costal cartilage. The gland is developed early in fœtal life, increases in size during the first two or three years of life, then remains stationary until the tenth to the fourteenth year, when it begins to atrophy and undergo fatty degeneration. At its maximum period of development the organ is above two inches long, one and one-half inches broad, and about a third of an inch thick. At birth its weight is about half an ounce. Beyond its character as a lymph gland little is known of the function of this organ. The thymus gland of young animals such as the lamb and calf constitutes the delicacy known as *sweetbreads*, though the pancreas or 'belly sweetbread' of certain animals is often substituted in trade for this article. Thymus has been used in medicine in the treatment of exophthalmic goitre. See ORGANOTHERAPY.

THYROID GLAND (from Gk. θυρεοειδής, *thyreoeidēs*, shield-shaped, from υρεός, *thyreos*, large oblong shield, from θύρα, *thyra*, door + εἶδος, *eidos*, form). One of the ductless or vascular glands, lying at the upper part of the trachea, and consisting of two lateral lobes, placed one on each side of this canal, and connected together by a narrow transverse portion at the lower third, called the isthmus. It is of a brownish red color, and its normal weight is about an ounce. Each lobe is somewhat conical, and is about two inches long and three-quarters of an inch broad. Minute examination of the gland shows it to consist of lobes and lobules held together by connective tissue. Each lobule is made up of numerous completely closed sacs 0.04 to 0.1 inch in diameter. The sacs contain a transparent, viscid, albuminous fluid. Each sac is surrounded by a plexus of capillary blood vessels which do not pierce the lining of the sacs. Numerous lymphatic vessels are also present. At an early period the sacs dilate, their cellular lining atrophies, and their contents undergo colloid degeneration. The function of the thyroid gland is very obscure. It is possibly a blood-forming gland; possibly it regulates the formation of mucus in the body. It is subject to several varieties of enlargement known under the general name of goitre, and is also the seat of various benign and malignant tumors. *Myxœdema* (q.v.) is a condition of the system brought about through loss of function of the thyroid gland, either from atrophy or removal of the organ. The prepared extract of the thyroid gland of animals is used in the treatment of this condition. See CRETINISM, ORGANOTHERAPY.

THYR'SUS (Lat., from Gk. θύρσος, stalk, stem). An ivy and vine wreathed staff tipped with a pine cone, which was carried by Bacchus and his followers in the religious rites.

TI (Polynesian name), *Cordyline terminalis*. A tree-like plant of the natural order Liliaceæ, found in Southeastern Asia, the Eastern Archipelago, and the Hawaiian and other Pacific islands. It sometimes exceeds twelve feet in height. The reddish, lanceolate leaves are used as cattle food, and as thatch for houses. Their fibres are sometimes made into cloth. The large, hard, fibrous, and almost insipid root becomes soft and sweet when baked. It is very nutritious, and is much used as an article of food. The juice is used for making sugar, a fermented beverage, and a distilled liquor. Fully twenty-five varieties of Cordyline are grown under glass for their ornamental, often variegated, foliage.

TIAHUANACO, tē-ä'wä-nä'kō. A ruined city of Bolivia, a few miles from the Peruvian frontier, on an arid plain midway between lakes Titicaca and Aullagas, at an elevation of 12,900 feet. The present town of the same name stands a short distance from the ruins and is built for the most part of beautifully cut stones from the ancient buildings. In the ruined town five great structures besides an equal number of shapeless mounds may be traced. These buildings are commonly known as the Fortress, the Temple, the Palace, the Hall of Justice, and the Sanctuary. The fortress consists of a rectangular mass of earth 620 feet long, 450 feet wide, and about 50 feet high, supported by walls of stone forming terraces, the walls sloping inward. On the summit are traces of rectangular buildings. Adjoining the pyramid to the east is a rectangular apron mound. The Fortress has been almost destroyed by excavations for treasures, but these diggings show that there were subterranean structures within the mound. All the buildings of Tiahuanaco are oriented to within ten degrees of the cardinal points. The Temple, believed to be the oldest building here, is a rectangle 388 by 455 feet, defined by erect stones between 8 and 10 feet high, 2 by 4 feet broad, and from 20 to 30 inches thick. On the eastern side, aligned along a lower terrace, are ten columns about 15 feet high, by 4 feet by 3 feet. The interior of the rectangle is raised eight feet above the level of the ground and has a sunken court 280 feet long and 190 feet broad. To the east of the Temple is the Palace, of which the massive foundation remains, composed of blocks of trachyte 8 to 10 feet long and 5 feet wide. The piers of this building are deeply sunk in the ground and rest on a pavement of cut stones. The Hall of Justice stood at one end of a sunken court in a rectangle in plan like that of the Temple. It was a platform 131 feet long and 23 broad, built of enormous blocks of stone, and had three groups of alcoves or seats arranged at the ends and in the centre, and between the central and side groups were monolithic doorways with sculptured friezes. The Hall of Justice also stands on a raised area, in the centre of which was a building about 50 feet square, constructed of very large stones, and called the Sanctuary. Within the building is a slab of stone 13 feet 4 inches square and 20 inches thick. On its surface is cut what seems to be the plan of a building resembling that of the Fortress, and six niches in which perhaps statues were located.

Tiahuanaco is famous for its great monolithic gateway of hard trachyte 13 feet 5 inches long, 7 feet 2 inches high above ground, and 18 inches thick. The lintel over the front of the gateway is sculptured in low relief and the back is carved to represent doors and windows. The masonry at Tiahuanaco is laid without mortar, the stones on each course are tongued and grooved at the ends, and bronze pins and T-clamps were employed to hold the courses in place. Earlier travelers speak of statuary at Tiahuanaco, but these pieces have been destroyed except a head, which belonged to a figure probably about 18 feet high. The building stone was transported from 15 to 40 miles and the dressing was done with bronze and stone tools. There is no reliable tradition as to the builders, who it is supposed were the Incas or Aymarás, and no reason can be assigned for the location of the city on a barren plain at a great altitude, unless it be that the foundation was determined by religious ideas. Consult Stübel and Uhle, *Die Ruinenstätte von Tiahuanaco* (Breslau, 1892).

TIAN-SHAN, tê-än′ shän′, or CELESTIAL MOUNTAINS. A great mountain system of Central Asia. It begins in the southeastern part of Russian Turkestan, and extends in an eastward direction for nearly 1500 miles across East Turkestan toward the Desert of Gobi, in which it is gradually lost (Map: Persia, N 2). It forms the northern boundary of the great Tarim Basin, which it separates from the watersheds of Lake Balkash and the Syr-Darya. It is connected by broken ranges with the Altai Mountains to the north. The system consists almost throughout its length of a number of parallel ranges with a total width of about 200 miles. In the central portion there is a main ridge forming an unbroken wall covered with perpetual snow throughout its length, and culminating in the west in the Khan-Tengri, a peak bearing enormous glaciers and reaching an altitude of 24,000 feet. East of this ridge the mountains descend in a broad plateau with scattered peaks and ridges from 6000 to 1000 feet high. West of the Khan-Tengri the system spreads out like a fan with numerous branches which finally lose themselves in the plains of Russian Turkestan. One of these ranges runs into the Pamir (q.v.), where, through the Sarikol, it connects with the Kuen-lun, Hindu-Kush, and Himalaya systems. In this western portion there are several important passes affording routes between Russian and East Turkestan. The system incloses numerous large longitudinal valleys whose bottoms form wide steppe regions. Above these the slopes are covered with immense spruce forests succeeded by an alpine flora to the snow-line. The loftiest group in the eastern portion, the Bogdo-ola, is held sacred by the Mongolians, and figures prominently in their religious mythology.

TIARA (Lat. *tiara, tiaras*, from Gk. *τιάρα, τιάρας, τιάρης*, head-dress of the Persian kings). The triple crown of the Pope. Although a cap called a tiara was worn by some Oriental monarchs, as by the Achæmenid dynasty of Persia, as an ecclesiastical head-dress it has more affinity with that of the Jewish high priests, the form of which is more or less preserved in the mitres worn by the bishops of the Eastern Church today. (See COSTUME, ECCLESIASTICAL.) It is composed of a high cap of gold cloth, encircled by three coronets, with a mound and cross of gold on the top. From the cap hang two pendants, embroidered and fringed at the ends. The original Papal crown consisted of the cap alone, and was first used by Pope Nicholas I. (858-867). Alexander II. added a second coronet about 1065, and Urban V. (1362-70) the third. A symbolic meaning has since been found in the triple crown, as representing the authority of the Pope over the Church militant, expectant, and triumphant. It is placed on the Pope's head at his coronation by the second cardinal deacon, with the words "Receive the tiara, adorned with three crowns, and know that thou art father of princes and kings, ruler of the world, vicar of our Saviour Jesus Christ." At ceremonies of a purely spiritual character the Pope wears the mitre, like other bishops, not the tiara.

TIBALDI, tē-bäl'dē, Pellegrino (1527-98). An Italian architect and painter, born at Bologna. A pupil of Daniele da Volterra in painting, he subsequently worked both as an architect and painter under the influence of Michelangelo in Rome, whither he had gone in 1547. His graceful altar-pieces, especially attractive through the loveliness of the female heads, are very rare. Of his frescoes "Hercules Taming the Animals" may still be seen in the Loggia dei Mercanti (Exchange) at Ancona. In the architecture he is prominent as one of the chief representatives of the late Renaissance. In 1560-69 he built in Milan the Jesuit Church of San Fedele, in 1565 reconstructed the Archiepiscopal Palace, and in 1570 became first architect of the Cathedral, for which he designed the baroque façade. Called to Madrid by Philip II. in 1586 to take part in the erection of the Escorial, Tibaldi also decorated its library with warmly colored frescoes, was created Marchese di Valsolda, and after nine years returned to Milan, where he died. Consult: Zanotti, *Le pitture di Pellegrino Tibaldi* (Venice, 1756); and Gurlitt, *Der Barockstil in Italien* (Stuttgart, 1887).

TIB'BUS, TIBUS, or **TUBUS** (rock people). A Nigritian people, inhabiting Tibesti, in the Eastern Sahara, and extending southward into the Sudan. In these different areas they vary greatly in hair and features. There are only 70,000 of them spread over an area of 300,000 square miles, under the following names: Tedas, Dasas, Bedeyat, Zoghawa, and Bulzeda. For generations they have been most active in the traffic by caravan across the Sahara. In religion they are Mohammedan. Consult: Nachtigal, *Sahara und Sudan* (Berlin and Leipzig, 1879-89); Rohlfs, *Quer durch Afrika*, vol. i. (Leipzig, 1874).

TI'BER (Lat. *Tiberis*, poetical *Thybris;* Ital. *Tévere*). The principal river of Central Italy. It rises in Tuscany, at the south of the Monte Fumajolo, in the Province of Arezzo, about thirty miles east of the source of the Arno, at an altitude of more than 3600 feet above the level of the sea, and flows toward the south in a winding course, entering the Province of Perugia (Umbria), where it passes through the valley between Perugia and Assisi. It receives the waters of many smaller streams, and at Orte, where it is joined by the Nera (the ancient *Nar*), it begins to form the boundary between the provinces of Umbria and Rome, encircling Mount Soracte and entering the Campagna Romana. About three miles above Rome it is swelled by the Anio (now Aniene or Teverone), then passes through the city of Rome, where it forms an island, the Insula Tiberina (now Isola' di San Bartolomeo), and enters the Tyrrhenian Sea about twenty-six miles below.

The total length of the Tiber is 245 miles; its breadth at Rome is about 250 feet. It is a swift-running stream, carrying down an enormous amount of alluvial matter, which, in solution, gives the water that yellowish color for which the flavus Tiberis was renowned. The sediment deposited at the mouth of the Tiber is pushing out the land at the rate of about ten feet a year, so that the ruins of Ostia, the ancient harbor of Rome, are now more than four miles inland. The delta is formed of two mouths; the *fiumicino*, originally a channel dug by Trajan for his harbor (Portus Traiani), now the larger and navigable branch, and the *fiumara*, now almost choked by sand banks; and these inclose the Isola Sacra, a desolate and unhealthy island once sacred to Venus. The Tiber is navigable by small steamers as far as Rome, and by smaller craft as far as Orte, about sixty miles from its mouth. It is subject to frequent and often disastrous inundations, of which the ancient writers have recorded no less than twenty-three. Among the more famous floods are that mentioned by Horace (*Odes*, I. 2), that of 1598, when the water at Rome rose 51½ feet, and that of 1900, when it reached a flood-height of almost 54 feet. To remedy this evil, the Government, beginning in 1876, has constructed massive embankments at Rome, at the expense of more than $25,000,000; but already the carefully planned work has proved defective. The stream on the north of the Tiber island has become clogged with sand, and in the flood of 1900 fully a quarter of a mile of the south embankment was carried away by the water.

Consult: S. M. Smith, *The Tiber and Its Tributaries* (London, 1877), Narducci, *Saggio di Bibliografia del Tevere* (Rome, 1876).

TIBE'RIAS, Lake or Sea of. A lake in Palestine. See Gennesaret, Lake of.

TIBE'RIUS (Tiberius Claudius Nero Cæsar) (B.C. 42-A.D. 37). The second Emperor of Rome (A.D. 14-37). He was the son of Tiberius Claudius Nero and Livia Drusilla (q.v.), and was adopted by Augustus (q.v.) when he married Livia in B.C. 38, after her compulsory divorce. He was carefully educated, and early manifested intellectual power and military skill. His first important command was the expedition sent in B.C. 20 to restore Tigranes to the throne of Armenia. A more noteworthy commission was given him in B.C. 15, when, in company with his younger brother Drusus (q.v.), he defeated the Rhætians. Two years later he was consul with P. Quintilius Varus, and in B.C. 11 he fought successfully against the Dalmatians and Pannonians. The death of Drusus in B.C. 9 recalled Tiberius to Germany, but in B.C. 7 he held the consulship for the second time. The troubles which were to overshadow his life had, however, already begun. In B.C. 11 he had been forced by Augustus to divorce his wife, Vipsania Agrippina, whom he loved deeply, and to marry the Emperor's daughter Julia, the widow of Marcus Vipsanius Agrippa (q.v.). Her conduct, and perhaps his own jealousy of the growing favor of Gaius and Lucius Cæsar, the two grandsons of Augustus, children of Julia and Agrippa, led him to retire, against the Emperor's will, to Rhodes in B.C. 6, the very year in which the tribunician power was conferred upon him for five years. He remained in Rhodes seven years, and before his return Julia had been banished for life to the island of Pandataria. The death of Lucius Cæsar in A.D. 2 and of Gaius in 4 led Augustus to adopt Tiberius as his heir. From this time until the Emperor's death Tiberius was in command of the Roman armies, and campaign followed campaign. In 4 he reduced Germany from the Rhein to the Elbe, from 6 to 9 he waged war again in Dalmatia and Pannonia, and from 10 to 11 he held the Rhein against the Germans who had defeated Varus (q.v.). In 12 he was honored with a well-earned triumph, When the death of Augustus occurred, August 19, 14, Tiberius was on his way to Illyricum. He was summoned home by his mother, and at once assumed control of the Empire. Despite his execution of Postumus Agrippa, the grandson of Augustus, his reign was at first beneficent. Gradually, however, a change took place in Tiberius. He minimized the power of the people, and transferred the election of magistrates from them to the senate. At the same time he watched with suspicion the increasing popularity of Germanicus Cæsar (q.v.), his nephew. In 19 Germanicus died, poisoned, if the reports current at the time may be believed, at the instigation of his uncle. About this time the evil genius of the reign of Tiberius, Ælius Sejanus (q.v.), gained his ascendency over the Emperor. Under his influence a system of espionage was instituted which doomed all who in any way opposed Tiberius. Freedom was abolished in Rome, the senate was demoralized, and the Emperor sank to the level of a cruel and ruthless tyrant. In 23 Sejanus abetted the murder of the only son of Tiberius, Drusus Cæsar (q.v.). Three years later the Emperor left Rome with Sejanus, going first to Campania and in 27 to Capri, where he remained till his death.

In 29 Livia Drusilla died, thus removing one of the last barriers to the complete degeneration of her son. Two years later Tiberius learned of the treachery and ambition of Sejanus, who was put to death, only to be replaced by Macro, as corrupt as his predecessor. In 37 Tiberius died, smothered, though already on his death-bed, by Macro, and was succeeded by Caligula (q.v.). The reign of Tiberius was beneficial to the Empire at large, and the provinces especially flourished under his sway. Only in Rome, and only where his personal interests were at stake, was he merciless.

The writings of Tiberius have been lost. His style is said to have been obscure, archaic, and affected. He wrote a brief autobiography, a lyric on the death of Lucius Cæsar, and a number of Greek poems.

Consult: Ihne, *Plea for the Emperor Tiberius* (London, 1853); Pasch, *Zur Kritik der Geschichte des Kaisers Tiberius* (Altenburg, 1866); Freytag, *Tiberius und Tacitus* (Berlin, 1870); Stahr, *Tiberius' Leben, Regierung, Charakter* (2d ed., ib., 1873); Tuxen, *Kejser Tiberius* (Copenhagen, 1896); Baring-Gould, *Tragedy of the Cæsars* (London, 1892).

TIBET, or **THIBET**, tĭb′et *or* tĭ-bĕt′. A region of Central Asia, forming part of the Chinese Empire. It is bordered on the north and east by Chinese territory, and on the west and south by Kashmir, Nepal, Bhutan, Sikkim, Assam, and Burma. Tibet is one of the least known parts of the world, foreign travel and exploration being forbidden in accordance with Chinese policy. There is some uncertainty even as to its exact boundaries and extent. Politically three distinct regions included within its wide limits must be eliminated: (1) 'Little Tibet,' between 74° and 79° east longitude, now included in Kashmir, and composed of Baltistan and Ladakh (qq.v.); (2) and (3) the two regions known as Ku-ku-nor and the Ts'aidam, or Ch'aidam, lying south of the Nan-shan, east of the Altin-tagh, and north of the curve formed by the eastern and southeastern extensions of the Kuen-lun system, bearing the names of Akka, Tolai, Angirtekshia, Barkhan-Bhōba, Shuga, etc.

Physical Features. Tibet presents two distinct physical divisions: (1) A region of lakes in the north, and (2) a region of rivers in the south and east. The first, occupying the greater portion of the western half of the country, is known as the Chang Tang or 'Northern Plain.' It is an arid treeless and shrubless solitude, with rounded hills and broad flat valleys between them, and a number of sharply defined mountain ridges rising several thousand feet above the plain. It has an average elevation of from 14,000 to 16,000 feet, falls away gradually to the east and south, and is dotted with lakes—mostly salt, some of them of considerable size. The more or less parallel mountain ridges, together with their separate valleys, lie buried beneath a vast accumulation of mountain débris, giving the surface the aspect of a plateau of uplift, or of one of tectonic construction. The streams terminate in salt lakes, which give unmistakable evidence of gradual desiccation. Large stretches toward the Kuen-lun are uninhabitable, and are abandoned to the wild beasts. In the southern zone, between the parallels of 32° and 33° north, a lofty range reaches as far east as 90° 25′—the Nin-chin Tang-la, the highest peak of which has an altitude of 24,153 feet, the Goring-la pass having an elevation of 19,587 feet. From 33° 50′ north toward the Kuen-lun there are ranges of extinct volcanoes with altitudes of 20,000 feet. One of the best known lakes of this region is the Pangong-tso, 13,930 feet above sea-level, partly in Ladakh (about latitude 34° north and longitude 79° east).

This inhospitable region is bordered on the east and south by the region of rivers, which is also a region of snow and ice-covered mountains and deep ravines. Its eastern section covers the whole eastern half of the country, stretching from about 90° east to China. It is almost entirely occupied by a succession of more or less wooded but lofty and steep mountains, with a general north to south trend, cut into deep narrow gorges, in which flow the rapid streams of melted snow which unite to form the upper courses of the great rivers which are known in their lower courses as the Hoang-ho, the Yang-tse-kiang, the Mekong, and the Salwin (qq.v.). The southern section of this river region lies to the south of the Chang-tang and extends from the Nin-chin Tang-la north of Lhasa, the capital, to the great South Chain, and is overlooked by Mount Everest, the highest peak of the Himalaya. Its mountains have a southeast and east trend, with many lateral intersecting ranges and spurs, which give direction to its numerous streams. In it are found the sources of three important rivers—the Indus and the Sutlej (qq.v), which rise in the Gang-ni or Kailas Mountains in the west and flow through India, and the Brahmaputra, which, under the name of Yaru-Tsangpo, rises farther east in the Mariam-la Mountains. The principal lakes of this region are the Sacred Manasarowar, near the sources of the Indus and the Sutlej, and 'Scorpion Lake,' the Yamdok or Palti, south of Lhasa, with a circuit of 45 miles. Here are found the bulk of the population, the seat of the government, and the great centres of culture and refinement.

CLIMATE. The climate is extremely severe. It is dry owing to the shutting out of the moisture-carrying clouds from the south by the great South Chain of the Himalayas. There are sometimes, however, heavy downpours of rain. Bower, who crossed the country between 32° and 34° north latitude, found the temperature in June to range from 18° to 34° F.; in July, from 17° to 30°; in August, from 19° to 35°; in September, from 19° to 36°; in October, from 15° below zero to 21° above; in November, at the decreased elevation of Eastern Tibet, from 15° below to 21° above; and in December, at a still lower level (9000 to 8154 feet), from 1° to 14° above zero.

FLORA. It has been estimated that not more than one-twentieth of the surface of Tibet is covered with vegetation. It has been fairly well settled that the flora, so far as the northern and eastern sections are concerned, belongs to the Arctic Alpine division of the great northern region. Toward the south it approaches that of India; and in parts the vegetation is luxuriant.

FAUNA. This includes the wild yak (*Poëphagus grunniens*), antelope, gazelle, kyang or wild ass (*Equus hemionus*), nyang or mountain sheep, *Ovis ammon* (found above an elevation of 15,000 feet), wolf, fox, wild dog, bear (regarded by the natives with dread as the primitive speechless wild man and hence unmolested), musk deer, and hare. In game-birds—especially in Eastern Tibet—there are the sand-grouse, several species of pheasant, ducks, teal, the bar-headed goose, coolen, etc. Toward the south the fauna is more Indian in character, and includes the lynx, leopard, tiger, etc. Among the domestic animals are the cat and the dog, but no fowls. Nor are song-birds found, except as strays from passing flocks.

MINERAL RESOURCES. Shut in as Tibet is, both politically and physically, little is as yet known of its geology. It is, however, supposed to be rich in minerals, and gold, silver, iron, and coal are mentioned. Gold-washing is a common occupation in some parts and small quantities of gold-dust are exported; but mining is prohibited. The gold-fields lie in the district known as Thok Jolang, in the southwestern part of the Changtang, and there Littledale found mining operations carried on six months of the year, exclusively by Lhasa people. Lapis lazuli and other semi-precious stones, as well as gems, are extensively used for personal adornment by both sexes, and it is supposed the country must be rich in these. The Kuen-lun Mountains have for many centuries been the chief source of the jade supplies of China, and in Europe and America fine specimens of heliotrope jadeite are shown reputedly of Tibetan origin; but the true provenance of the specimens is not known.

AGRICULTURE. Farming and the tending of flocks and herds are the chief occupations, but, owing to the elevated and rugged nature of the country, both are attended with many hardships. The entire Chang-tang is uncultivable, and it is only at elevations less than 13,500 feet that the growing of barley—the hardiest of all the cereals, and the chief article of food in Tibet—becomes possible. The other crops are wheat, buckwheat, cabbages, potatoes, turnips, radishes, and pulse, and among the fruits, apples, apricots (especially in the western province), and peaches, and in the south pomegranates and jujubes. A little rice is produced in the south, but the main supply is imported.

INDUSTRIES. Tibet has no factories, but many minor industries are carried on in the settled districts, and the people are reputed to be skillful weavers, potters, and metal-workers. Dergé in Eastern Tibet is noted for its swords, guns, teapots, tinder-boxes, and bells, as well as for its saddlery. An excellent kind of serge called *pulo* is produced everywhere.

COMMERCE. The chief products of Tibet are wool, lambskins, lynx, fox, leopard, and other skins, yak-tails used in India as chowries or fly-flaps, deers' horns, musk, rhubarb, gold-dust, precious stones, borax, nitre, salt, and live stock. Much of the wool goes to Kashmir to be manufactured into the famous Kashmir shawls. In exchange for these, Tibet receives tea, cotton and cotton goods, silk, sugar, and tobacco from both China and India; satins, gold brocades, red leather, chinaware, gun-barrels, hardware, drugs, and flour from China; leather and saddles from Mongolia; broadcloth, indigo, spices, coral-beads, and pearls from India; rice from Sikkim; and saffron from Kashmir. Tibetans are great consumers of tea, and it has been estimated that over 13,000,000 pounds of brick tea are received annually from China alone. The preferred medium of exchange is the Indian rupee, but much of the business of the country is mere barter.

TRANSPORTATION AND COMMUNICATION. Lhasa, the capital, is the great central mart, from which trade routes radiate in all directions: to China by way of Chiamdo, Bat'ang, Li-t'ang, and Darchendo, in Eastern Tibet; northeast through the Ts'aidam and Ku-ku-nor to Kan-su and Mongolia; westward to Gartok in the Province of Nari on the borders of Kashmir, where a great market is held in August and September; northwest to Rudock, a frontier post, the emporium for the trade with Leh. Another trail leads through Gyantse, Khamba-jong, and the recently opened British-Tibetan mart Yatung (q.v.) to Kalimpong and Darjiling in Sikkim; another leads through Shigatse to Bhutan, or through Ilam on the southwest to Nepal. Transportation is difficult and tedious, most of these journeys requiring months to complete. Robbers are numerous and bold, hence traders travel in large companies; the pack-animals are yaks, mules, ponies, and where the road is too stony for the yak, sheep are used, one sheep carrying 25 to 30 pounds. Food, fodder, and tents must be carried; the passes are precipitous and frequently blocked with snow. The animals are never housed by the way, and the mortality among them is very great. In the settled parts of the country the streams are usually bridged, or if unfordable they can be crossed in round wicker-work boats covered with skins, the animals swimming.

GOVERNMENT. For administrative purposes the territory, subject to the Lhasa Government, represents 4 provinces (Nari, Tsang, Wu, and Khams), and is divided into 53 jongs or prefectures and 123 sub-jongs. At the head of each jong are two jongpons of equal rank, one a layman, and one a lama, with civil, military, and judicial jurisdiction. Under these are the local magistrates, headmen and elders. Over all is the Amban or Imperial Minister Resident at Lhasa, who is the intermediary between the local Government and Peking. He is charged with the supervision of the foreign relations of the country, and settles all difficulties which may arise between the tribes. Taxes are paid in kind. The regular army consists of 9000 men, 3000 of whom are usually at home on half pay. A militia force of 65,000 can be called out at any time.

Population. Judging from a partial census taken in 1737, and the statements of travelers since then, it is safe to assert that within the bounds given in this article to Tibet the population does not exceed 3,500,000, of whom at least 500,000 are lamas; in 1737 there were 316,200 in Wu-Tsang alone. Many influences are at work to keep down the population, among which may be mentioned the absence of immigration, the prevalence of polyandry and of celibacy among the lamaists, and the ravages of smallpox, which is always epidemic, and carries off vast numbers every year.

Religion. Bön, the indigenous religion of the country, is a kind of Shamanism (q.v.). It still has many adherents, especially in Eastern Tibet; but the State religion, and the prevailing one, is the corrupt form of Buddhism called Lamaism (q.v.). There are several sects, but the most powerful is the Gelugpa, which constitutes the established Church. (See Tsongk'a-pa.) Followers of this sect wear yellow caps as distinct from the unreformed Nyingmepas, who wear red caps, and are the next most powerful sect. The lamas or monks are very numerous, dwell in great monasteries, frequently called lamaseries, of which there are said to be over 3000, some of them of immense size, having accommodation for from 3000 to 10,000 persons. They are commonly considered to be repositories of great wealth. Education is chiefly in the hands of the lamas.

Ethnology. Judged by their language alone, Tibetans proper belong to the Tibeto-Indo-Chinese branch of Keane's *Homo Mongolicus*. Physically, however, they exhibit marked variations, there being present at least two types—one Mongoloid, the other a somewhat slender figure, thin, prominent, often aquiline nose, straight eyes, and long, sometimes wavy, hair. In the permanently settled portions of the country, where centres of population have existed for centuries, the people have varied considerably from the original type, the result being a mixed race, becoming more Chinese as one goes toward China, or more Indian (Nepalese or Kashmiri) as one travels southward or westward. This mixture is in part due to the concubinage of native women with foreign traders, soldiers, pilgrims, officials, etc., and in part to the system of polyandry. Monogamy prevails among the nomads, but elsewhere polyandry is common, one woman becoming the wife of the brothers of a family, the oldest being considered the father of all the children, the others being regarded merely as 'uncles.' There is also some polygamy among the wealthy, as in China.

History. The early history of Tibet is legendary and obscure. In the middle of the eighth century Tibet extended from Ku-ku-nor and Ladakh on the north into India in the south, while on the east the tribesmen came into frequent conflict with China, and it is recorded that they even entered Chang-an, the capital, in 763. In 747 the famous Indian wizard and teacher, Padma-sambhava, had arrived; he made a long missionary journey through the country, everywhere vanquishing the Shamanistic devils, and laid the foundation of Lamaism. In 749 the first monastery was built. Muni-tsanpo came to the throne in 789. In order to better the condition of the poor, he compelled the rich to share their wealth with the indigent. This leveling process was unsuccessful. Lang-dharma, who died in 899, left only minor sons; the kingdom was broken up into two, later into a number of petty principalities, and it was easy for Genghis Khan to incorporate Tibet into his empire in 1206.

Kublai Khan, the conqueror of China, actively promoted the spread of Buddhism throughout the Mongol Empire. Buddhism having entered from India and China in the first half of the seventh century, the language was reduced to writing, the translation of the sacred books was begun, and about 650 the first temple—the Labrang, at Lhasa—was erected. From this time forth the internal history of Tibet is the history of the struggle of Buddhism (already corrupt) with the indigenous Shamanism (q.v.), the rise and development of Lamaism (q.v.) and the Lamaistic hierarchy, the abolition of the kingly dignity and the establishment of the supremacy of the Grand Lama at Lhasa as the head of both Church and State. In 1270 he made the chief of the Sakya sect head of the Church, and conferred on him the temporal power. Near the end of the fourteenth century arose Tsong-k'a-pa (q.v.), the great reformer, through whose efforts Lamaism was purified somewhat, and a new and powerful sect, the Gelugpa, was founded. In 1642 Kushri Khan, the Mongol Prince of Ku-ku-nor, conquered Tibet, and in 1645 made over the sovereignty of it to the Grand Lama of the time, with the title of Dalai (or Talé) Lama. He has continued ever since to be both the head of the State and the head of the Church, the Chinese Empire having confirmed him in both offices in 1650. In 1717 the Sungars invaded the country, but were driven out by Chinese armies in 1720, when Eastern Tibet was placed under the direct rule of Chinese officials, a Kansu and Sge-chuer. In 1774 Warren Hastings sent from India an envoy to negotiate friendly commercial relations between Tibet and the British East India Company. He was well received. Another embassy was sent under Turner in 1783, but his efforts were made futile by the policy of the company under the administration of Lord Cornwallis, who, under treaty engagements with Nepal, assisted the Gurkhas when in 1790 they invaded Tibet and plundered Tashilunpo. They were driven out in 1792, and since then the passes between India and Tibet have been closed. In 1893 a convention was signed opening Yatung (q.v.) on the Tibetan frontier as a British trade-mart. The list of Europeans who have entered Tibet in more recent times comprises Bagle in 1774; Turner in 1783; Manning in

1811; Huc and Gabet in 1846; Przhevalski in 1870-71, 1879, and 1887; Rockhill in 1889 and 1891-92; Bonvolot in 1889; Bower in 1890-91; Littledale, 1894; Sven Hedin during his journeys of 1894-97 and 1899-1902; Miss Taylor, and a few others. Many 'pundits,' trained by the great Trigonometrical Survey of India, have frequently traversed it and have procured much valuable information regarding the country. Much of it, however, is 'confidential,' and is still unpublished.

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TIB′IA (Lat. shin-bone). In anatomy, the larger of the two bones forming the leg, and the one to which the fibula is attached. It articulates with the femur above and with the astragalus below. The tibia was the name of the commonest musical instrument of the Greeks and Romans. It was a pipe or flute. originally made of bone, but later of a reed, with the opening at the top, protected by a natural knot, with a tongue beneath, partially detached by a longitudinal slit. It was used at festivals, sacrifices, and dances, as an accompaniment to the rowing of the trireme, sometimes also to the march of troops to battle. The *tibia dextra* was the bass instrument and was held in the right hand, the *tibia sinistra*, or treble instrument, in the left. The *tibiæ pares* were both treble or both bass, and the *tibiæ impares* were one bass and one treble.

TIBUL′LUS, Albius (c.54-c.19 B.C.). A Roman elegiac poet, born of an equestrian family. He inherited an estate at Pedum, between Tibur and Præneste, which had been either wholly or partially confiscated in the civil wars. Tibullus, however, recovered part of his property, and spent there the best part of his short life. He was patronized by Messalla, whom in 31 he accompanied into Aquitania, to suppress a serious revolt. He was present at the battle of Atax, which gave the final blow to the insurgents; and he celebrates in a fine strain of poetry the honorable part he bore in the campaign. Next year Messalla was sent to the East and again Tibullus accompanied him; but having been obliged from illness to stop at Corcyra, he returned to Rome. Henceforth he devoted himself to the study and composition of poetry. His Elegies, divided into four books, are mainly addressed to his mistresses, Delia, Nemesis, and Glycera, whose inconstancy or coldness he bewails in tender and exquisitely finished verses. The third book, however, is now believed to be the work, not of Tibullus, but of another and inferior poet; while the hexameter poem on Messalla, with which the fourth book opens, is supposed to be also by another. The character of Tibullus was singularly pure, amiable, and winning. During life he had the honor of being addressed in an ode and epistle by Horace; after death, of being bewailed in an elegy of matchless beauty by Ovid. The best editions are those of Baehrens (Leipzig, 1878), Hiller (ib., 1885)), and Müller (ib., 1885). The poems were translated into English by Grainger (1752) and Cranstoun (1872), and into English prose by Kelly (1854). Consult Sellar, *Roman Poets of the Republic* (London, 1863).

TICAO, tē-kä′ō. An island belonging to the Philippine Province of Masbate (q.v.).

TIC DOULOUREUX, tĭk do͞o′lo͞o′ro͞o′, *Fr. pron.* -rē′. See Facial Neuralgia.

TICH′BORNE TRIAL. A celebrated trial in which an impostor attempted to obtain possession of the Tichborne estates in Hampshire and Dorsetshire, England, by assuming to be the heir, Roger Charles Tichborne. The case was remarkable for the great public interest it aroused, for the length and thoroughness of the trial, and for the success of the impostor in deceiving a great number of intelligent persons. Roger Charles Tichborne was born in 1829, and after some education in France, and at the Roman Catholic College at Stonyhurst, England, entered the British Army. His French accent and his eccentricities made him unpopular and he resigned and went to Brazil. He sailed from Rio de Janeiro in 1854 in the ship *Bella*, which was lost at sea with all on board. His father, Sir James Tichborne, died in 1862, and as Roger was supposed to be dead, a younger son, Alfred, succeeded to the estates. Lady Tichborne refused to believe that her son, Roger Charles, was dead, and advertised extensively for information regarding his whereabouts. In 1865 a coarse, ignorant butcher named Arthur Orton, who resided at Wagga Wagga, Queensland, Australia, under the name of Thomas Castro, conceived the idea of representing himself to be Roger Charles Tichborne and claiming the estates. His first step was to write a letter to Lady Tichborne claiming to be her son. The letter was illiterate and contained statements as to his identification which were wholly false and inapplicable to the true heir. He subsequently came to England, went over the Tichborne estates, gained all the information he could as to the former life and habits of Roger Charles, and succeeded in convincing the family solicitor and several others of his identity. In January, 1866, he called on Lady Tichborne in Paris and was received as her son. This was most remarkable, as there was no similarity in the appearance of Orton and Roger Charles, and Orton had no knowledge of the French language, in which the true heir was proficient. After this recognition he had great success in gaining adherents to his cause. The Tichborne family, however, repudiated him, and at a large expense investigated his life, discovering his true name and past life. He succeeded in raising large sums of money by issuing bonds, payable upon his obtaining possession of the property. These were known as the 'Tichborne bonds' and were widely distributed. He brought ejectment suits to recover the estates in 1871; and succeeded in inducing over 100 witnesses to swear that they recognized him or believed him to be

Roger Charles. Despite his ignorance, he exhibited remarkable shrewdness and cunning at the trial, which lasted 103 days and ended in his being nonsuited. In 1873 he was tried for perjury, being defended by Edward Keneally, and after a trial of 188 days he was convicted, and sentenced to fourteen years' penal servitude. He was released in 1884, and again attempted to stir up public sentiment in his favor, but was unsuccessful. The cost of the two trials has been estimated at £200,000. He died in abject poverty in 1898. Consult: *The Tichborne Romance* (Manchester, England, 1871); *Charge of Lord Chief Justice of England in the Case of Queen vs. Thomas Castro* (London, 1874).

TICINO, tē-chē'nō. A river of Switzerland and Northern Italy (Map: Switzerland, C 2). It rises on the southern slope of the Saint Gotthard, and flows south and southeast, traversing Lago Maggiore, and emptying into the Po after passing the city of Pavia. Its length is 154 miles. Its upper course is a wild mountain torrent flowing through romantic gorges, but below the lake it is navigable and communicates with several canals.

TICINO (Ger. *Tessin*). A southern canton of Switzerland, bordering on Italy, between Valais on the west and Grisons on the east. Area, 1088 square miles (Map: Switzerland, C 2). It has a very mountainous surface intersected by the valleys of the Ticino, Maggia, Moesa, and of a few other streams. In the north rise the Lepontine Alps with the Saint Gotthard, in the east are the Adula Alps, while the southern part around Lago Maggiore is comparatively low, and is the most fertile part of the canton. Notwithstanding its mountainous character, Ticino has two-thirds of its area under cultivation. Cereals are the chief products, but southern fruits and grapes are also cultivated on a large scale. The manufacturing industries are undeveloped and native artisans emigrate annually to other parts of Europe. The chief means of transportation is the Saint Gotthard Railway. The Constitution (as amended in 1892) provides for a Legislative Assembly elected by the people on the basis of proportional representation, and an Executive Council, also elected by the people. The optional referendum prevails. Population, in 1888, 126,751; in 1900, 138,638, almost exclusively Italians. Capital, Bellinzona (q.v.). Consult Motta, *Bibliografia storica ticinese* (Zurich).

Ticino as part of Gallia Cisalpina was early joined to the Roman Republic. After the decline of the Roman power it passed successively into the hands of the Ostrogoths, Lombards, and Franks. During the later mediæval period its territory formed a portion of the Duchy of Milan, from which it was wrested in successive conquests during the fifteenth and sixteenth centuries by the members of the Swiss Confederacy, whose title was confirmed by the 'Eternal Peace' of 1516. The attempt to establish Protestantism in the District of Locarno was rigorously stamped out by the exile of members of that faith in 1555. The rule of the Italian district by the other members of the Confederacy was harsh, but only one rebellion, in 1755, marked its course. In 1798 this district, divided into the cantons of Bellinzona and Lugano, was constituted part of the Helvetic Republic; in 1803 they were united into one canton—Ticino—which received greater privileges as a full member of the Confederacy. Other difficulties were removed by the Constitution of 1830, but measures of a religious and commercial nature have often separated the inhabitants from the sympathy of their northern neighbors, and local struggles of Radical and Ultramontane parties have often necessitated Federal interference.

TICK (AS. *ticia*, miswritten for *tiica, tīca*, Ger. *Zecke*, tick; connected with Arm. *tiz*, tick). One of those members of the order Acarina which belong to the families Argasidæ and Ixodidæ, which have been grouped together in the superfamily Ixodoidea. The ticks or 'louse-flies' are eight-legged creatures in which the cephalothorax is coalesced with the abdomen. The young, newly hatched individual is flat and nearly circular and has only six legs. With the first molt it enters the second or nymphal stage, which is characterized by the presence of a fourth pair of legs. After the second molt it becomes mature. In the free-living state the body of a mature tick is flattened dorsally and is of an oval shape. The body is covered with a leathery integument which generally assumes on the dorsal surface a hardened, chitinous, more or less smooth, and darker appearance. Near the margin it is impressed by a depressed line leaving a distinct rim around the body.

All ticks, so far as known, although found upon plants in their early stages, are parasites of animals. The young seek on every possible occasion to fasten themselves to vertebrate animals. Mammals and birds seem to be preferred, and spots where the skin is soft are chosen. When the very young first fasten themselves they cannot penetrate deeply enough to draw blood, but the irritation causes a suppuration on which they feed. When, however, they have grown sufficiently to enable them to reach a blood-vessel, the small, flat, semitransparent creatures soon become distended, the body becomes rounded, and the color frequently becomes dark red. In a week or more the larva is transformed into the nymph, which at the expiration of another week is changed to a mature individual. The female only sucks blood, so far as is known. The male retains its form and size, and although it attaches itself to warm-blooded animals, it evidently does so only for the purpose of seeking the female.

Several species occur in the United States. The common dog tick or wood tick (*Dermacentor electus*) is found frequently in the woods in the Northern States. The common tick occurring upon the ground-squirrel in the Mississippi Valley is *Ixodes ricinus*. *Argas miniatus* is very destructive to chickens in parts of Texas and Florida, and *Argas reflexus*, the pigeon tick, is common in pigeon-houses in both Europe and the Southern United States. This species is capable of living an almost incredible length of time without food. In Persia a species, the miana-bug (*Argas Persicæ*), lives in houses and seeks its human prey at night; its bite causes serious disturbance, and is said even to cause death. In South America a species known as 'garapate' (*Amblyomma Americanum*) occurs in dry, bushy places, where it clings to twigs and transfers itself to passing horses or cattle as opportunity occurs. It also lives in the United States and has been found on human beings. Eight species of ticks in the United States have been found upon cattle, one associated with the Texas cattle fever (*Boöphilus annulatus*) being the most noted and the most destructive. Other species of the same genus transmit the same or similar diseases of cattle in other parts of the world. *Boöphilus australis* transmits what is probably the same disease in Australia, and *Boöphilus decoloratus* (the so-called 'blue tick') acts the same way in South Africa, carrying the disease commonly known as 'red water.'

Texas cattle fever is particularly destructive to Northern cattle that have been shipped south or that have been brought into contact with Southern infested cattle which have been shipped north. The dipping of cattle in vats containing cottonseed oil or any one of several mixtures, known as 'cattle dips,' destroys the ticks.

Certain mites of the family Gamasidæ are sometimes known as ticks, although the name in this application is erroneous. The bird tick (*Dermanyssus avium*) is a familiar parasite of caged birds. The poultry tick (*Dermanyssus gallinæ*), which is also known as the 'little chicken mite,' gathers on fowls in the hennery, especially at night, and sucks their blood. Certain of the true insects are also erroneously called ticks. For example, the flies of the family Hippoboscidæ are quite generally known as bird ticks. (See FOREST FLY and PUPIPARA.) The degraded wingless flies of the family Nycteribiidæ are called bat ticks.

Consult: Osborn, *Insects Affecting Domestic Animals* (United States Department of Agriculture, Washington, 1896); Salmon and Stiles, *Cattle Ticks of the United States* (ib., 1902); Marx, "Classification of the Ixodidæ," in *Proceedings Entomological Society of Washington*, vol. ii., No. 2 (1892); Marx, "The Morphology of the Ticks," id., vol. ii., No. 3 (1892).

TICK'ELL, THOMAS (1686-1740). An English poet, born at Bridekirk, in Cumberland. He was educated at Queen's College, Oxford, of which he became fellow (1710-26). He attracted the attention of Addison by some lines praising the latter's *Rosamond;* and Addison, on becoming Secretary of State in 1717, made him Under-Secretary. He was secretary to the Lords Justices of Ireland from 1725 till his death. He published *Prospect of Peace* (1712); *The Royal Progress* (1714); and a poetical version of the first book of the *Iliad* (1715), out of which grew the famous quarrel between Pope (q.v.) and Addison (q.v.). His best known poem is *Colin and Lucy;* the longest is *Kensington Gardens.* Goldsmith calls his *Elegy on Addison* (prefixed to Addison's *Works*, 1721), "one of the finest odes in our language." Consult Dr. Johnson's *Lives of the Poets* (London, 1854, 1890, etc.).

TICKET (OF. *estiquette*, *etiquette*, Fr. *étiquette*, ticket, label, etiquette, from OHG. *stehhan*, Ger. *stechen*, to stick; connected with Lat. *in-stigare*, to prick, incite, Gk. *στίγμα*, *stigma*, mark, brand, puncture, Skt. *tij*, to be sharp). A slip of paper containing a statement or certificate that the person to whom it is issued, or the holder, is entitled to some right or privilege therein referred to or described, as railroad tickets, theatre tickets, pawn tickets, and lottery tickets. A ticket is evidence of a contract between the holder of the ticket and the person or corporation issuing it. Usually tickets do not purport to express the entire contract between the parties, and the terms or conditions which are not expressed may be supplied by parol evidence (q.v.). Where the ticket grants the right or privilege of using the grantor's real estate, as in case of theatre tickets, the holder of the ticket acquires no title or interest in the real estate, but becomes a mere licensee (see LICENSE) entitled to use the real estate in the manner and for the purposes specified. The licensor or grantor of the ticket, however, may at will revoke the license, even though such a revocation is a breach of the contract; and upon such revocation the holder of the ticket becomes a mere trespasser and may be summarily ejected, but only necessary force can lawfully be used for that purpose. He may, however, be entitled to recover damages for breach of the contract in ejecting him. See THEATRE.

This rule does not apply in the case of tickets issued by common carriers, who, by virtue of their public calling, are compelled to accept for carriage all who pay a reasonable fare and comply with their reasonable rules and regulations. Passenger tickets under ordinary circumstances are generally now held to be contracts, and not mere symbols or means of identification of the passenger, so that the holder of a ticket is deemed to assent to its terms. Such stipulations, which usually restrict the liability of the carrier, have been held to be valid and binding if reasonable and not against public policy. Common carriers may require passengers to buy tickets as a condition of their being carried; and, when reasonable opportunity to do so is given, the carrier may charge an additional rate when the passenger has failed to buy a ticket. Common carriers may make any condition as to the time and use of tickets which is reasonable. Thus provisions contained in the ticket that it shall be used before a date named, or that it shall be stamped by the carrier before it is presented for a return trip, or that it shall not be transferable have been held to be valid.

The carrier may require the passenger to produce the ticket or an identification check for inspection whenever required to do so, and upon the passenger's failure to comply with the regulation may eject him. This appears to be the general rule even when the passenger's inability to comply with the regulation is due to the neglect of the carrier's agents, as when the wrong ticket is given out by the carrier's ticket agent or the wrong coupon is taken up by one conductor, so that the passenger is left without the proper coupon at a subsequent stage of his journey. The passenger's right in such a case is not to insist upon being carried without payment of the fare demanded by the conductor or other agent of the carrier, but to pay the fare demanded and to bring an action against the carrier for breach of the contract evidenced by the ticket. Purchase of a ticket entitles the holder to all the accommodations usually given by the carrier to holders of that class of tickets. If, however, they are not provided, as in case the carrier fails without excuse to provide the passenger with a seat, his right is not to refuse to pay fare or surrender his ticket, but to recover damages for the carrier's breach of contract or undertaking to carry. See CARRIER, COMMON; TRANSPORTATION; etc.

TICKET OF LEAVE. In Great Britain and its Australian colonies, a kind of permit or license granting a prisoner his liberty for good conduct, and revocable for subsequent misconduct, under the terms of its conditions. The term was first applied to the license of liberty granted to convicts in Van Diemen's Land as a part of the reform in prison methods in 1840, and later to those who were granted a similar license in England as a partial compensation for their long term of imprisonment after transportation had been discontinued, but the terms of sentence had not been shortened. These convicts became so numerous, and the number of crimes committed by them became so serious, that a still further reform led to the system of granting the license upon the mark system, under which it was given only to convicts sentenced for terms longer than two years, and who by their work and industry, as shown by their marks, became entitled to it. Under this system the ticket of leave has been found to work well, its chief defect being the drawback put upon the prisoner's chance of success in obtaining work and living among reputable people by his liability to constant surveillance by the police officials. This defect is largely removed by the existence of various private charitable institutions which look after the prisoners who place themselves under their charge in such a manner as to remove the publicity of their being watched. The prisoner is practically free to come and go as he chooses within a certain district, under certain conditions of living an honest industrious life among honest people, and making periodical reports.

The effectiveness of such a system of rewarding good conduct on the part of prisoners, and inducing them to live honest lives without imprisonment, but yet where their conduct is subject to control, has become so generally recognized in the United States that similar acts have been passed in about half of them, the license being generally called a 'parole.' Most of these acts have been passed since 1890, and under none of them can a parole be granted to a person convicted of murder in either the first or second degree; and most of them refuse it to a prisoner serving under a second conviction of crime. Of course the prisoners themselves are found to favor the granting of paroles; and the better element among them are in favor of the honest and strict enforcement of the conditions of surveillance.

Consult the works referred to under PENOLOGY; PRISONS; and also the *Report* of J. Franklin Fort to the American Bar Association in 1898.

TICK'NOR, FRANCIS ORRERY (1822-74). An American poet, born in Baldwin County, Ga. He studied medicine in the North and practiced his profession at Columbus, Ga. A small volume of miscellaneous verses was published in 1879. Two poems of Ticknor are well known and rank among the best lyrics produced in the South. They are the pathetic "Little Giffen" and the stirring "Virginians of the Valley."

TICKNOR, GEORGE (1791-1871). An American literary critic and historian, born in Boston. Educated in a scholarly home, a graduate of Dartmouth (1807), admitted to the Boston bar in 1813, he gave up the legal profession for literature, went to Europe in 1815, studied four years at Göttingen and in other Continental cities, and returned in 1819 with a valuable library to a professorship of modern languages and literature in Harvard College. Here he devoted himself especially to French and Spanish, and attracted hearers beyond the university circle. He resigned his professorship in 1835, passed three years in Europe and eleven further years in elaborating his greatest work, *History of Spanish Literature* (1849), which was translated into German and Spanish and came to be regarded as a standard work, even in Spain. It was reissued in 1854, and again reëdited and enlarged in 1863. A fourth edition embodies his latest revisions. He published also a *Life of William Hickling Prescott* (1864) and several minor works. His *Life, Letters, and Journals* are collected in two volumes (1876). Other letters describing his life as a German student may be found in W. P. Trent's *English Culture in Virginia* (Johns Hopkins University Studies). His library, containing one of the best collections of Spanish literature in existence, was bequeathed to the Boston Public Library. As an educator Ticknor was in advance of his generation; as a citizen he represented the best traditions of Boston; as a scholar he held his own with the erudite men of his day. His greatest work, however, does not in its style represent the personality of the man so much as it does the conscientiousness of the scholar, and it is slowly losing its prestige.

TICKNOR, WILLIAM DAVIS (1810-64). An American publisher, born at Lebanon, N. H. He founded at Boston, in 1828, the publishing firm of Ticknor & Fields, afterwards known as Ticknor & Co. In addition to the works of Longfellow, Holmes, Saxe, Whittier, and Lowell, he published the *Atlantic Monthly* and *North American Review*, and made his office the resort of the leading literary men of his time. Mr. Ticknor was among the first American publishers to pay foreign authors for their work.

TICON'DERO'GA. A village in Essex County, N. Y., 100 miles north by east of Albany; on the stream which conveys the waters of Lake George into Lake Champlain, and on the Delaware and Hudson and other railroads (Map: New York, G 2). It is rich in reminiscences of the Colonial and Revolutionary periods. The vicinity is noted for its extensive production of crystalline graphite, furnishing the greater part of the total output of the United States. The water power afforded by the falls is utilized by several industrial establishments. Paper, wood pulp, and lumber products constitute the leading manufactures. Population, in 1890, 2267; in 1900, 1911.

In 1755 the French, recognizing the strategic value of the promontory, built a fort here and called it Fort Carillon (chime of bells), in allusion to the pleasing sound of the waterfalls near by. Several years later the present name was adopted. In 1757 Montcalm assembled here a force of 9000 men, with which he took Fort William Henry, on Lake George. On July 8, 1758, General Abercrombie, with 15,000 men, stormed Fort Carillon, but was repulsed with a loss of 2000, Viscount George A. Howe being among the killed. In 1759 General Amherst with a force of 12,000 men invested it, and the French, being too weak to withstand an attack, dismantled and abandoned both this fort and Crown Point, which were then enlarged and strengthened by the English. Being weakly garrisoned after the cession of Canada to Great Britain, Ticonderoga was surprised and captured on May 10, 1775, by Ethan Allen. On June 30, 1777, Burgoyne invested it and on July 5, by placing a battery on Mount Defiance, a higher point, then called Sugar Loaf Hill, he forced the garrison to evacuate the place. Later in the year General Lincoln attacked the British here and captured Mount Defiance, releasing 100 American prisoners and taking 293 of the English, but he failed to recover the fort itself. After Burgoyne surrendered at Saratoga, the English garrison was removed and the fort dismantled, though in 1780 another English force under General Haldimand was stationed here for a time. After the war the fort gradually fell in ruins.

TIC-POLONGA. See DABOIA and Colored Plate under SNAKE.

TICUNA, tḗ-kōō′ná, or TUCUNA. A wild tribe of uncertain affinity inhabiting the forests of the Upper Amazon (Marañon) about the confluence of the Javary, on the Brazil-Peru frontier. They go perfectly naked, excepting for necklaces of monkey teeth and armlets of feathers, and depend for a living upon hunting and fishing. Physically they are well formed, and rather slender, with a dark complexion and a gentle expression. In disposition they are honest and direct. They bury their dead in great earthern jars, with their face turned toward the rising sun, and weapons and fruit placed upon the bosom. They have many interesting masked dances and curious ceremonies at the naming of children.

TIDAL WAVE. A term erroneously applied to almost any unexpected wave that inundates the seacoast or the shore of a great lake. These waves are rarely, if ever, due to the tides, since the tidal wave is a phenomenon admitting of exact calculation and prediction; on the other hand, they may usually be traced to some distant earthquake or violent storm. See EARTHQUAKE.

TIDEMAND, tē′dȧ-mȧn, ADOLF (1814-76). A Norwegian genre painter, born at Mandal. He studied at the Academy of Copenhagen and under Theador Hildebrandt and Schadow at Düsseldorf, whence he went to Munich and later to Rome. Afterwards he usually spent the summer in Norway and the winter at Düsseldorf, where Scandinavian artists congregated around him and Gude. Besides the large historical compositions "Gustavus Vasa Addressing the Dalecarlians" (1841) and "Devotional Meeting of the Haugainer" (gold medal, 1848, National Gallery, Christiania, and Düsseldorf Gallery), he painted many genre subjects, remarkable for masterly conception and vigorous coloring, such as the cycle of ten pictures illustrating "Norwegian Peasant Life" (1850, Château of Oscarshall, near Christiania); "Summer Evening on a Lake" (1851, National Gallery, Berlin); "The Wolf-Hunter's Tale" (1853) and "A Funeral in Norway" (1854, both in the Ravené Gallery, ib.); "Grandmother's Bridal Crown" (1865, Karlsruhe Gallery), and others. He died at Christiania.

TIDE-MILL. See WATER-POWER.

TIDES (AS. *tīd*, OHG. *zīt*, Ger. *Zeit*, time; connected with Skt. *a-diti*, boundless, and ultimately with Eng. *time*). The daily rising and falling of the waters of the ocean. When the water has reached the highest point it is called *high water*, and at its lowest point *low water*. The rising of the water is called *flood*, the falling *ebb*. Tides are caused by the gravitational attraction or pull of the sun and moon upon the water, and upon the earth itself. The moon, being so much nearer than the sun, is of course the principal cause. When the moon is directly over a given place it pulls the water under it, and thus tends to heap up a tidal wave just under the moon. At the same time it is pulling the earth itself; but it pulls the water more than the earth underneath, simply because the moon is nearer to the water on the surface than it is to the solid earth behind it. For we must remember that, according to Newton's law of attraction, the pull decreases rapidly when the body pulled is removed to a greater distance. But this reason also makes the attraction exerted upon the solid earth greater than that affecting the mass of water upon the side of the earth opposite to the moon. This water, being still farther away than is the solid earth, gets the least pull of all. The earth is, so to speak, pulled away from that part of the ocean that is opposite the moon, instead of directly under it. This causes another distinct heaping up of water opposite the moon, giving us a second tidal wave. There should be, therefore, two lunar tidal-wave crests, one directly under the moon and the other on the side of the earth opposite the moon. This explanation is modified somewhat on account of the attraction of the sun, which at times tends to increase, and again at times to diminish, the lunar tide. We thus get the high tides of new and full moon (spring tides) and the low tides of certain other ages of the moon (neap tides). And the double tidal wave explains why there are two high tides and two low tides every twenty-four hours. This explanation is called the 'equilibrium' theory of the tides. It is very plausible, but unfortunately it fails to agree with observed facts, though it is nevertheless of great use in leading up to a better theory. Under the equilibrium theory we should expect high water at any place about the time when the moon, as astronomers say, passes the meridian. This time might be modified by the solar effects, but only to a rather small amount easily calculated. Unfortunately, this is not in accord with observation. There are places where the high water comes as much as six hours away from the meridian passage of the moon. In other words, the equilibrium theory is at times in error by the maximum possible amount. The trouble is that it tells us what would happen if the forces governing the tides had plenty of time to act. But the turning of the earth on its axis continually presents a new meridian to the moon, so that the tidal-wave crest is always following the moon, ever trying to be highest directly under it. Thus what should occur under the equilibrium theory is greatly modified by the theory of the motion of fluid waves. This leads them to the 'dynamical' theory of the tides.

A consideration of the subject is much simplified by assuming a condition of things that does not really exist in nature. Let us imagine a canal full of water encircling the earth at the equator. Sir Isaac Newton was the first to investigate what would happen to a wave set in motion in such a canal. It can be shown mathematically that the speed at which such a wave would travel depends simply on the depth of the canal. The deeper the canal, the greater the speed of the wave. This is, of course, very important, and shows what a perfectly free wave would do under such simplified conditions. It can even be computed that if the canal were 13¾ miles deep, the wave would travel round the earth in exactly twenty-four hours. Now, it is the tendency of the sun and moon to set such a free wave in motion at each instant of time; and these go on traveling along more or less like the supposed simple wave in the canal. If the ocean were 13¾ miles deep, the waves would have a period of one day; and the new free waves forming all the time would reinforce the old ones, leading to an enormous tidal accumulation. Fortunately, the ocean is much less than 13¾ miles deep, and the waves travel much more slowly than once a day. It may happen, therefore, that as the waves travel around the earth, their speed may be such that we shall find a wave hollow instead of a wave crest under the moon. Thus, the modification of the equilibrium theory by the wave motion may at times completely reverse things, giving us low tide when we should expect high tide.

We may carry the canal idea a step further, with a remarkably interesting result. Suppose the whole surface of the earth were covered with a series of canals parallel to the equatorial canal. Then, as we approach the pole, the canals will be shorter, since the equatorial circumference of the earth is longer than it is in any other latitude. Thus the waves in high latitudes would not have so far to go as the waves in low latitudes, and so might tend to reinforce each other as explained above. So we might have 'inverted' tides in the equatorial regions and direct ones in the polar regions; and in some intermediate latitude there would be, as Darwin says, "very great tides, the nature of which cannot be specified exactly." This would occur, as we have seen, where the earth's circumference is short enough to permit a free wave to go all around in about twenty-four hours. These dynamical considerations of wave motion in canals lead to results bearing some sort of resemblance to the actual observed phenomena of nature. It should be noted, of course, that the foregoing considerations refer to theoretical conditions such as would exist if the earth were simply covered with a layer of water. But the actual facts of nature are so different that they modify very greatly the theoretical tidal action of the sun and moon. So large a part of the terrestrial surface is covered by land that the free motion of tidal waves is seriously impeded. It is therefore impossible to predict the times of high water accurately from theoretical considerations alone. Fortunately, the practical prediction of the time of high water for any place can be effected by analyzing a long series of tidal observations made at the place in question. This method of procedure has been in use for many years, and we now possess tidal tables for all principal seaports accurate enough for the purposes of navigation.

An interesting modification of ordinary tides occurs in rivers. Here the tidal rise appears of course as a strong current running up-stream, where the ocean level outside the river-mouth has been raised. At times this tidal current advances with a high and dangerous wave crest (called a *bore*), and it may acquire velocity enough to raise the water-level in the river considerably above that of the ocean outside. Phenomena of this kind, and indeed all tidal phenomena, are partly modified by the configuration of the coast line and the depth of water.

TIDE WATERS. Waters subject to the ebb and flow of the tides. The term is of legal significance because synonymous in the common law with 'navigable waters,' in relation to which were developed the system of rules defining the rights and obligations of transportation and commerce thereon. The open sea is the common property of all nations (see HIGH SEAS) and the rights of a particular nation thereon are restricted to the marginal belt of a marine league. (See TERRITORIAL WATERS.) By the rules of the common law still prevailing in England, both the title and dominion of the sea, and of all rivers and arms of seas where the tide ebbs and flows, and of all lands below high-water mark, including both the shore and the soil under such waters, are vested in the Crown for the public benefit. Tidal waters are public highways, but non-tidal waters, though actually navigable, are subject to private ownership, the riparian owners holding title to the middle of the stream, subject to the paramount right of the public use for navigation. In the United States the physical features of the country and its dual political organization rendered a strict application of the common-law rule inexpedient, and the law in regard to inland streams not subject to tides varies somewhat in this regard in the different State jurisdictions. Prior to the adoption of the Constitution, the colonies existing as separate political entities had exercised full sovereignty. While under the Constitution the Federal Government possesses exclusive jurisdiction over dealings with foreign nations and in the regulation of interstate commerce (Article I. § viii. sub. 3), yet the title and dominion of tidal waters and lands remains prima facie vested in the several States abutting thereon for the public benefit, subject only to the paramount right of navigation, which, whether of foreign or interstate commerce, is under the governance of the general Government. In this respect also the rights of the original thirteen States and of those later admitted are the same, and as to the territory acquired subsequent to the adoption of the Constitution, the title and dominion of such tidal lands and waters passes to the United States for the benefit of the whole people, but impressed with a trust for the several States ultimately created out of said territory, except in cases where grants have been made by the sovereignty exercising jurisdiction prior to its acquisition by the United States, or where said lands are subject to trusts requiring other disposition. Such were the rules laid down in regard to the territory of California acquired from Mexico. Yet it has been sometimes held that Congress has the power, whenever necessary and proper, to grant lands below high-water mark in tidal waters in territories belonging to the United States.

In Canada it has been decided that the Saint Lawrence River and the Great Lakes are public navigable waters and are not subject to the common-law rule applying to non-tidal waters, which vests title to the middle of the stream in the riparian owners, but that title and dominion thereto belong to the Crown for the use and benefit of the public. Further, by the English law the power of legislation over both tidal and non-tidal waters is vested in Parliament. Private rights to shores and to lands beneath tidal waters can be acquired only by express grant, prescription, or usage. In England the recipient of such grant cannot sustain a claim prejudicial to the public user. In the United States the right of State legislatures to alienate this right of public domain has not been accurately defined. The Supreme Court of the United States has recognized this right so far as it does not substantially impair the interests of the public. Instances of such valid grants are those made to a municipality for docks and like commercial facilities, grants to railroads for right of way, and grants to owners of uplands for beneficial enjoyment or commercial purposes. Impediments to navigation in tidal waters unless authorized by a competent power are nuisances and may be abated. When by unavoidable accident a vessel is sunk and the owner abandons control, he is not liable for injuries caused thereby, though navigation is obstructed.

See such articles as RIPARIAN RIGHTS; HIGH SEAS; MARE CLAUSUM, etc., and consult Gould, *The Law of Waters* (3d ed., Albany, 1900); Coulson and Forbes, *The Law Relating to Waters* (2d ed., London, 1902).

TIDORE, tê-dō′rȧ. A small island of the Molucca Archipelago, situated off the west coast of Gilolo, a few miles south of Ternate (q.v.). It is important as the seat of the Sultan of Tidore, who, under Dutch supervision, exercises authority over parts of Gilolo, New Guinea, and neighboring islands. See MOLUCCAS.

TIE. In music, an arch drawn over two notes on the same degree, uniting them so that they are played or sung as one single note of the same value. See SYNCOPATION.

TIECK, tēk, CHRISTIAN FRIEDRICH (1776-1851). A German sculptor, born in Berlin, pupil of Schadow there, and of David d'Angers in Paris. In 1801-05 he was employed at Weimar, where he associated with Goethe, and designed his bust, which he afterwards also executed in marble for the Walhalla. In 1805 he went to Italy, returning to Germany in 1809, at the invitation of Crown Prince Ludwig of Bavaria. For this patron he executed at Munich and Carrara a large number of busts, including those of the Prince himself, of Schelling, of Humboldt, and of his brother, Ludwig Tieck. In 1819 he began his celebrated series of mythological sculptures for the Royal Theatre at Berlin, and in 1820 he was made professor at the Berlin Academy. This work occupied him until 1829, when he began the series for the Berlin Museum, which include the bronze group of "Horse Tamers" upon the roof, and a statue of Schinkel in the corridor. Tieck was one of the principal representatives of the school founded by Rauch. His technique, however, was less naturalistic than that of Rauch, and smoother and more detailed in execution.

TIECK, LUDWIG (1773-1853). A German romantic novelist, translator, and critic, brother of the preceding, born in Berlin. After studies at Halle, Göttingen, and Erlangen and four years of literary work in Berlin, Tieck went to Jena in 1799 and joined the Schlegels and Novalis in their romantic agitation. Leaving Jena, he went to Dresden, moved to Frankfort on the Oder, visited Italy (1805), England and France (1817), and in 1825 became director of the Dresden Court Theatre after having since 1819 been the centre of a literary circle there. Royal favor brought him in 1841 back to Berlin, where his dramatic talents were used in the production of several Greek plays. Tieck's significant literary career opens with *Abdallah* (1795), *Sternbalds Wanderungen* (1798), and *William Lovell* (1795-96), all novels of 'storm and stress.' His youthful imagination ran riot also in mediæval legends and fairy tales, e.g. the three volumes of *Volksmärchen* (1797), among which were versions of *Puss in Boots, Bluebeard,* and *Red Riding Hood.* A comedy, *The World Topsy-Turvy* (1799), *Die verkehrte Welt*, proclaimed even more emphatically his period of romantic revolt. To this year belong also the ultra-romantic *Phantasien über die Kunst*, full of enthusiasm and of a mystic religiosity. His *Romantische Dichtungen* (2 vols., 1799 and 1800) were the first work to show the direct influence of association with the Schlegels. They were followed by an admirable translation of *Don Quixote* (1799-1801) and by *Kaiser Octavianus* (1804), his longest novel. This period of rapid production was succeeded by a nervous breakdown. After his recovery his work is less mystic, less erratic, more artistic, e.g. *Phantasus* (1812-17), and an edition of Ulrich von Lichtenstein's *Frauendienst* (1812), but Tieck did not reach the complete maturity of his genius till his visit to England, the direct results of which are *Shakespeare's Vorschule* (1823-29), *Dramaturgischen Blätter* (1826), and his noble continuation of Schlegel's translation of Shakespeare. Indirectly the same influence is seen in the *Novellenkranz* (1831-35; 12 vols., 1853). Tieck's *Works* are in 28 volumes (1828-54). Some tales and novels are translated by Carlyle and by Thirlwall. Consult the German studies by Kopke (Leipzig, 1855), Friesen (Vienna, 1871), and Steiner (Berlin, 1893). Carlyle's *Essay on Tieck* was published in 1823 and introduced him to English readers.

TIEDGE, tēd′*ge*, CHRISTOPH AUGUST (1752-1841). A German poet, born at Gardelegen, Prussian Saxony. After studying jurisprudence at Halle, he occupied positions as secretary and tutor at Magdeburg, Ellrich, and Halberstadt, and in 1799 settled in Berlin. There he met Elisa von der Recke, whom he accompanied on a journey to Italy in 1804-06, remaining afterward her faithful companion, first in Berlin and from 1819 on at Dresden, where, placed beyond material care by his friend's last will. he continued to live until death. Some singable lyrics. of which "Schōne Minka, ich muss scheiden" is still unforgotten, first established his reputation. and *Urania über Gott, Unsterblichkeit und Freiheit* (1800; 18th ed., 1862), a lyric-didactic poem. inspired by the ethics of Kant, enjoyed wide popularity in the beginning of the nineteenth century. A kind of sequel to it were the *Wanderungen durch den Markt des Lebens* (1833). Among his other poetical efforts, the *Elegien und vermischte Gedichte* (1803) met with the greatest success.

After his death the Tiedge Foundation was established in Dresden for the purpose of caring for the poet's grave and of granting subventions to poets and artists or their widows and children. Administered by the Saxon Ministry of Public Instruction, its funds amounted to more than 662,000 marks, in 1901. Consult: Falkenstein, *Tiedge's Leben und poetischer Nachlass* (Leipzig, 1841); Eberhard, *Blicke in Tiedges und Elisas Leben* (Berlin, 1844); and Kern, *Beiträge zu einer Charakteristik des Dichters Tiedge* (ib., 1896).

TIEFFENBRUCKER, tē′feṇ-brụk′ẽr. A well-known violin-maker of the sixteenth century. See DUIFFOPRUGGAR, CASPAR.

TIEL, tēl. A town in the Netherlands, Province of Gelderland, situated on the right bank of the Waal, and on the Elst-Dordrecht Railway, 19 miles west of Nimeguen (Map: Netherlands, D 3). The town possesses the beautiful Church of Saint Mary, partly finished, the Church of Saint Martin, dating probably from the twelfth century, and a communal college. Tiel was an important commercial centre as early as 972, when it received municipal privileges from the Emperor Otho I. It is the principal trading place of the Neuse-Waal district. It manufactures mustard and madder. Population, in 1890, 9896; in 1900, 10,788.

TIELE, tē′le, CORNELIS PETRUS (1830-1902). A Dutch theologian. He was born near Leyden, and studied at Leyden and Amsterdam. He then entered the ministry, being connected with the Remonstrant or Radical sect of the Evangelical Church, and served churches at Moordrecht and Rotterdam (1853-1872). Meanwhile he continued his theological studies and published a valuable work on Zoroastrianism, *De Godsdienst van Zarathustra* (1864). In 1866 he began with Kuenen the editing of the *Theologisch Tijdschrift*, which at once became one of the leading Continental reviews. In 1872 he published a *Comparative History of Egyptian and Semitic Religions*. In 1873 he became professor of theology at the Remonstrant Seminary at Leyden, and while there published a *Manual of the History of Religions* (1876), which at once took a leading place in the literature of the subject. It has been translated into English (*History of Religion*, London, 1877). In 1877 Tiele became professor of the history and philosophy of religion. In 1893 he began the publication of a monumental work on *The History of Religions Down to the Days of Alexander the Great*, three volumes of which have appeared, and a fourth posthumous volume is expected (translated into German, *Geschichte der Religion im Alterthum*, Gotha, 1895). In 1896-97 he gave two courses of lectures at Edinburgh on the Gifford Foundation, published as *The Elements of the Science of Religion* (1897-99), and also in Holland and Germany. He also wrote the article "Religion" in the *Encyclopædia Britannica*, 9th ed. His *Babylonisch-assyrische Geschichte* (Gotha, 1886-88) has but one rival in its extensive scope. Consult notices by Jastrow in *The Open Court*, vol. xiv.; *The Independent*, vol. liv.; and *The Study of Religion* (New York, 1902).

TIENEN, tē′nen. A town of Belgium. See TIRLEMONT.

TIEN-TSIN, tyĕn′tsĭn′; properly **T'IEN-TSIN** (Heaven's Ford). A city and treaty port of the Province of Chih-li, China, situated on the eastern edge of the Great Plain, in latitude 39° 10′ N., longitude 117° 48′ E., on the right bank of the Pei-ho (Map: China, E 4). It is at the junction of the Pei-ho with the Grand Canal, which, prior to the silting of the canal, afforded easy inland communication with many of the great cities of the country and bore to Tien-tsin the great fleets of junks engaged in the transportation from the south of the 'tribute-rice' for the provisioning of Peking. It is 70 miles by water from the sea, and about 70 southeast of Peking. It is in rail communication with Peking, the Kai-ping coal mines, Shan-hai-kwan, and Manchuria, and with Pao-ting-fu, and thence southward through Ching-ting with Hankow. The city, which was only a wei or military station until 1782, is comparatively small. Its walls of brick and stone are 30 feet high, nearly four miles in circuit, and pierced with four gates surmounted with towers. The houses are generally of brick or pressed mud, and only one story high. Like those of most Chinese cities, the streets are filthy and ill-kept The suburbs are very large, and in them is carried on most of the trade. The population is 1,000,000. In 1860 Tien-tsin was opened by treaty to foreign residence and trade. The Foreign Settlement—known as Tsu-chu-lin, or 'Red-Bamboo Grove'—is also situated on the right bank of the river and about 1½ miles below the city, but within the line of circumvallation known as 'San-ko-lin-sin's Folly.' It is laid out in foreign style, has a jetty or pier and a fine bund or esplanade along the river bank, good, well-kept streets, fine dwellings and warehouses, gas, electric lights, and many good public buildings, such as the custom house and the town hall, known as Gordon Hall. There are schools, hospitals, club houses, and the naval school established by Li Hung Chang, and within a short distance are two well-equipped arsenals. The government of the settlement is vested in a municipal council elected by and composed of the land-renters.

Tien-tsin has no factories. Its principal manufactures are straw braid and sam-shu, and cured skins and tobacco. There is an immense trade in salt.

In 1901 the total value of the trade of the port, as shown by the Imperial Maritime Customs Reports, was $38,370,000, of which $20,450,000 represented direct foreign imports. The principal imports are woolens, drills, sheetings, shirtings, jeans, twills, seaweed, sugar, rice, grain, kerosene oil, tea, opium, steel, and salt (the last is a Government monopoly). The articles of export are sam-shu, straw braid, furs, goatskins, camels' wool, coal, wood, tobacco, fruit, and rhubarb. Nearly all the tea consumed in Asiatic Russia is shipped from the south to Tien-tsin, from which point it goes overland by caravans to Kalgan, and thence to Siberian ports.

In 1853 Tien-tsin was besieged by a strong force of Taiping rebels on their way to Peking, but they were defeated by the Mongol general San-ko-lin-sin and driven off. In 1860 it was taken by the Anglo-French punitive expedition on its way to Peking. While Li Hung Chang was Viceroy of Chih-li, from 1870 to 1895, he made his headquarters at Tien-tsin, and in consequence the city was the centre of much political interest. Its importance in this respect greatly declined when Li was removed from office after the disastrous war with Japan in 1894-95. During the Boxer uprising in 1900 the foreign settlement suffered from the besieging Boxers, and the city from the relieving forces of the Allies. The city held out until the severe fighting of July 13th-14th, during which the Allies lost in killed and wounded between 800 and 900, the United States contingent, in proportion to its number, suffering most. The city is connected with the rest of the world by cable, and with the British Legation in Peking by the Marconi wireless system. Owing to the importance of the foreign business interests centred here, and the proximity of the town to Peking, the Viceroy of the province, whose seat is at Pao-ting-fu, spends a large portion of the year here. As the river freezes over in winter, Tien-tsin is cut off from the outer world from about November to April, but the foreign admirals always agree to have at least one gunboat stationed off the bund during that period.

TIEPOLO, tê-ā′pô-lô, Giovanni Battista (1696-1770). The last great master of the Venetian school of painting. Of his life hardly anything is known. He was not a member of the celebrated family of Tiepolo, as has been supposed. He was born April 5, 1696, and at an early age was placed with the painter Lazzarini, a mannerist, whom he soon left for Piazzetta. He was, however, more influenced by the great masters of the past, especially by Veronese. It is impossible to fix the dates for his pictures before 1737. We know that he was famous long before that, and was patronized by the Doge Cornaro and noble Venetian families, and by many cities and churches in Northern Italy. The first of his principal works that can with certainty be dated are the beautiful decorations of the Villa Valmerana at Vicenza, executed in 1737. The subjects are taken from Homer, Vergil, Ariosto, and Tasso. In freshness and charm, in conception and technique, they bear favorable comparison with Veronese's masterpieces in the Villa Maser. In 1739 followed the three ceiling decorations in Santa Maria del Rosario (Venice), including the "Institution of the Rosary," and in 1743-44 those of the church of the Scalzi, the chief of which represents "Angels Bearing the Casa Santa from Nazareth to Loreto." To the same period belong the ceiling paintings of the Palazzo Rezzonico, and about 1745 he decorated the grand hall of the Palazzo Labia. The ceiling is highly fantastic, and the illusive architectural decorations of the walls form an admirable framing for two of his best frescoes, "Cleopatra's Banquet" and the "Embarkment of Cleopatra and Anthony." The date of his decorations in the archiepiscopal palace at Udine, one of his best works, is not known.

Under the patronage of Karl Philipp of Greifenklau, Bishop of Würzburg, Tiopolo passed the years 1750-53 in that city, engaged in decorating the episcopal (now the royal) palace. On the lofty ceiling over the grand staircase he painted frescoes of "Olympus" and of the "Four Quarters of the Earth;" in the Kaisersaal, three scenes from the life of Frederick Barbarossa; in the chapel, two large altar-pieces, the "Ascension of the Virgin" and the "Fall of the Angels." Returning to Venice in 1754, he became director of the Venetian Academy. Between this time and his departure for Spain he painted another grand ceiling decoration, the "Triumph of Faith," in the Chiesa della Pietà, and perhaps most of his easel pictures. About March, 1762, he was summoned by King Charles III. to Spain to decorate the royal palace. In the guard room he painted the "Smithy of Vulcan," in the ante-room an "Apotheosis of Spain," and in the throne-room, magnificent ceiling frescoes of "Spain and Her Provinces." At Madrid he executed most of his etchings, and it was there that he died, March 22, 1770.

In the classical reaction immediately following Tiepolo's death, scant justice was done him, and not until comparatively recent times has he been accorded his place. His art is essentially decorative, and harmonizes perfectly with the Rococo architecture of the day. The color is light and flaky, and exquisitely delicate, and the treatment of light is above reproach. To a wonderfully rich fantasy and invention he joined an equal facility of execution. Sometimes he degenerates into extravagances, and what prevents him from ranking with the greatest artists of all time is the frivolity of his conceptions and the artificiality consequent upon the lack of a more direct contact with nature.

Tiepolo's easel pictures show the same grace of form and charm of color as his frescoes, and are more carefully executed. Among the best known are "Christ in the Garden of Olives" and "Calchas and Iphigenia," in the Liechtenstein Gallery at Vienna; "Saint Catherine of Siena" and an "Adoration of the Kings," in the Imperial Gallery (ib.); "Martyrdom of Saint Agatha" and "After the Bath," in the Berlin Museum; the "Immaculate Conception" at Vicenza and Madrid; and a "Holy Family with Saint Gaetano," in the Venetian Academy. In the Venetian churches are several altar-pieces, like "Madonna in Glory" in the Church of the Jesuits, and "Christ Bearing the Cross" in Sant' Aluise. His etchings show much taste and neatness of execution, and in their weird humor and naturalism they resemble those of Goya, whose *Caprichos* probably inspired Tiepolo's principal series, *Scherzi di Fantasia*. Of his two sons, who assisted in most of his works, Domenico (1727-1804) etched several of his father's paintings and painted inferior frescoes in his style, while of Lorenzo, the younger son, almost nothing is known.

Consult: Zanetti, *Della pittura Veneziana* (Venice, 1771); Urbani de Gheltof, *Tiepolo et la sua famiglia* (Venice, 1879), and *Tiepolo in Ispagna* (Venice, 1881); Molmenti, *La villa Valmarana* (Venice, 1880), and *Carpaccio e Tiepolo* (Turin, 1885), and the biographies of Wessely, in Dohme's *Kunst und Künstler Italiens* (Leipzig, 1877); Leitschuh, (Würzburg, 1896); and Chennerières (Paris, 1898).

TIERCE (OF., Fr. *tiers*, third part, from Lat. *tertius*, third, from *tres*, three). In music, an interval (q.v.) synonymous with a third. In the organ, a mutation stop pitched 2⅓ octaves above the diapason.

TIERCE. In heraldry (q.v.), a term of blazon used to indicate that the field is divided by lines into three equal parts.

TIERGARTEN, tēr′gär-ten (Ger., Zoölogical Garden). The largest park of Berlin, on the south side of the Spree and west of the Brandenburg Gate. It contains 600 acres and is about 2 miles long. Portions of the park retain the natural features of forest and lake. It contains a number of fine statues and the column of victory from which the Siegesallee, the most fashionable drive of the city, leads south.

TIER′NEY, George (1761-1830). An English politician. He was born at Gibraltar, Spain, was educated at Eton and Cambridge, and in 1878 entered Parliament as a Whig. There he soon acquired a high reputation as a debater, and, after Fox's withdrawal, became a prominent if not the leading opponent of Pitt's policy. For several years it was his custom to bring forward a series of resolutions opposed to those of the Chancellor of the Exchequer. He was finally accused by the latter of deliberately impeding public business, and as a consequence fought a bloodless duel with him. In 1803 he became treasurer of the navy and a Privy Councilor, and after acting as Secretary of State for Ireland (1806), was president of the Board of Control (1806-07) and master of the mint in Canning's Ministry (1827-28). After 1817 he was the recognized leader of the Opposition.

TIERRA DEL FUEGO, tē-ĕr′rȧ dĕl fwā′gō̇ (Sp. Land of Fire; formerly often written in the corrupted form Terra del Fuego). An archipelago situated between latitude 52° and 56° south, off the extreme southern end of South America, from which it is separated by the Strait of Magellan (Map: America, South, C 8). It consists of a large main island sometimes called King Charles South Land, and a number of smaller islands lying to the west and south of it, the southern group being separated from the main island by Beagle Channel. The total area of the archipelago is estimated at over 27,000 square miles, of which the main island occupies more than four-fifths. The principal of the smaller islands are, beginning at the northwest, Desolación, Santa Inez, Clarence, Hoste, Navarin, Wollaston, and at the extreme south, Horn Island, ending in Cape Horn. At the extreme east lies the isolated Staten Island or Isla de los Estados. All these islands are separated from each other and from the mainland by narrow, deep, and tortuous channels, and are, together with the west coast of the main island, deeply indented by narrow fiords. The east coast is more regular. The Andean mountain system is continued in several ranges through the western part of the archipelago, covering all the smaller islands and the western half of the main island. They are mostly of Mesozoic formation with considerable granitic and volcanic intrusions, though there are no volcanoes. Their height averages 3500 feet, and Mount Sarmiento, an imposing snow-clad peak on the southwestern peninsula of the main island, has an altitude of 7200 feet. The eastern half of the main island is a continuation of the Patagonian plateau.

The climate of Tierra del Fuego is not so rigorous as it was formerly supposed to be. It is an equable oceanic climate with no extreme heat or cold. A meteorological station established since 1896 at Ushuaia on Beagle Channel shows a mean temperature for January to be 52.7°, and for July 31°. The rainfall is greater than on the Patagonian plateau, and the country is more favorable for settlement than the more northern regions. The eastern region has good soil and pasture land, and along the base of the mountains there are extensive forests of beech (*Fagus antarctica*) and pine. The western islands, which have not been thoroughly explored, are less favorable as regards climate and soil, but in the east and along Beagle Channel hardy cereals will ripen, and considerable areas of land have already been brought under cultivation by white settlers. Agriculture and cattle-raising are the main occupations, though gold has been found in paying quantities, and seams of lignite have also been discovered. The native Fuegians are rapidly disappearing, and now number probably less than 1000. They belong to three distinct tribes, the Aliculufs in the central regions, the Onas in the west, and the Yaghans in the south. Politically the portion of the main island lying east of a line running from the eastern entrance of the Strait of Magellan to the middle of Beagle Channel, together with the Isla de los Estados, constitutes the Argentine Territory of Tierra del Fuego (q.v.). The remaining portions belong to the Chilean Territory of Magallanes. The civilized population of the Argentine Territory, which contains practically all the inhabitants, was 477 in 1895, and 2159 in 1900. The archipelago was discovered by Magellan in 1520, but was never systematically explored until the last two decades of the nineteenth century.

Consult: Bove, *Patagonia, Terra del Fuoco* (Genoa, 1883); Hyades and Deniker, *Anthropologie et ethnographie* (Paris, 1891); Conway, *Aconcagua and Tierra del Fuego* (London, 1902).

TIERRA DEL FUEGO. A territory of Argentina, formed of a portion of the main island of the Archipelago of Tierra del Fuego (q.v.) and of the Isla de los Estados. It is bounded on the west by the meridian of 68° 34′ W., which separates it from the Chilean territories; on the north and east by the Atlantic Ocean; and on the south by the Atlantic Ocean and the Beagle Channel (Map: Argentina, D 14). Its area is about 8000 square miles. The territory of the island was in dispute until 1881, when by arbitration of the United States it was divided between Chile and Argentina. The territorial Government of the Argentine portion was organized in 1884. The main river, Pellegrini, is of little importance. The capital is Ushuaia (q.v.).

TIERS ÉTAT, tē-âr′ zâ′tȧ′. See States-General.

TIES, Railway. See Railways.

TIETJENS, tē′tyĕns, or **TITIENS**, Teresa (1837-77). An operatic singer, born at Hamburg, of Hungarian parents. She made her début in that city in the character of Lucrezia Borgia in 1849, taking at once a very high position on the lyric stage; at Frankfort and Vienna she was even more warmly received; and her first appearance in London in 1858 was a complete triumph. She visited the United States in 1875. The great volume and purity of her voice and her sympathetic and dignified acting combined to make her famous in strong dramatic parts.

TIF′FANY, Charles Comfort (1829—). A Protestant Episcopal clergyman. He was born in Baltimore; studied at Dickinson College, Andover Theological Seminary, and the universities of Halle and Heidelberg; and was ordained priest in 1866. He was rector at Fordham, N. Y. (1867-71), assistant rector at Trinity Church, Boston (1871-74), rector in New York (1874-90), and Archdeacon of New York (1893-1902). His publications include *History of the Protestant Episcopal Church* (1893) and *The Prayer Book and Christian Life* (1897).

TIFFANY, Charles Louis (1812-1902). An American merchant. He was born at Killingly, Conn., and after receiving an academic education at Plainfield Academy, and serving an apprenticeship in a cotton manufactory, he removed to New York City in 1837. There in partnership with a fellow townsman, John B. Young, on a borrowed capital of $1000 he established at 259 Broadway, next door to A. T. Stewart's, a stationery and fancy goods store. The venture prospered from the start, and gradually the jewelry part of the business became the most important. In 1847 the firm began the manufacture of gold jewelry. In the following year, when as a result of the widespread revolutionary movements in Europe the price of diamonds fell 50 per cent., Mr. Tiffany sent word to his partner, Mr. Young, who was then in Paris to buy all the diamonds he could. This was done with the result that the house thereby reaped a large fortune and became from that time on one of the principal firms of diamond merchants in the world. Several times the rapidly increasing business necessitated moving into larger quarters farther up town and several times the firm name was changed, finally becoming Tiffany & Co. in 1851. At that time a branch house was established in Paris. During the Civil War Mr. Tiffany placed his store and resources at the disposal of the Government, and it became for a time one of the principal depots of military supplies. During the draft riots (q.v.) in 1863 the store was barricaded and the clerks were armed in preparation for a threatened attack of the mob. In 1868 the firm was incorporated and in 1870 removed to a specially constructed building on Union Square. At that time, in addition to the Paris branch, a branch house was maintained in London, and an office and watch factory in Geneva, Switzerland, and the house took rank as the leading importers of gems and works of art as well as the chief manufacturing jewelers in America. Mr. Tiffany was the first to adopt the department store plan for the jewelry business and was the originator of many ideas and methods in the jewelry trade since generally adopted. The sterling silver standard .925 fine, adopted by him in 1851, became the recognized standard throughout the country. Mr. Tiffany was made a member of the French Legion of Honor in 1878 and received at various times decorations from other foreign rulers. He was a liberal patron of the fine arts, and did much to encourage and promote the study and knowledge of art in America.

TIFFANY, Louis Comfort (1848—). An American painter and decorative designer, born in New York City. He was a pupil of George Innes and Samuel Coleman, and in Paris of Léon Bailly, making a special study of the decorative arts in their relation to architecture. After his return to the United States he resided in New York City and devoted his attention to the direction of the Allied Arts Company and the Tiffany Glass and Decorative Company. He introduced the art of mosaic in this country, and produced designs of high power and good decorative quality. His best known invention, however, is favrile glass, in which by chemical means he produced delicate refracting powers somewhat like those in ancient glassware affected by decomposition. His works include windows for Columbia University Library, Memorial Hall, Harvard College, and Yale College, and for many churches. His principal mosaics are in the crypt of Saint John's Cathedral, in New York City. His easel paintings are principally Oriental scenes.

TIF′FIN. The county-seat of Seneca County, Ohio, 40 miles southeast of Toledo; on the Sandusky River, here spanned by several bridges, and on the Baltimore and Ohio, the Pennsylvania, and the Cleveland, Cincinnati, Chicago and Saint Louis railroads (Map: Ohio, D 3). It is the seat of Heidelberg University (Reformed), opened in 1850, and of the College of the Ursuline Sisters, and has a public library. Other prominent features are the court-house, the Soldiers' Monument, and Riverview Park. Tiffin is favorably situated for commerce and also has large industrial interests. Among its manufactures are tools, pottery, glass, emery wheels, church furniture, agricultural implements, wagons, well-drilling machines, nail, bolt, and nut machines, underwear and woolen goods. The government is vested in a mayor, elected every two years, and a unicameral council. Tiffin was settled in 1819-21 and was incorporated in 1850. Population, in 1890, 10,801; in 1900, in 10,989.

TIFFIN, Edward (1766-1829). An American physician, preacher, and political leader. He was born at Carlisle, England, removed to Charlestown, Va., about 1786, and graduated in medicine at the University of Pennsylvania in 1789. In 1792 he became a local preacher in the Methodist Church, and also studied law. About 1798 he removed to Chillicothe, in the Northwest Territory, and in 1799 was Speaker of the Territorial Legislature. In 1802 he presided over the convention to frame a State Constitution of Ohio, and was the first Governor of the State (1803-07). During his second term he arrested the Burr-Blennerhasset expedition. In 1807-09 he was a member of the United States Senate, but resigned, and in 1809 was Speaker of the Ohio Legislature. When the General Land Office was established in 1812, President Madison appointed Tiffin the first Commissioner, and by his foresight the latter saved all the papers when the Capitol was burned by the British troops. From 1815 until just before his death he was Surveyor-General of the Northwest Territory. The town of Tiffin, Ohio, was named in his honor.

TIFLIS′, *Russ. pron.* tyĕf-lyēs′. A government in the centre of Transcaucasia, Russia. Area, about 17,200 square miles (Map: Russia, F 6). It belongs to the region of the Caucasus (q.v.) and contains numerous snow-clad peaks, including Kazbek, over 16,000 feet in height. Between the mountain chains are deep and narrow valleys which make Tiflis one of the most picturesque and striking parts of the Caucasus. The principal river is the Kur. The climate is very severe in the mountainous part. About one-third of the total area is covered with forests. Agriculture is the principal occupation in the valleys and stock-raising in the mountain regions. Besides cereals, of which wheat is the most important, fruits, especially grapes, are extensively raised. Various metals occur and copper is mined to some extent. The chief manufactures are flour, cotton goods, tobacco, spirits, etc. The natives produce various woolen articles, such as felt, rough cloth, etc., copper and silver articles, silver thread, filigree work, etc. Population, in 1897, 1,040,943, of whom the Georgians and the Armenians constituted 45 and 24 per cent., respectively, and the Russians less than 5 per cent.

TIFLIS. The former capital of Georgia, the administrative centre of the Caucasus, and the capital of the Government of Tiflis, situated on both banks of the Kur, about 340 miles by rail northwest of the seaport of Baku (Map: Russia, F 6). The town presents a very mixed appearance. The Russian quarter is well built, with handsome churches and public buildings and European shops, while the native quarter is built in Oriental fashion. The most noteworthy ecclesiastical structures are the ancient Cathedral of Zion, containing interesting icons and manuscripts; the Monastery of Saint David; and the old church in the fortress, supposed to date from the fifth century. There are a natural history museum with a library, a sericultural station with a museum, and extensive botanical gardens. The principal manufactures are felt, cotton goods, leather products, oil, etc. The trade, mostly in Armenian hands, is very extensive, Tiflis, in virtue of its railway connection with the two main seaports of the Caucasus, as well as with European Russia, being the distributing centre for Transcaucasia. Population, in 1897, 160,645, principally Armenians, Georgians, and Russians. The environs abound in sulphurous springs.

TIGER (Lat. *tigris*, from Gk. τίγρις, tiger; probably connected with Av. *tiyra*, arrow, *tiyra*, sharp, Skt. *tij*, to be sharp, Gk. στίζειν, *stizein*, to mark, puncture, and ultimately with Eng. *stick*). The largest and most powerful of cats, *Felis tigris*, and the most specialized and efficient of the Carnivora, comparable only with the lion, and very similar in size and structure, but very different in appearance and habits. It is more slender and cat-like than the lion, and has a rounder head and no trace of a mane, but the hair of the cheeks is rather long and spreading. Its skull may be distinguished from that of the lion by the fact that the nasal bones reach backward beyond the frontal processes of the maxillæ. The males are rather larger than the females, and make a more square, less oval footprint or 'pug.' The pupil of the eye is round, however much contracted. The average size of an adult male is 9½ feet from nose to tip of tail. Authentic measurements exceeding 11 feet are very rare, and stories of 15 to 18 feet entirely erroneous. Its height at the shoulder is proportionately less than that of the lion, a large male measuring from 3⅓ to 3½ feet. A ten-foot tiger will weigh about 500 pounds. The hair is thick, fine, and shining; in the colder countries thicker and longer than in tropical regions. The color is a bright tawny yellow, beautifully marked with dark transverse bands, passing into pure white on the under parts; the dark bands are continued as rings on the tail, which is long and tapering and has no terminal tuft. These colors and stripes, sometimes broken, although so conspicuous in a caged tiger, or one standing in the open, in daylight, so blend with the dusky gloom and slender shadows of the bamboo jungle or long grass in which the animal lurks as to make it practically invisible.

The tiger inhabits Asia, where it has an extensive but rather localized distribution. Westwardly its range extends to the Lower Euphrates and the southern shores of the Caspian; but it does not occur in Persia south of the Elburz Mountains, nor in Beluchistan or Afghanistan. Northward, it is to be found throughout Southern Siberia and Mongolia, eastward in the Amur Valley to the Sea of Okhotsk, in Saghalien and Japan. The elevated Tibetan plateau has no tigers. Southward the species ranges throughout China, Siam, Burma, the Malay Peninsula, Sumatra, Java, and Bali, and all of India, but is unknown in Ceylon. The last-mentioned circumstance is a strong part of the evidence which has led naturalists to conclude that the tiger is a comparatively recent immigrant into the south, and that it is not naturally a tropical species.

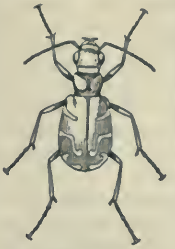
In general the tiger is an inhabitant of the woods and thickets rather than of open lands, and although able to leap into or climb trees (except smooth, perfectly upright ones), it does so only for some special purpose. Usually it hides in some dense cover by day, and goes abroad at night in search of prey. It is most numerous in the swampy shore jungles around the Bay of Bengal and on the Malayan coasts and marshy estuaries, where it swims miles from island to island, or across rivers and inlets.

Its prey consists of almost anything in the way of flesh, from a bison or crocodile to any small creature which it may think it worth its while to strike down. Carrion may be eaten under stress of famine, but as a rule the animal devours only what it has itself killed, and ordinarily does not even return a second time to a carcass from which it has taken one full meal. It searches for and stalks its prey, or lies in ambush and leaps upon it like other cats; and its method of killing large animals, so far as it may be said to practice one, is to seize the shoulders with one paw, grasp the forehead with the other, and break the neck by a twisting pull. A band of bison or wild oxen, guarded by bulls (see BISON), will beat it off, and often kill it; even a single bull in favorable circumstances is a match for it. The elephant and rhinoceros have little to fear, and a bear will make a stout resistance, but such encounters rarely occur; nor do fights between male tigers seem to be common, as this cat is not, like the lion, polygamous. In India and eastward the tiger subsists largely upon domestic cattle and hogs, and upon human beings. 'Man-eaters,' when they do not wholly depend upon human victims, apparently prefer them; many, but not all, of these are old and comparatively feeble. The destruction of human life thus caused in India and eastward is very great, and there seems little diminution in spite of improved arms, an increasing number of sportsmen, and Government rewards. In 1902 about 1300 lives were so lost in British India alone. The prey when struck down is usually carried away by the tiger to be eaten elsewhere, and extravagant stories of the tiger's strength have been related in connection with this habit. It is absurd to speak of its leaping a palisade with a buffalo or even a man in its mouth. A tiger will lift from the ground and partly carry, partly drag, an animal of 200 or 300 pounds weight, with considerable ease; but heavier ones must be laboriously dragged.

Tigers are solitary beasts, rarely hunting even in pairs, and much less noisy than the lion. Their usual call is a prolonged, moaning, thrilling sound, repeated twice or thrice and becoming louder or quicker. In the cooler season they wander widely, but in the hot weather remain in some narrow district near water—a single one in each 'beat.' Tigresses breed iregularly, once in two or three years only, regardless of season, and produce usually two cubs, almost invariably one male and the other female. The cubs require three years to reach maturity and stay with their mother most of this time. When caught young tigers may easily be tamed, but are more difficult to rear and less tractable than lions. Captive and tamed tigers have been kept by the East Indian rulers from the days of antiquity, and a favorite amusement was to pit them in the arena against lions, in which combats they were usually victorious. The 'royal Bengal tiger' has been a part of the showman's stock in trade ever since, and is to be seen in every menagerie, where these animals breed, but less readily than do the lions. Some have been trained to go through certain performances.

Bibliography. Recent general works, especially Brehm's, the *Royal*, the *Standard*, and the *Cambridge* "Natural Histories;" Mivart, *The Cat* (New York, 1892); Elliot, *Monograph of the Felidæ* (1878-83); Fayrer, *Royal Tiger of Bengal* (London, 1875); Blanford, *Fauna of British India* (London, 1888); Sanderson, *Wild Beasts of India* (London, 1893); Baker, *Wild Beasts and Their Ways* (London, 1890); Pollok, *Sport in British Burma* (London, 1879); and the writings of Kinlock, Forsyth, Shakespeare, Wallace, Rice, Baldwin, Dawson, and other sportsmen-travelers in Eastern Asia, a capital summary of whose observations will be found in Porter's *Wild Beasts* (New York, 1894). See Colored Plate of Felidæ accompanying article Lion.

TIGER BEETLE. One of the active, predatory beetles of the family Cicindelidæ. Of the carnivorous beetles they are among the most active, voracious, and fierce, whence they receive their name. They frequent sandy places and earthen paths, and have the habit when approached of running rapidly for some distance, occasionally turning suddenly back, and often taking to flight. While variously colored, and sometimes even bright green spotted with yellowish, they harmonize as a rule with the general color of their environment. Their larvæ live in deep, straight vertical burrows in the ground, and station themselves near the burrow's mouth, holding themselves in position by means of a pair of strong hooks on the fifth segment of the abdomen. The head and thorax are broad, and are used to block the mouth of the burrow while waiting for prey. The food consists of insects which alight on the spot or run over it. Some 1400 species are known, the majority of them inhabiting the tropics. Some species are wingless, while others are very active; some are found only on the mounds of termites; some species frequent the trunks of trees which they ascend in a spiral manner. Less than a hundred species are known in the United States, but tiger beetles are abundant and are seen everywhere. The largest American form is *Amblychila cylindriformis*, which is found in sandy regions in the mid-Western States. *Tetracha Carolina* and *Tetracha Virginica* are large greenish species found in the Atlantic and Southern States. The genus Cicindela contains more than half the species in the entire family, and a very great majority of the forms which are found in North America. A typical American species, the spotted tiger beetle (*Cicindela sex-guttata*) is depicted upon the Colored Plate of Insects.



A TIGER BEETLE.

TIGER-CAT. Any wild cat of medium size which resembles the tiger in form or markings. The ocelot, serval (qq.v.), and especially the chati (*Felis mitis*) of South America, and clouded tiger of India are frequently so called. See Tiger; Wild Cat.

TIGER-FLOWER (so called from the coloring). *Tigridia Pavonia.* A plant of the natural order Iridaceæ, distinguished by the three large outer segments of the perianth and by the filaments being united into a long cylinder. It is a native of Mexico, but hardy enough to endure the climate of the United States, and much cultivated in flower-gardens for the singularity and great beauty of its ephemeral flowers. The root is a scaly bulb.

TIGER-HUNTING. Tiger-hunting probably taxes man's skill and courage in a higher degree than the pursuit of any other sort of game, and may justly be placed at the head of the list of sports of the chase. The enormous strength of the beast, coupled with savage cunning, renders it the most formidable of brute foes. Nothing is more patent in the voluminous history of the sport (see Tiger for outline of pertinent literature) than that no two tigers behave in the same way when encountered; and the same animal may act differently at different times. Tigers learn by experience, have no fear whatever of man *as man*, and rarely make tactical mistakes. In some parts of India hunters in parties go after them on foot, but this is justly regarded as an extreme of foolhardiness; the hunter's handicap is far too great, and few men dare the risks of this kind of sport. One of two methods usually is chosen by the tiger-hunter according to circumstances: (1) lying in wait for the animal at night (when there is moonlight) on an elevated platform, or (2) seeking him upon the back of a trained elephant. The former is the choice in cases where a tiger is known to haunt a particular locality. The hunter then chooses a likely spot and builds a platform or 'machan' (usually in a small tree), which must be raised not less than 12 feet above the ground, and be large enough to hold two persons. On the ground near by is placed the carcass of a deer or cow; an even better bait is a tethered live goat. An hour before sunset the hunter, with a native assistant, climbs upon the platform and awaits the coming of the tiger. Sometimes the animal steals out of the shadows and seizes and carries off the prey so quickly that no good chance for a shot is offered. Again it will stalk boldly out and stand in full view. Sometimes when fired at, but not killed, it darts back into the jungle and disappears, but it may also attack and tear down the machan, or lurk near by to seize the men when they descend.

The most effective method of hunting the tiger is by means of elephants, and with the aid of native shikaries and beaters. Frequently the preparations are upon a scale of royal magnificence, for so kings and princes are accustomed to entertain one another in the East, especially when a native ruler desires to honor or gratify some some European guest or ally. On such occasions the game has been surrounded and watched for days previously by an army of natives. The costly and splendid tiger-hunting with which King Edward VII. was entertained when visiting India as the Prince of Wales will long remain memorable even in that country of royal pageantry. The method in this master-sport is to surround the tiger by a sufficient number of 'beaters,' who, by beating drums and making a great noise, drive it toward the favorable spot where the sportsmen are awaiting it upon the backs of elephants, which are furnished with open, box-like howdahs. As the circle narrows the drivers become more cautious, for the animal may be depended upon to know the country perfectly, and to make use of every means of concealment and escape, or of attack. Then men are stationed in trees to try to trace his movements and warn others by cries and signs. Meanwhile the sportsmen press forward on their elephants, depending largely upon the senses and sagacity of these animals for a warning of the terrific and usually unforeseen charge of the animal, which may by a bold leap tear the hunter from the howdah, or stampede the elephant, or get through the barrier alive. It is a moment which calls for the utmost coolness and skill as well as courage, and the sport is never free from peril. The danger is multiplied by the various accidents possible. Even if the tiger is unable to spring upon the elephant, saddle-girths may break or howdahs may fall. Nine out of ten elephants, even if always stanch heretofore, will become panic-stricken and bolt, when the danger of their riders being dashed against a tree and killed is more imminent than any other. Thus unforeseen casualties are numerous, and the total tangible reward is only a hide, which after all may be of inferior beauty and value.

TIGER-LILY. See LILY.

TIGER-MOTH. A name applied on account of their coloration to certain moths of the family Arctiidæ, as *Arctia nais*, and especially to the Isabella tiger-moth (*Isia Isabella*), an American species, grayish yellow with black markings. The caterpillar is known as the 'woolly bear,' and is densely clothed with reddish brown and black hairs. It feeds upon a great variety of low-growing herbage. See Colored Plate of AMERICAN MOTHS.

TIGER-SHARK. The largest, fiercest, and most formidable of West Indian sharks (*Galeocerdo tigrinus*), brown in color, with numerous small dark spots which give the fish its name, but grow indistinct with age.

TIGER-SNAKE. An elapine, poisonous snake (*Hoplocephalus curtus*) of Australia. See DEATH-ADDER.

TIGHE, tī, Mrs. MARY (BLACHFORD) (1772-1810). An Irish poet. Her father, a clergyman, was a librarian in Dublin. In 1793 she married her cousin, Henry Tighe, a member of the Irish Parliament. Mrs. Tighe was greatly admired for her beauty and her charming poem, in Spenserian stanzas, *Psyche, or the Legend of Love* (privately printed in 1805). The poem was a version of the story of Cupid and Psyche in the *Golden Ass of Apuleius.* This and other poems were published in 1811, with a portrait after a painting by Romney.

TIG′LATH-PILE′SER. The Old Testament form of the name borne by several Assyrian kings, the Assyrian form of which is *Tukultiapal-esharra*, 'My trust is the son of Esharra;' since son of Esharra (lit., the good house) is a designation of the god Ninib—a solar deity—the name is equivalent to 'My trust is Ninib.' Of the Assyrian kings bearing this name, the most important is Tiglath-pileser I., who began to rule about B.C. 1120. Under him the dominion of Assyria was considerably enlarged by conquests in districts embracing Northern Syria, Cappadocia, Armenia, Kurdistan, and Persia. He claimed to have conquered no less than forty-two countries, and in his days Babylonia was forced to acknowledge Assyrian supremacy. Twice he invaded the south and entered the city of Babylon itself. His activity in rearing temples and palaces was no less remarkable, and he devoted himself specially to the embellishment of the old city of Asshur on the Tigris, which he once more made the seat of government in place of Calah. Although he was able to hand over the succession to his son Asshur-bel-kela, his great empire was not maintained, and shortly afterwards a period of decay set in which appears to have lasted almost up to the days of the second Tiglath-pileser, whose reign may be placed about B.C. 950. Nothing is known of him beyond his name and titles. The third Tiglath-pileser, ruling from B.C. 745 to 727, was in some respects more remarkable than Tiglath-pileser I. Rising from obscurity, he either set on foot a rebellion against Asshur-Nirari III., or availed himself of an opposition that had sprung up against this King to seize the throne for himself. He assumed the name of Tiglath-pileser as King, his original name having been Pulu or Pul, by which he continued to be known in Babylonia and which is given to him likewise in the Old Testament (II. Kings xv. 19). To reinforce his position he proceeded to the south and brought to submission the Aramæan tribes who had been causing the Babylonians considerable trouble. Securing in this way the good-will of the Babylonians, by whom he was hailed as a deliverer, he could devote himself to the troublesome neighbors in Media to the east of Assyria. Two expeditions were required before the pacification of the country was secured. Tiglath-pileser III. appears to have introduced the policy of planting

Assyrian colonies in hostile districts with a view of thus making Assyrian influence a more permanent factor than could be accomplished merely by military invasions. Successful also in breaking up a combination that had been formed against him in Ararat under the leadership of Sarduris II., aided by a group of allies in Asia Minor, he secured a large booty in a battle in which he claims to have captured no fewer than 72,950 soldiers of the enemy. He encountered more difficulty in quelling a revolt in Northern Syria in B.C. 742-740. As early as B.C. 739 there was a conflict between the Assyrians and a certain Azariah of Jaudi, and until recently it was supposed that this was none other than King Azariah of Judah, but chronological as well as other difficulties stand in the way of this identification, and it is more probable that the land Jaudi referred to is not Judah, but a district in Northern Syria. The King overthrew Azariah and his allies and again showed his administrative abilities by placing the hostile district, divided into small principalities, under Assyrian Governors. He enumerates in his inscriptions a long list of rulers of petty States in Asia Minor and Syria who brought him tribute, and among these we find Menahem of Samaria, the notice thus confirming the statement in II. Kings xv. 19-21.

In B.C. 734 Tiglath-pileser again proceeded to the West, being appealed to by Ahaz, King of Judah (II. Kings xvi. 7), to assist him against the combination formed by Pekah, King of Israel, and Rezin of Damascus. Rezin was defeated and fled to his capital, and while a portion of the Assyrian army laid siege to it, another section was sent to ravage and plunder the Syrian, Israelitish, and Philistine towns. In B.C. 732 Damascus fell and an Assyrian official was appointed Governor. Among those who hastened to pay homage to Tiglath-pileser, we find his vassal King Ahaz (or Jehoahaz as he is called in the Assyrian inscriptions) of Judah. This visit is the one referred to in II. Kings xvi. 10. Tiglath-pileser also claims to have deposed Pekah of Israel and to have put Hosea in his place. According to the biblical statement (II. Kings xv. 30) Pekah was murdered in the course of a revolt instigated by Hosea, who no doubt was abetted by the Assyrian King. Shortly after his successful campaign in Syria and Palestine, Tiglath-pileser was obliged to proceed once more against Babylonia, where trouble had broken out. Two years elapsed before he could take the decisive step of having himself crowned King of Babylonia. The ceremony took place on the Babylonian New Year's festival of the year B.C. 728. As King of Babylonia he assumed his original name of Pulu (identical with Parus in the Ptolemaic canon). Not long afterwards, in B.C. 727, he died, leaving his policy of political centralization to be carried on by his son Shalmaneser IV. Consult the Babylonian-Assyrian histories of Rogers, Winckler, Tiele, and Hommel.

TIGRA′NES (Lat., from Gk. Τιγράνης, Armen. *Tigran*). The name of several kings of ancient Armenia. The most famous was Tigranes the Great, who was born about B.C. 121. He was for many years a hostage at the Parthian Court, but was exchanged for seventy districts about 95, when he succeeded to the throne. He made an alliance with his father-in-law, Mithridates (q.v.), King of Pontus, against the Romans. He was at first successful, and about 83 he conquered Syria, later extending his power over much of Asia Minor, besides taking from the Parthians the provinces of Mesopotamia, Adiabene, and Atropatene. In 71 Mithridates fled to him for refuge from the Roman general Lucullus (q.v.). Refusing to give up the fugitive, Tigranes was attacked by the Romans, and was defeated in 69 at Tigranocerta, his newly founded capital, although a mutiny prevented Lucullus from following up his advantage. Three years later Pompius (q.v.) took the field against the Armenians, and in 64 after a long siege compelled Tigranes to surrender at Artaxata. He remained in possession of Armenia Major, however, on the payment of 6000 talents. In 55 he named his son Artavasdes co-ruler. The date of his death is uncertain.

TIGRÉ, tē-grȧ′. A division of Abyssinia (q.v.).

TI′GRIS (Greek, from the old Persian *tigra*, an arrow). One of the two large rivers which inclose the historic region of Mesopotamia, in Asiatic Turkey (Map: Turkey in Asia, M 6). It rises by two main headstreams in the mountains of Kurdistan, near the Euphrates. Thence it flows in a winding southeast course of about 950 miles till it joins the Euphrates at Korna to form the Shat-el-Arab, which after a short course flows into the Persian Gulf. The Tigris is a rapid and turbid stream. In its upper course it receives numerous tributaries from both sides. Below Mosul, however, the tributaries come nearly all from the east, the region between the Lignis and the Euphrates being here a desert overgrown with wormwood and similar scrub. Farther down the Tigris communicates across the desert with the Euphrates by a number of bayous or canals, some of which are dry the greater part of the year. At the confluence the Tigris, though shorter than the Euphrates, is more voluminous, and it is navigable for steamers to Bagdad. Thence smaller vessels proceed to Mosul, and above that city rafts descend from Diarbekir, almost at the source of the river. The rafts, however, are broken up at Mosul and transported back by camel. The main tributary of the Tigris is the Diyala, which joins it from the east, a short distance below Bagdad, and which is navigable for some distance by small vessels. Next to the Diyala, the largest affluent is the Greater Zab. Outside of the three cities mentioned the banks of the Tigris are very thinly populated. Among the remains of ancient cities on the banks of the Tigris are those of Nineveh, Seleucia, and Ctesiphon.

TILBURG, til′bo͞ork. A manufacturing town in the Netherlands, Province of North Brabant, 36 miles southeast of Rotterdam, and 19 miles east of Breda (Map: Netherlands, D 3). The town has a new church in the Gothic style, and a cloth-hall, and is besides an important manufacturing centre, with more than 300 factories, most of them woolen and cloth mills, and tanneries. Population, in 1895, 36,275; in 1900, 40,628.

TIL′BURY FORT. A fortification in Essex, England, on the north bank of the Thames, opposite Gravesend, 30 miles below London (Map: England, G 5). Originally erected in the time of Henry VIII. as a block-house, it was converted (1667) into a regular fortification after the bold expedition of De Ruyter into the Thames and Medway, and has been greatly strengthened since 1861. Large docks comprising 588 acres, opened in 1886, have reclaimed the waste land formerly surounding the fort.

TIL′DEN, Samuel Jones (1814-86). An American lawyer and statesman, born at New Lebanon, N. Y. He attended Yale College and the University of the City of New York, where he graduated in 1837; studied law, and in 1841 was admitted to the bar of New York City. As a lawyer he rose to the first rank. In 1846 he was a member of the State Legislature, in which he devoted his attention particularly to the subject of the State canals, and in the same year served as a member of the State Constitutional Convention. In 1867 he again sat as a delegate to the Constitutional Convention. Having been elected again to a seat in the Legislature, he took the lead in 1872 in the impeachment proceedings against Barnard and Cardozo, two of Tweed's corrupt and subservient judges. He contributed to the exposure of the frauds of the Tweed Ring, and took the leading part in the prosecution of its guilty members. By 1868 he had become the acknowledged leader of the Democratic Party in New York, and his activity in overthrowing the Tweed Ring led to his election in 1874 as Governor of New York. His administration (1875-76) was marked by economy in the management of the State canals. In June, 1876, he was nominated by the Democratic National Convention at Saint Louis for President of the United States, and in the ensuing Presidential election received a majority of the popular vote, and according to the final count came within one vote of receiving a majority of the electoral vote. Because of alleged frauds in the elections of Louisiana, South Carolina, and Florida, the votes of those States, which were nominally given for the Democratic Party and which would have turned the election in Tilden's favor, were claimed by the Republicans, and the excitement which followed threatened to disturb the peace of the country. Finally Congress created an Electoral Commission (q.v.), consisting of five justices of the Supreme Court, five Senators, and five Representatives, to settle the dispute, and by a strict party vote of 8 to 7 it gave its decision in favor of Tilden's opponent, Rutherford B. Hayes (q.v.). Tilden thereupon promptly requested his friends to accept the decision with good grace, though many of his supporters continued to believe and to assert that he had rightfully been elected President. In 1880 and in 1884 the Democratic Party wished to nominate Tilden again for the Presidency, but each time he refused to be a candidate. He lived his remaining years in retirement near Yonkers, N. Y., dying on August 4, 1886. He bequeathed the greater portion of his fortune of about $5,000,000 to philanthropic purposes, chiefly for the establishment and endowment of a public library in the city of New York. The will was contested and only about $2,000,000 went to the establishment of the Tilden Foundation of the New York Public Library (q.v.). Tilden's biography was written by John Bigelow (New York, 1895), and his writings were edited by the same author (2 vols., 1885).

TILE (AS. *tīgol, tīgele*, from Lat. *tegula*, tile, from *tegere*, to cover). Properly a piece of material for covering a roof, but limited to harder materials than wood. Slate, marble and other hard stones which can be cut into thin slabs and resist ordinary breakage have been used for tiles. Ordinary roof tiles are of earthenware and these may be perfectly flat and used to shed the water by being laid over one another on a sloping surface, exactly as shingles are laid. The other kind of roof tile is that which is made with ridges by the use of two kinds of tile, those which are flat and those which are curved and laid with the convex side uppermost to cover the joints between the flat ones. There is also a kind of tile which has the flat and the raised ridge-like convexity cast or molded in the same piece of ceramic ware. From the use of the term to cover many different kinds of roofing it has come to have two different meanings. First, any flat slab, if small and forming one of many pieces used to cover a large surface, is a tile; second, the different ceramic wares used in building and in all kinds of engineering work, drainage, and the like are called tiles.

The decorative value of tile is seen chiefly in flooring. The tile floors of the Middle Ages were composed of earthenware tiles, each of which is complete and of one color, or incised with a pattern in such a way that a different-colored clay may be inlaid. In the south of Europe wall tiles were much used according to a fashion always prevalent in the East, and were taken up by the Moslem peoples. These tiles in Cairo, Damascus, and other Levantine cities are of such beauty that squares composed of nine or sixteen are often sold for many hundreds of dollars; and even these are admittedly inferior to the tiles of the Persian mosques. In Spain a modification of this tendency showed itself in the production of tiles of slight relief in the outlines of decorative scrolls and the like, so that the brilliant color with which these scrolls were painted is incrusted, as it were, between slight ridges raised in the clay. These tiles, unfit for floors, are very decorative when used for the linings of walls. The Gothic revival in England between 1840 and 1870 brought with it a strong movement to restore these appliances of decorative buildings; and many tile floors were designed and made in mediæval taste. In consequence of this the earthenware tile industry became an extensive one in Great Britain and for many years the greater number of tiles imported into the United States came from England. Tiles of much greater refinement and beauty were made on the Continent, especially in France. Other tiles have been made with heads, human figures, and even groups in slight relief, the ornamentation being obtained by sculpture rather than color. In very recent times the chief makers of decorative pottery have tried the adornment of tile with good results. There has grown up among these designers a certain freedom of color composition which no other trade seems to have achieved.

Clay tiles may be divided broadly into solid and hollow, the former being thin and, except for some roofing tiles generally flat, while hollow tiles have a great variety of thickness and shape. In the preparation of the clay for molding some one or more of the processes described under Clay (paragraph on *Clay Mining* and *Working*) are employed, varying with the class of clay and the final product. For tile-burning see Kiln; Terra Cotta.

Encaustic Tiles, for floors, walls, and other purposes, are decorative tiles in which the main body is of one color of clay and a pattern is inlaid in a contrasting color of clay. The term is a mere trade name, without special significance. Those which are small, unglazed floor tiles in plain colors, the design being made by the combination of tiles of different colors and shapes, are commonly called mosaic tiles. Glazed porcelain tiles bearing fixed designs in vitrifiable colors are also sometimes called encaustic tiles. The famous Dutch tiles are simply enameled earthenware, usually in blue, but sometimes in colors, and generally with Scriptural subjects for the design. They were first made in the Netherlands during the Renaissance period.

Floor Tiles are now made by machinery in metal dies, in which they are subjected to heavy pressure. The clay is first prepared as for ordinary ceramic work and then dried again and ground in powder. *Wall tiles* are made with the back surface broken by 'undercutting,' so the cement may have a better hold. They usually have a highly glazed surface. Floor tiles are generally preferred unglazed. They are made from a mixture of barytes and very hard clay, which vitrifies throughout its surface. When the tiles are to be figured the old process of filling in the embossed surface with liquid clay has been replaced by a method of dry filling. The pattern is produced by the use of brass plates, an eighth of an inch thick, a separate one being used for each color. Thus, for an ornament in red and white on a blue ground, one plate is perforated so as to enable the red portion of the clay power to be filled in, another is cut for the white portion, and a third for the blue ground. When all are filled up the tile is pressed in a screw-press and fired as in the ordinary plain tile.

Fireproofing, Structural, or Hollow Tiles are rapidly growing in use (see Fireproof Construction), particularly for fitting around steel columns and girders forming partitions, floor arches, and ceilings. Their lightness is greatly in their favor. They are divided into three classes: Dense, porous, or terra cotta lumber, and semi-porous. *Dense tiles* are prepared for molding much like terra cotta. They are given heavy pressure and a long burning, and are sometimes made from fire clay. *Porous tiles* are made by mixing one part by bulk of soft wood-sawdust or finely cut straw with two parts of clay, passing the mixture through a disintegrator or cutter, and then between two sets of corrugated rolls, one below the other. From the rolls conveyors take the mixture to the tile machines described below. The subsequent burning destroys the sawdust or straw, leaving a very porous tile into which nails may be driven, or which may be cut with a saw; hence the name, terra cotta lumber. *Semi-porous tiles* are made of good fire clay containing 60 per cent. of silica, calcined fire clay, and coarsely ground bituminous coal. These materials are mixed, molded, and burned much like porous tiles.

Hollow Tile Machines are of various forms according to the character of the clay. The tempered clay is forced through forms and around plugs. The forms give the outer and the plugs the inner shape to the tiles. The plugs are of metal, with their front ends just inside the form. Plungers force the clay over or around the plugs, then through the forms. The continuous shapes are separated by wires or knives. Some of the special forms require partial hand-shaping.

Roofing Tiles, when of clay, are something like terra cotta (q.v.) in their composition and manufacture. They are made in various colors and shapes, the shapes being governed largely by the kind of vertical joints employed.

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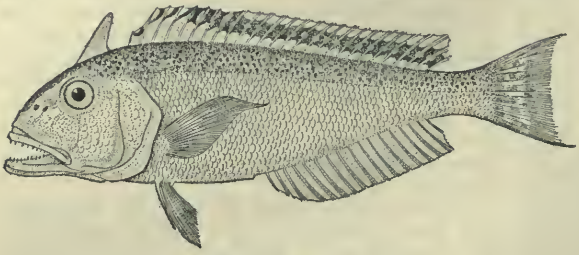
TILEFISH (name coined from penultimate syllable of generic name). A deep-sea fish (*Lopholatilus chamæleonticeps*) chiefly remarkable for its strange history. It was accidentally discovered in large numbers in 1879 by fishermen trawling for cod south of Nantucket, and was found again in 1880 and 1881. In the spring of 1882 shipmasters reported that an immense area of ocean surface about 300 miles south of Long Island was covered with many millions of floating fish, dead or dying, chiefly tilefish, which showed no marks of injury or disease. Verrill and other ichthyologists, judging by various circumstances, explained this as the result of an incursion of cold water, forced by the heavy northerly gales of that spring, into the warm area of the Gulf Stream.

This fish represents a genus of the family Malacanthidæ, which includes several edible fishes of the seas of both sides of tropical America, one of which, the blanquilla or 'whitefish' (*Caulolatilus princeps*), is a well-known food fish of southern California. The tilefish is a large, big-headed, brilliantly colored, active fish, sometimes 40 pounds in weight, but ordinarily from 10 to 20 pounds. It is characterized by a high adipose protuberance upon the nape in advance of the long dorsal fin, and by a short barbel at the angle of the lips on each side. Its flesh was found to be excellent, and the United States Fish Commission made great efforts to learn where it might be found, but the disaster of 1882 seemed to have wholly exterminated the species. Some ten years later an occasional one was captured, and investigation of the edge of the continental plateau was resumed by the Fish Commission. It was finally determined that the area of their distribution extends along a band of sea-bottom from about 39° N. latitude southward between 69° and 73° W. longitude to an unknown distance, in water from 60 to 80 fathoms deep, wherever the water has a temperature not colder than 50° F. Increasing catches were made in 1900, 1901, and 1902.



THE TILEFISH.

Consult Collins, "History of the Tile Fish," in *Annual Report of the United States Commissioner of Fish and Fisheries for 1882* (Washington, 1884); Lucas, *Annual Report of the United States National Museum for 1889* (Washington, 1891); Bumpus, "The Reappearance of the Tilefish," in *Bulletin of the United States Fish Commission* (Washington, 1899).

TILGHMAN, tĭl′mȧn, Matthew (1718-90). An American patriot, born in Queen Anne County, Md. He was early engaged in the Indian wars, and was elected a delegate to the Maryland Assembly, where he sat continuously until the formation of the State Government, February 5, 1777, and was Speaker of the House in 1773-75. From 1774 until the establishment of the State Government he was president of the convention which exercised the chief authority. He was also head of the Committee of Correspondence of the Council of Safety, and of the delegation to the Continental Congress. He was a strong advocate of independence, but was prevented from signing the Declaration of Independence by being called home to preside over the convention to frame a State constitution. He was an earnest, enthusiastic patriot and did much for the American cause in Maryland.

TILGHMAN, Tench (1744-86). An American soldier, born near Easton, Md. Prior to the Revolution he was engaged in mercantile pursuits at Philadelphia, but early in 1775 entered the American army as lieutenant in an infantry company, and in July was sent as a special commissioner to treat with the Iroquois. From August, 1776, until the close of the war, he was an aide and military secretary of General Washington, participating in all the battles of the main army during this period; and in October, 1781, carried to Congress the news of Cornwallis's surrender, covering the distance from Yorktown to Philadelphia in four days. In May, 1781, he was made a lieutenant-colonel, to take rank from April 1, 1777, and in October, 1781, Congress voted him "a horse properly caparisoned and an elegant sword, in testimony of their high opinion of his merit and ability." After the war he removed to Baltimore, where he died. Consult *Memoir of Tench Tilghman* (Albany, 1876).

TILGNER, tĭlk′nẽr, Viktor (1844-96). An Austrian sculptor, born in Pressburg. While still a pupil of Franz Bauer and Joseph Gasser at the Vienna Academy, he was commissioned to execute the bust of Bellini for the opera house and the statue of Duke Leopold VI. for the arsenal. Influenced by the French sculptor Déloye, who was engaged in Vienna on work for the exposition in 1873, Tilgner adopted an exceedingly dashing and lifelike style and attracted wider notice with his portrait bust of Charlotte Wolter (1873). After a visit to Italy in 1874 he produced the group of "Triton and Naiad" (Volksgarten, Vienna), and among many excellent portrait busts and statues those of Emperor Francis Joseph, Crown Prince Rudolf, Heinrich Laube, Rubens (Künstlerhaus, Vienna). Other noteworthy works include fountain groups for the Imperial villas at Ischl and in the Tiergarten near Vienna, the heroic-sized figures of "Phædra" and "Falstaff" (Burgtheater, Vienna), the bust of Liszt (1893, Oedenburg), the statues of Mozart (1896) and Makart (1898), both in Vienna, and a number of successful polychrome busts and genre statuettes. A selection of his works, in 60 heliotype plates, was published by Ilg (Vienna, 1896-97).

TILIACEÆ (Neo-Lat. nom. pl., from Lat. *tiliaceus*, relating to the linden, from *tilia*, linden-tree, Gk. *πτελέα*, *ptelea*, Arm. *t'eλi*, elm). The Linden Family. A natural order of dicotyledonous trees and shrubs, and a few herbs, mostly natives of the tropics, chiefly in Asia and Brazil. A few are found in the temperate parts of the Northern Hemisphere. They have simple, alternate leaves with stipules, and axillary flowers. The calyx is usually of four or five sepals; the corolla, of four or five petals, or sometimes wanting. The stamens are generally numerous, the outer ones sometimes abortive and petal-like. The ovary is composed of 2 to 10 carpels; there is one style, and the stigmas are equal in number to the carpels. The properties of the order are generally mucilaginous and wholesome, the bark fibrous.

The Tiliaceæ yield valuable light timber (see Grewia), jute or corchorus (q.v.), and other fibres. The chief genera are Tilia, Grewia, Triumfetta, Corchorus, and Sparmannia.

TILLAGE (from *till*, AS. *tilian*, *teolian*, Goth. *tilōn*, OHG. *zilōn*, *zilēn*, Ger. *zielen*, to aim, strive for; connected with Goth. *tils*, good, AS. *til*, goodness, OHG. *zil*. Ger. *Ziel*, aim, goal). The process of stirring and mixing the soil for the purpose of increasing its productiveness. The operations of plowing, harrowing, spading, hoeing, etc., constitute tillage. There are three distinct classes of tillage: (1) surface tillage brought about by such implements as harrows, cultivators, and weeders; (2) sub-tillage, such as is secured by sub-soiling; and (3) intertillage, such as is carried on while the soil is occupied by a crop. Pulverizing the soil by tillage not only favors the root growth of plants but improves the moisture and other physical conditions of the soil, promotes weathering and disintegration, which set plant food free, supplies conditions favorable to the activity of beneficial organisms in the soil (nitrification, q.v.), and destroys weeds (and in many cases injurious insects).

TILLEMONT, têl′môɴ′, Sébastien le Nain de (1637-98). A French ecclesiastical historian, born in Paris. He was educated at Port-Royal, under the Jansenist influence, and was ordained a priest in 1676, mainly at the persuasion of his friend Le Maistre de Sacy, who had long been his spiritual adviser. In 1681 Tillemont made a visit to Holland and Flanders, for the purpose of seeing Arnauld and other Jansenist refugees. He had worked meanwhile on his Church history. To avoid the opposition of the censor, he separated from the Church history the history of the emperors, which he was enabled to print as a distinct work, without referring it to the censorship, under the title *Histoire des empereurs*, etc. (1691-1738). In 1693 the first volume of the Church history appeared under the title *Mémoires pour servir à l'histoire ecclésiastique des six premiers siècles*, complete in 16 volumes (1693-1712). The *Emperors* comprises all the reigns from Augustus to Anastasius (518); the *Histoire ecclésiastique* comes down to about the same period. Both are laborious compilations from the original writers. He was also author of *Vie de Saint-Louis* (new ed., 1847-51).

TIL′LEY, Sir SAMUEL LEONARD (1818-96). A Canadian political leader, born at Gagetown, New Brunswick. He took a great interest in the temperance question, and in 1850 he was elected to the New Brunswick Legislature by the Liberals, and there played an important part until 1865. He advocated Canadian union in 1864, and in 1866 succeeded in carrying New Brunswick for that cause. He was a delegate to the Westminster Conference where the British North American Act (1867) was drawn up, and on the establishment of the new Government he was elected to the Dominion House of Commons, and appointed Minister of Customs. Afterwards he held the portfolios of Public Works and Finance, and in 1873 he became Lieutenant-Governor of New Brunswick. In 1878 he was again elected to the House of Commons and again appointed Minister of Finance. In 1885 he retired from Dominion politics, but accepted a reappointment as Lieutenant-Governor of New Brunswick, an office which he held until 1893.

TILL′MAN, BENJAMIN RYAN (1847—). An American politician, born in Edgefield County, S. C. He was educated at Bethany Academy, became a planter, and interested himself in the development of industrial and technical education in South Carolina. He became the recognized leader of the farming element in the Democratic Party in South Carolina, received the support of the 'Farmers' Alliance,' and in 1890, as the Democratic candidate, was elected Governor of the State. He was reëlected in 1892, and in 1895 was elected United States Senator, being reëlected to that office for a second time in 1901. His speeches against President Cleveland in 1895-96 in the Senate won him the name of 'Pitchfork' Tillman. He was active in both 'free-silver' campaigns, in 1896 and 1900, as one of the most radical supporters of the candidacy of W. J. Bryan. An assault which he made on his colleague, J. L. McLaurin, in the Senate in March, 1902, led to his being censured and suspended by that body.

TIL′LO, ALEXEI ANDREYEVITCH (1839-1900). A Russian general and scientist, distinguished for his work in geodesy, meteorology, terrestrial magnetism, hypsometry. He was born at Kiev and attended the Russian military schools. He studied at the Astronomical Observatory at Pulkowa, receiving a thorough training in geodesy under Struve and Doellen, and it was chiefly through his efforts that the Imperial Department of Agriculture organized expeditions to study the sources of the principal Russian rivers. He was an indefatigable observer, explorer, author, and investigator and the most prominent geographer of his day in Russia. His published works include magnetic and meteorological charts and the physometric charts of Russia.

TILLODONTIA, tĭl′lō-dŏn′shĭ-ȧ (Neo-Lat. nom. pl., from Gk. τίλλειν, *tillein*, to pluck, tear + ὀδούς, *odous*, tooth). An extinct suborder of early Tertiary fossil mammals supposed to be ancestral to the modern rodents. The principal genera, Esthonyx, Tillotherium, Stylinodon, Dryptodon, and Anchippodus, are found in the Eocene and Miocene beds of the Western United States. See RODENTIA.

TIL′LOTSON, JOHN (1630-94). Archbishop of Canterbury. He was born in Sowerby, in Yorkshire, in 1630, the son of a clothier, who was a zealous Independent. He was educated at Clare Hall, Cambridge. He was a preacher in 1661—attached apparently to the Presbyterian party in the Church of England, for at the Savoy Conference (q.v.) he was present as an auditor on the Presbyterian side; but he submitted at once to the Act of Uniformity (1662), and in 1663 he was appointed to the rectory of Keddington in Suffolk, and almost immediately after was chosen preacher at Lincoln's Inn. In 1666 he published *The Rule of Faith*, in reply to a work by an English clergyman named Sargeant, who had gone over to the Roman Catholic Church. He was made a prebendary of Canterbury in 1670 and dean in 1672. With Burnet, he attended Lord Russell during his imprisonment for complicity in the Rye House Plot, and on the accession of William III. rose high into favor. In March, 1689, he was appointed clerk of the closet to the King; in November, made Dean of Saint Paul's; and in April, 1691, was raised to the see of Canterbury, vacant by the deposition of Sancroft (q.v.), after vainly imploring William to spare him an honor which he foreboded would bring him no peace. Nor was he mistaken in his painful presentment. The non-juring party pursued him to the end of his life; but he bore their animosity without complaint or attempt at retaliation. A collected edition of his *Sermons*, in 14 volumes, was published after his death by his chaplain, Dr. Barker (London, 1694), and has been frequently reprinted. The best edition of his sermons and other works is by Dr. T. Birch, who also wrote his *Life* (London, 1752).

TILLY, JOHANN TSERKLAES, Count of (1559-1632). A Catholic general in the Thirty Years' War. He was born at the Castle of Tilly, in Brabant, in 1559. He received his military training in the Spanish armies, fought against the Turks in Hungary, and in 1610 was selected by Duke Maximilian of Bavaria to reorganize his army. At the outbreak of the Thirty Years' War (q.v.) he was placed in command of the forces of the Catholic League and on November 8, 1620, won the battle of the White Hill, near Prague, which put an end to the short reign of Frederick of the

Palatinate in Bohemia. He then carried on the struggle in the Palatinate, was defeated by Mansfeld and the Margrave of Baden-Durlach at Wiesloch (April 27, 1622), but gained a decisive victory over the latter at Wimpfen (May 6th) and defeated Christian of Brunswick at Höchst (1622) and Stadtlohn (1623). For these services he was created a count of the Empire. He defeated Christian IV. of Denmark at Lutter (August 27, 1626), and coöperated with Wallenstein in bringing about the complete triumph of the Catholics in this second phase of the Thirty Years' War. When the influence of the League secured Wallenstein's retirement (1630), Tilly succeeded to the command of the Imperial forces, and took by storm the town of Magdeburg (May 20, 1631). The atrocities which the Croats and Walloons of his army perpetrated on this occasion form a stain upon a character that was remarkable in that age for honesty and loyalty to conviction. The capture of Magdeburg was Tilly's last triumph. Gustavus Adolphus completely routed him at Breitenfeld (September 17, 1631). In April, 1632, the Swedish King forced the passage of the river Lech in Tilly's front after a desperate conflict, in which Tilly was mortally wounded. He was removed to Ingolstadt, where he died. Consult: Villermont, *Tilly* (Tournay, 1859); Klopp, *Tilly im Dreissigjährigen Kriege* (Stuttgart, 1861), both written from the Catholic point of view; and Wittich, *Magdeburg, Gustav Adolf und Tilly* (Berlin, 1874).

TIL′SIT. A town of Prussia, in the Province of East Prussia, on the left bank of the Memel or Niemen, sixty-one miles northeast of Königsberg (Map: Prussia, J 1). It stands in a fruitful district. It has broad streets and a cleanly appearance. It has paper, sugar, and oil mills, iron foundries, machine shops, distilleries, chemical establishments, breweries, and shoddy mills. Population, in 1900, 34,539.

At Tilsit, on a raft in the middle of the Niemen, occurred, June 25, 1807, the celebrated meeting between Napoleon and Alexander I. of Russia, following the defeat of the Russian forces at Friedland (q.v.). On July 7th peace was concluded at Tilsit between France and Russia and on the 9th between France and Prussia. The latter was stripped of her possessions west of the Elbe and of the Polish territories acquired in 1793-95, out of which Napoleon created the Duchy of Warsaw. Danzig was made a free city. Prussia joined the Continental System and closed its ports to English vessels. Its army was reduced to 42,000 men, and until the payment of a heavy indemnity a number of the chief strongholds were to remain in the hands of the French. A secret agreement between France and Russia provided for the imposition by force of the Continental System on Portugal, Austria, and the Scandinavian countries. Practically at Tilsit the French and Russian monarchs divided between them the mastery in Europe, France remaining the arbiter in West and Central Europe, while Russia was given a free hand in Sweden and Turkey.

TIL′TON, THEODORE (1835—). An American journalist, poet, and novelist, born in New York. He graduated at the College of the City of New York in 1855, and was an editor of *The Independent* from 1856 to 1871, and of *The Golden Age* (1891-74). In 1874 he brought criminal charges against the Rev. Henry Ward Beecher (q.v.), whom he accused of improper relations with his wife. Afterwards he attracted attention as a platform speaker, chiefly in behalf of woman's rights. After 1883 he lived in Paris. His books include: *The Sexton's Tale and Other Poems* (1867); *Sancta Sanctorum, or Proof Sheets from an Editor's Table* (1870); *Tempest-Tossed,* a romance (1874); *Thou and I,* verses (1880); *Swabian Stories,* ballads (1882); *The Chameleon's Dish* (1883) and *Heart's Ease* (1894), volumes of verse. His *Complete Poetical Works* appeared in 1897.

TIMÆ′US (Lat., from Gk. Tίμαιος, *Timaios*) (c. 352-256 B.C.). A Greek historian; son of Andromachus, tyrant of Tauromenium, in Sicily. He was banished from Sicily by Agathocles, and passed most of his life in Athens. His chief work, a *History of Sicily* in sixty-eight, or, according to others, thirty-eight books, embraced the period from the earliest times to B.C. 264. Polybius and others, notably Diodorus Siculus, pronounce him unfit for writing history on account of his "lack of critical acumen, malignity, and tendency to superstition." But, although most of these charges are founded on truth, Timæus's deficiencies have probably been exaggerated, since modern critics and most of the ancients, including Cicero (*De Oratore,* ii. 14), praise his general knowledge and his accuracy in indicating the chronology of the events which he describes. He is said to have introduced the practice of recording events by Olympiads. For the fragments, consult: Müller, *Fragmento Historicorum Græcorum* (Paris, 1841).

TIMARU, tē-mä′ro͞o. A seaport of Geraldine County, South Island, New Zealand, on the east coast, 100 miles southwest of Christchurch by rail, and the junction of a line to Fairlie (Map: New Zealand, C 6). Agricultural machinery and implements are manufactured; it has a fine harbor. Population, in 1891, 3668; in 1901, 6424.

TIMBER (AS. *timber,* OHG. *zimbar,* timberwork, room, Ger. *Zimmer,* room; connected with Lat. *domus,* Gk. δόμος, OChurch Slav. *domŭ.* Skt. *dama,* house). In law, such trees as are suitable for building purposes. Timber trees belong to the owner of the land, both when standing and fallen, unless converted into lumber in a convenient form for transportation. Therefore, timber will pass with the land under a conveyance, and is included in a mortgage on the land, without being specifically mentioned. A tenant is not legally entitled to cut more timber than is necessary for the purposes for which he hired the land, unless under special agreement. The term 'timber' is also applied to large pieces of lumber, suitable for the framework of buildings, bridges, etc., as distinguished from shingles, lath, etc. See REAL PROPERTY.

TIMBER. See LUMBER.

TIMBER PRESERVATION. See FORESTRY.

TIMBUKTU, tĭm-bụk′to͞o, or **TIMBUCTOO.** A town of Africa, in the first of the three Military Territories of French Sudan (q.v.), situated 9 miles north of the Niger, in about latitude 16° north, and longtitude 5° west (Map: Africa, D 3). The climate is unhealthful. The town, near the southern borders of the Sahara desert, lies between a rolling table land on the north and the swamps of the Niger. It has flat, windowless, clay houses; its streets are of sand and gravel. It was largely in ruins when taken by the French. They have, however, energetically begun introducing improvements, and new streets and European churches and schools have been constructed. Timbuktu is fortified. There is also a fortress at Kabara on the Niger. There are two important and handsome mosques. Timbuktu is notable for its commerce, and is the focus of the caravan trade in West-Central Africa. The annual value of the transit trade alone is put at $4,000,000. Gums and rubber are perhaps the leading articles. Gold, ivory, wax, salt, hardware, beads, and cheap cloth are also prominent items. The trade is chiefly by barter. The few local manufactures include cottons, leather articles, and pottery. French goods and money are replacing those of other countries. Timbuktu is a centre of Mohammedan learning and has a large Moslem library. The population, which has greatly diminished in recent times, is about 10,000. The town was founded in 1077 by the Tuareg tribe. It passed through different hands, began to be a place of commercial importance in the sixteenth century, and was seized by an army from Morocco in 1591. The Fulahs drove out the Moors early in the nineteenth century. Timbuktu was first visited by a European in 1826—Major Laing, an Englishman. From 1844 to 1846 it was again in the hands of the Tuaregs. In 1863 Ahmed el-Bathai drove out the Fulahs for the last time. The town passed into the possession of the French in 1894. Consult: Lenz, *Timbuktu* (Leipzig, 1892); Dubois, *Timbuctoo the Mysterious* (London, 1896); Toutée, *Du Dahomé au Sahara* (Paris, 1899).

TIM'BY, THEODORE RUGGLES (1822—). An American inventor, born in Dover, N. Y. In 1841 he prepared a model of a revolving battery which he submitted to the military authorities in Washington, and from which he subsequently developed a metallic revolving fort to be used on land and water, and for this in 1862 he obtained a patent for a revolving tower for defensive and offensive warfare. In consequence of this patent he received a royalty of $5,000 in 1862 for each turret constructed by the builders of the *Monitor*. His other inventions include a method for firing heavy guns by electricity (1861); a cordon of revolving towers across a channel (1862); a mole and tower system of defense (1880); a subterranean system of defense (1881); and a revolving tower and shield system (1884), for all of which he obtained patents.

TIME (AS. *tima;* connected with *tid*, OHG. *zit*, Ger. *Zeit*, time, Eng. *tide*, Skt. *a-diti*, boundless). In the philosophical sense, a term used in the description of the succession of phenomena. Time has been considered by some philosophers to be an illusion; by others to be a confused idea; by others again a form of phenomena, but not a characteristic of ultimate reality; by others to be real but with a qualified sort of reality; by others to be an unqualifiedly real characteristic of the ultimately real world; and by others to be a reality which exists independently of the timed world of objects. For reasons given in the article on SPACE (q.v.), the most acceptable view is that time has no independent existence, as if it were a kind of vessel whose parts appeared in succession, but that it is real in the sense that the ultimately real world is timed. The question of the infinity of time is to be solved in the same way as that concerning the infinity of space.

In its legal aspect, the meridian of the sun is the generally recognized standard of time, but where persons enter into legal relations expressly with reference to some arbitrary system, as that adopted by railroads for their convenience, the courts will apply the standard contemplated by the parties, in case of a controversy. In computing a period of time from a certain day, the general rule is to exclude the first day and include the last day of the count. This rule may be disregarded if it will best effectuate the intention of the parties to an agreement. It is generally held that a policy of insurance includes the last day of the period named therein. In many States Sunday, or other *dies non*, is included in the computation of a number of days if they exceed a week, that is, seven days, but excluded if less than seven days. In some States a *dies non* is included unless it would be the last day of a period. See DIES NON; MONTH; DAY.

In music, time is the division of a measure into the fractional parts of a whole note. The sign which indicates the character of the subdivision, and which consequently regulates the rhythm of the movement, is called the time-signature. This is generally a fraction ($\frac{2}{4}$, $\frac{3}{4}$, $\frac{6}{8}$, etc.) placed after the clef at the beginning of a movement. In the fraction the lower figures represent the kind of notes to be used as time standards, while the upper figure shows how many of them are to be given in a bar. There are two general classes of time, duple and triple; in the former, the number of beats in a bar is divisible by two; in the latter, by three. Common time, so called, is 4 and is represented by the sign C. Compound duple time and compound triple time differ only from their originals in that each beat (containing a dotted note or its equivalent) is divisible by three. See RHYTHM; TEMPO.

TIME, RECKONING OF. See INTERNATIONAL DATE LINE; HOUR; DAY; TIME, STANDARD.

TIME, STANDARD. The time in common use for regulating the ordinary affairs of life. It is derived from the sun. Leaving out of account small irregularities of the solar motion that are of no consequence for our present purpose, when that celestial body is on the meridian of any place we call the time at that place 'noon' or twelve o'clock. (See EQUATION OF TIME.) It follows that when it is noon at any given place it is similarly noon at all other places having the same meridian, and at places having a different meridian it is either forenoon or afternoon. In fact, as the sun rises in the east and sets in the west, it is evident that when it is crossing the meridian of any place it must have already passed that of neighboring places to the eastward, and not yet have reached that of neighboring places to the westward. In other words, when it is noon in the given place it is already afternoon in places to the eastward, and still forenoon in places to the westward. The farther east one travels, the later is the local time; and this gives rise to the rather perplexing time differences so familiar to travelers.

In the case of railroads this matter of time differences has caused especially confusing complications. It was formerly customary for a road to use throughout large sections of its territory the local time of one of the principal cities through which it passed. The result was that when two railroads met in some smaller town, it happened not infrequently that they were running under widely different time systems. As many as five different kinds of time have been thus simultaneously in use in a single town.

It was the need of an international standard of time that led to the Prime Meridian Conference (q.v.) at Washington, 1882. This recommended the use of the Greenwich civil time, reckoned from zero up to 24 hours. In accordance with this resolution, and to remedy the difficulty mentioned above, the United States and Canada selected a series of standard meridians, differing in longitude from that of Greenwich, England, by exact multiples of 15°. October 18, 1883, a convention was called by W. F. Allen, Secretary of the General Railway Time Convention, which decided on the introduction of standard time to take effect November 18, 1883, and on that day the change was made without any difficulty.

Now 15° of longitude corresponds exactly to one hour of time difference, and therefore the local times of the several standard meridians differ from Greenwich by an even number of hours without fractional minutes and seconds. In the United States the standard time meridians are those whose longitudes are west of Greenwich 60°, 75°, 90°, 105°, and 120°. The times of these meridians are respectively 4 hours, 5 hours, 6 hours, 7 hours, and 8 hours earlier than Greenwich time because the sun, in traveling across the sky from east to west, passes the Greenwich meridian before it reaches the American meridians. The time of the 60th meridian is called *Colonial*, that of the 75th meridian *Eastern*, that of the 90th *Central*, that of the 105th *Mountain*, and that of the 120th *Pacific* time. The limiting lines of the time-zones have been so drawn arbitrarily that they never divide any town. Where such a division is theoretically unavoidable, the dividing line for actual use is drawn on the map with a crook in it, so as to put the whole town on one side of the line.

TABLE OF THE WORLD'S TIME STANDARDS

COUNTRIES	Hrs. fast of Greenwich Time	Time of Adoption
Belgium	0	May, 1892
Holland	0	May, 1892
Spain	0	January, 1901
Germany	1.00	April, 1893
Italy	1.00	November, 1893
Denmark	1.00	January, 1894
Switzerland	1.00	June, 1894
Sweden	1.00	January, 1895
Austria (railways)	1.00	
Cape Colony	1.30	1892
Orange River Colony	1.30	1892
Transvaal	1.30	1892
Natal	2.00	September, 1895
Turkey (railways)	2.00	
Egypt	2.00	October, 1900
West Australia	8.00	February, 1895
Japan	9.00	1896
South Australia	9.30	May, 1899
Victoria	10.00	February, 1895
New South Wales	10.00	February, 1895
Queensland	10.00	February, 1895
New Zealand	11.00	February, 1895

The resolutions of the Washington Conference were not so favorably received on the Continent. The introduction of the time of the 15th meridian east of Greenwich for the Austrian railways was proposed by Schram in 1886. In 1889 the matter was brought before the German Railway Union and the German Reichstag. Belgium and Holland were, however, the first Continental nations to adopt standard time, and other countries followed rapidly, as shown in the preceding table.

BIBLIOGRAPHY. Jacoby, *Talks by an Astronomer* (New York, 1902); Schram, "The Actual State of the Standard Time Question," in *Observatory*, vol. iii. (London, 1890).

See DAY; MONTH; YEAR; INTERNATIONAL DATE LINE; HOROLOGY; CLOCK.

TIM'ELI'IDÆ (Neo-Lat. nom. pl., from *Timelia*, from the East Indian name). An assemblage of passerine birds resembling thrushes in a general way, which has been formed as a sort of 'catch-all' to contain many genera difficult of definite assignment elsewhere. All are birds of the Old World, and most of them belong to the Oriental and Ethiopian regions, and are denizens of woods, jungles, and rough mountains. The most distinctive timeliines, perhaps, are the 'babbling-thrushes' of the genera Timelia, Pomatorhinus, Orthonyx, and their allies, and the 'hill-robins' of the genus Liothrix.

A TIMELIINE TYPE.

The slaty-headed babbling thrush (*Pomatorhinus schisticeps*) of the Himalaya Mountains.

TIMES, THE. A famous daily newspaper of London, England. Its publication really began January 18, 1785, with the first number of *The London Daily Universal Register*, the present name being first applied to the issue of January 1, 1788, by its founder, John Walter (1735-1812). The paper has ever since been managed and controlled by the descendents of the first John Walter, his successors being John Walter (1776-1847), John Walter (1818-94), and Arthur Fraser Walter (1846—). Under their skillful management, with the assistance of some of the ablest journalists the world has known, *The Times* has achieved a reputation for unequaled journalistic enterprise and unusual political influence. It has also been a pioneer in the adoption of new inventions in printing and publishing. Among improvements of the latter sort, one of the greatest was the introduction of steam printing presses, the use of which was begun with the issue of November 29, 1814, in spite of strong opposition from the employees. Subsequent experiments in *The Times* office led to the perfection of stereotyping, to the introduction of the Walter press, from which by the use of stereotype plates the paper was printed on both sides by a single operation, and to important improvements in folding, stitching, and type-setting machines.

For the first few years of its existence *The Times* was edited and managed solely by the two Walters—father and son. Its outspoken criticism of the King and his Ministers during this period drew down on the proprietors the wrath of the Government, and as a result they were several times fined and imprisoned in Newgate. Several attempts were likewise made to hamper or suppress their foreign news service, but this department of the paper had been carefully and systematically developed with the result that the news of Trafalgar and Waterloo and other notable victories of the British arms were published in London before the arrival of the official dispatches.

For some time prior to 1816 *The Times* was edited by Sir John Stoddart. In the latter year the editorial control was intrusted to Thomas Barnes. He was assisted as a leader-writer by Edward Sterling, whose virile articles earned for him the name of 'The Thunderer.' For a period of thirty-six years—from 1841 to 1877—the editor was John Thaddeus Delane (q.v.), one of the greatest of English journalists. He was succeeded in turn by Thomas Chenery, upon whose death in 1884 George Earle Buckle became editor. The influence and position of *The Times* rank it as unquestionably the leading paper of the British Empire, if not of the world. It has remained independent of party and has consistently favored a strong foreign policy and a constant strengthening of the ties between the mother country and the colonies. It supported in turn Beaconsfield's stand on the Eastern question and Gladstone's Egyptian policy. When, however, the latter adopted the idea of Home Rule for Ireland, *The Times* withdrew its support, was an active factor in the promotion of the Liberal-Unionist Party, and contributed largely to the defeat of the Home Rule bills. It was in the course of this campaign that it made one of its few great blunders in the publication of the famous Pigott forgeries, known as 'The Parnell Letters.' It supported Salisbury's Ministry in its South African policy in 1899-1902, although it vigorously criticised the conduct of the war after it had begun. In addition to its daily issue *The Times* publishes a tri-weekly, known as *The Mail*, a weekly edition, and a weekly *Literary Supplement*. It has published also an *Atlas* and a *Gazetteer*, and in 1898 undertook a reprint of the *Encyclopædia Britannica*, which with the subsequently published supplementary volumes constitutes the tenth edition of that celebrated work.

TIME SIGNALS. Signals used for the accurate regulation of clocks and watches. In the United States time signals are based on astronomical observations made at the United States Naval Observatory in Washington. These observations enable the astronomers there to keep their standard clock regulated; and from this clock a daily noon signal is sent out by electric telegraph to the Western Union Telegraph Company. This company in turn uses the observatory signal to regulate its standard clock, from which accurate time is distributed telegraphically to the public. Various persons, jewelers and others, who are subscribers to the Western Union time service, receive signals electrically, and are thus able to keep their own standard clocks correct. In certain places a 'time-ball' is let fall exactly at noon by means of an automatic electric signal from the telegraph company, and the public are enabled to regulate watches and clocks. In England an analogous time-service is furnished from the Royal Observatory at Greenwich; and other European countries, such as France and Germany, have similar arrangements in successful operation. Thus the direct determination of time by actual astronomical observation has been rendered unnecessary on the part of jewelers and nautical instrument makers. These latter were formerly compelled to observe time-stars themselves with small transit instruments (q.v.), in order to regulate the chronometers of vessels about to put to sea.

TIM'OCLES (Lat., from Gk. Τιμοκλῆς, *Timoklēs*) (4th cent. B.C.). An Athenian comic poet, belonging to the Middle Comedy. He was noted for his pure and pungent style and for his attacks on Demosthenes. The fragments of his plays are best published in Kock, *Comicorum Atticorum Fragmenta*, vol. ii. (Leipzig, 1886).

TIMO'CREON (Lat., from Gk. Τιμοκρέων, *Timokreōn*). A Greek lyric poet of the early fifth century B.C., born at Ialysus, in Rhodes. His works are lost, but his name has survived through his hatred for Themistocles, whom he bitterly attacked. The statesman was defended, however, by his friend Simonides, whose sarcastic epigram on Timocreon's gluttony and bibulous habits has been preserved by Athenæus. Tradition says that Timocreon excelled in drinking songs, to which he gave a satiric tone. Fragments are in Bergk, *Poetæ Lyrici Græci*, vol. iii., 4th ed. (1887).

TIMO'LEON (Lat., from Gk. Τιμολέων, *Timoleōn*) (?-B.C. 337). A Greek general, and the liberator of Sicily from the dominion of the tyrant Dionysus the Younger. He was born at Corinth, perhaps about B.C. 394, and was a member of one of the noblest and most illustrious of Corinthian families. On one occasion in battle he saved his brother Timophanes's life at the risk of his own, but, when Timophanes attempted to overthrow the democratic form of government at Corinth and make himself sole tyrant, Timoleon brought about his brother's death and the reëstablishment of the old constitution. Just after this event, and while the Corinthians were still deliberating with regard to the act, in B.C. 344, an embassy arrived at Corinth from Syracuse in Sicily, a colony of Corinth, requesting the aid of the Corinthians in the civil dissensions which were taking place in the island. A force was sent to assist the Syracusans, with Timoleon at the head. In Sicily at this time Hicetas and Dionysus the Younger were both striving to obtain the supremacy in Syracuse. The force commanded by Timoleon was small, but he succeeded in a short time in driving both of the would-be tyrants from the city. After repeopling the almost desolate city by recalling the exiles, and inviting new colonists from Greece, Italy, and Sicily, he spent the next two years in enacting laws and organizing a constitution, which he put on a completely democratic footing. The Carthaginians, alarmed at the reviving power of Syracuse, and the prospect of union among the Sicilian Greeks, now sent an army of 80,000 men under Hasdrubal and Hamilcar to subdue the whole island. Timoleon, with only 12,000 men, encountered them (B.C. 339) on the Crimissus, and gained one of the greatest victories ever won by Greeks over barbarians. He now proceeded to free the other Greek cities from the rule of the tyrants, and made a treaty with the Carthaginians, whereby the Halycus River was fixed as the boundary between the Greek and Carthaginian dominions in Sicily. Hicetas was driven from Leontini, and Mamercus from Catena, and free constitutions were conferred upon all the Greek cities in Sicily. After his great work was accomplished Timoleon lived as a private citizen at Syracuse, respected and honored, until his death. He died in B.C. 337, having been blind for a considerable time previously, and was buried in the market-place of Syracuse, where a gymnasium, called the Timoleonteum, was afterwards erected over his tomb. Consult Plutarch's *Life of Timoleon*, the standard histories of Greece, and Freeman's *History of Sicily* (1891-94).

TI′MON (Lat., from Gk. Τίμων). Called THE MISANTHROPE. A native of Athens, who lived at the time of the Peloponnesian War. The little that is known concerning him is learned chiefly from Aristophanes and the other comic poets of the period, and from Lucian, who made him the subject of one of his best-known dialogues. Disgusted with mankind, on account of the ingratitude of his early friends and companions, he lived a life of almost total seclusion from society, the only visitor whom he would receive being Alcibiades. Numerous stories were current in antiquity regarding his eccentricities, one of which is that he died because he would not allow a surgeon to visit him to set a limb. His grave, which was on the seashore, is said to have been planted with thorns, and to have been rendered inaccessible by the sea, which formed it into a small island. Shakespeare's *Timon of Athens* has as its ultimate source Lucian's dialogue.

TIMON OF ATHENS. A tragedy produced in 1607 or 1608, printed in 1623, of which Shakespeare wrote only the chief scenes, and which another, possibly Wilkins, finished; or perhaps Shakespeare's remodeling of an old play. The sources are the story of Timon told in the Life of Antony in North's *Plutarch* and in Painter's *Palace of Pleasure*, and used by Boiardo in his comedy *Il Timone*.

TIMON OF PHLI′US. A Greek poet and skeptic, who lived at Athens about B.C. 275. He wrote numerous works in both prose and verse. The most celebrated of his poems were the three books of σίλλοι, in which, in the form of a parody of Homer's epic poetry, he ridicules the tenets of all dogmatic philosophers, living or dead, from the skeptic's point of view. Like the classic satire of Rome, they were written in hexameter verse and, according to the testimony of the ancients (Diog. Laërt. ix. 12, 109-115; Euseb. Praep. Ev. xiv. p. 761), were excellent productions of their kind. The fragments are published in Wölke, *De Græcorum Syllis* (Warsaw, 1820); Paul, *Dissertatio de Sillis* (Berlin, 1821); and Wachsmuth, *De Timone Phliasio Ceterisque Sillographis Græcis* (Leipzig, 1885).

TIMOR, tê-mōr′. The largest and most southeastern of the Lesser Sunda Islands, situated 330 miles southeast of Celebes and 700 miles east of Java, between which and Timor the main chain of Lesser Sunda Islands intervenes (Map: Australasia, E 3). It has an extreme length from northeast to southwest of about 280 miles, with an average breadth of 55 miles, and an area estimated at 12,395 square miles. The coasts are for the most part steep, lined with coral reefs, and difficult of approach. The interior is not well known. It is traversed by a forest-covered mountain range, and the geological formation seems to be a core of slate, diorite, and serpentine flanked by beds of carboniferous limestone, Triassic sandstone, and some Tertiary formations. The mineral wealth is considerable, but unexploited. The climate is hot and unhealthful on the coast, and the rainfall is very slight, especially in the south. The flora and fauna are less varied than in the other East Indian islands, and the island forms a transition region between these and Australia. The resources of the island are not developed; agriculture is primitive, and the exports are few and small in quantity, coffee, wax, and a little sandalwood being the chief staples. Politically the island is divided nearly equally between Holland and Portugal, the latter possessing the northeastern half, with the seat of government at the small town of Deli. The Dutch portion forms the principal member of the Residency of Timor, which includes also the islands of Rotti, Savu, and Sumba, Eastern Flores, and the Solar and Allor groups. The capital of the residency is Kupang, a town of about 7000 inhabitants at the southern extremity of the island. The inhabitants are mainly Papuans with some intermixture of Malays and Chinese. Their number is vaguely estimated at 400,000. The number of Europeans in the entire Dutch residency was only 256 in 1895. Consult: Bastian, *Indonesien* (Berlin, 1885); Forbes, *A Naturalist's Wanderings in the Eastern Archipelago* (London, 1885); Wichmann, *Sammlungen des Geologischen Reichmuseum* (Leyden, 1881-84).

TIMORLAUT, tê-mōr′lout, or TENIMBER. A group of islands in the East Indian Archipelago, belonging to the Dutch Presidency of Amboyna, and situated between the Banda and Arafura seas, 240 miles southeast of the island of Ceram in the Moluccas, and about midway between New Guinea and the Lesser Sunda Islands (Map: Australasia, F 3). It consists of the large islands of Yamdena (1132 square miles), Larat, and Selaru, and a number of smaller islands, with a total area of about 2060 square miles. The large islands are hilly and forested, rising to a height of about 1000 feet, while the others are low and flat, and of coral formation. The inhabitants, a mixture of Malays and Negritos, are engaged in primitive agriculture, cattle-raising, and trepang fishery. Population, in 1895, officially estimated at 24,858.

TIMOTE, tē-mō'tā. A group of small tribes apparently constituting a distinct linguistic stock, whose modern representatives still occupy the mountainous district of Mérida, southward from Lake Maracaibo, in Western Venezuela. In former times they usually went naked, with their bodies painted red, and were agricultural, cultivating corn, chile, and various edible roots. They buried their dead in caves or in underground vaults, depositing with the corpse sacred figurines of clay.

TIMOTHEUS, tĭ-mō'thē-ŭs (Lat., from Gk. Τιμόθεος,), OF MILETUS. A Greek poet and musician, son of Thersander; he lived about B.C. 450-357. He was first of all a citharodes, i.e. one who, while singing, played his own accompaniment on the cithara. The special form of lyric poetry used for these public performances was the *Nomos*, whose name Terpander was said to have established. Originally this was largely a musical performance of hexameters from the epic, but Timotheus seems to have given definite form to novelties already attempted, and greatly enlarged the possibilities of artistic display by introducing a free metrical structure, which offered full scope for elaborate musical composition and vocal execution. He further enlarged his opportunities by increasing the number of strings on the cithara to eleven. His innovations met with strong opposition, and were especially distasteful to the Spartans, against whom he defends himself in his "Persians." His works have till recently been known only through the scantiest fragments and allusions, but in 1902 a papyrus manuscript of his nomos, the "Persians," was discovered by the German Oriental Society in a Greek sarcophagus at Abusir, near Memphis, in Egypt. About 116 lines of considerable length are preserved, and 80 of these are practically complete. It is the oldest Greek manuscript yet found, and was copied but a few years after the death of the author, and the fact that it is the only specimen of this branch of the Greek lyric lends special value to the poem. The subject is the defeat of the Persians at Salamis, and it seems to belong to the early years of the fourth century, when Athens was humbled and Sparta supreme, for in the vivid description of the battle there is no mention of Athens. The dialect, however, is the Attic of the poets. The style is highly wrought with many compounds and metaphorical terms, often far-fetched. Timotheus seems to have been less a poet than a musician, and with only his libretto it is scarcely possible to estimate properly his real position in Greek literary art. Consult: Wilamowitz-Möllendorf, *Timotheos, Die Perser* (Leipzig, 1903), text, a Greek paraphrase, and explanatory essay; *Der Timotheos Papyrus* (ib., 1903), photographic facsimile; T. R. in *Revue des études grecques*, vol. xvi. (Paris, 1903), an essay and translation into French.

TIM'OTHY (Gk. Τιμόθεος, *Timotheos*). One of the trusted disciples and assistants of the Apostle Paul. He was a native of Lystra, in Lycaonia, the son of a Gentile father and a Jewish mother (Acts xvii. 1). As a child he was carefully instructed in the Old Testament Scripture (II. Tim. iii. 15), but he was not circumcised. It is likely that his mother, Eunice, and his grandmother, Lois, were among the first converts made by Paul and Barnabas on their first visit to Lycaonia, and soon after, either through their or Paul's own agency, the youth Timothy embraced the new faith (II. Tim. i. 5). When Paul revisited Lystra Timothy was already favorably known in the neighborhood as an active Christian (Acts xvii. 2). Paul persuaded him to go with him as an assistant. Probably at the same time he was ordained by the local presbytery in accord with certain prophetic intimations as to his future (I. Tim. i. 18, iv. 14). To avoid unnecessary offense to the Jews, he was circumcised. From this time until the close of Paul's life Timothy was one of his most faithful, trusted, and intimate disciples. He was intrusted several times with important missions to the churches founded by the Apostle. At Berea (Acts xvii. 14), Athens, and Thessalonica (I. Thess. iii. 1-6), at Corinth, and later at Ephesus (I. Cor. iv. 17, xvi. 10), and again in Macedonia (Acts xix. 21-22) he rendered important services, and is joined with himself by Paul in the addresses of several of his epistles. Though he went to Jerusalem with Paul (Acts xx. 4), he was probably engaged in labors elsewhere when the Apostle embarked on his voyage to Rome. He visited his master at Rome (see the opening words of Philippians, Colossians, and Philemon), and was probably sent by Paul, shortly before his release, with a message to Philippi (Phil. ii. 19). After the Apostle's release he rejoined Timothy in the East, and later left him in charge at Ephesus in a position full of great responsibility. In his anxiety Paul wrote him the letter of advice and warning known as I. Timothy. When Paul was imprisoned the second time, and probably not long before his death, he wrote II. Timothy, summoning his beloved disciple to come to him as quickly as possible. At some later date Timothy himself was arrested, but afterwards released (Heb. xiii. 23). According to tradition he passed the remainder of his days as Bishop of Epheus.

TIMOTHY and TITUS, EPISTLES TO. Three letters of the New Testament commonly known as the Pastoral Epistles, bearing in their opening passages the claim to have been written by Paul.

The first two are addressed to Timothy, Paul's companion and fellow worker, whom the Apostle associated with himself at Lystra, on his second missionary tour (Acts xvi. 1-3), and who continued with him practically through the remainder of his active ministry. He was with Paul also in Rome, where he is named with the Apostle in the Epistles to the Colossians, Philippians, and Philemon. The last letter is addressed to Titus, also one of Paul's helpers, first met with in connection with the mission work in Antioch (Gal. ii. 1-4; cf. Acts xv. 2), and probably more or less associated with the Apostle's later work, though he is not mentioned again until the correspondence with the Corinthian church. All three letters have to do with the Apostle's instructions regarding the pastoral service in which the recipients were engaged at the time of writing. The second letter to Timothy, however, contains in addition a different element of a more personal kind.

For almost a century these letters have been the subject of critical suspicion in respect of their authorship, being discredited by liberal criticism long before the Tübingen School assigned them to the Gnostic period of the second century, and standing to-day as among the most generally rejected portions of the New Testament. At the same time, there has been from the first more or less disposition on the part of such criticism to recognize in the letters certain traces of genuine Pauline material—this tendency receiving of late large impulse from the propaganda of the Dutch School, which seeks to resolve all New Testament critical problems by aid of documentary sources for the writings in question. Along with this the date at which the letters in their present form were composed has been gradually moved back toward and even into the Apostolic century. The present differences in the liberal attitude toward the Epistles are practically as to the extent of Pauline material allowed in the Epistles and the nearness in thought and sympathy with the Apostle of their compiler. On the other hand, while this general negative position has been strongly combated by a conservative criticism which has sought to defend the entire genuineness of the letters, there is to-day a tendency to admit frankly the peculiar difficulties presented by the writings in the matter of their Pauline origin and a willingness to unite with all scholars in a fair and impartial study of the problems which these difficulties involve.

The question as to the Paulinity of these letters is naturally bound up in the larger question of the Apostle's second imprisonment, since it is clear that the letters disclose situations which in no way fit into the recorded life of Paul up to and including his first imprisonment. If, therefore, the Apostle was not released from the imprisonment narrated in Acts, engaging in further mission work, which ended in his being rearrested and brought to Rome for a second trial, these writings cannot reasonably be supposed to have come from his hand.

But the settlement of the question of authorship on the basis of this question of imprisonment alone has proved an unsatisfactory procedure, as in itself a second imprisonment is not possible of sufficiently definite decision to afford a critical standing ground. Scholars consequently have been giving of late increased attention to the study of the Epistles themselves —their vocabulary and literary style, the historical situations which they present, the ecclesiastical and theological development which they betray—in order to discover whether or not they involve sufficient Pauline elements to presuppose, on the Apostle's part, a further period of active ministry beyond the imprisonment narrated in Acts. The critical relation of the second imprisonment to the authorship of the letters is thus reversed, the latter rather than the former problem furnishing the standing ground from which the investigation proceeds.

In this investigation the questions which furnish the chief debate are (1) the specific stage of church organization and (2) the particular phase of false teaching which the letters disclose.

(1) As to the organization presented, it is clear that Timothy and Titus are representatives of the Apostle in charge over certain fields of work (I. Tim. i. 3, 4; iv. 11-16; II. Tim. ii. 1, 2; iv. 1, 2; Tit. i. 5, 6; ii. 15; iii. 12-14), which fields are evidently general, covering more or less extended regions around specific localities (I. Tim. ii. 8; Tit. i. 5), while the charges are apparently temporary (I. Tim. i. 3, 4; Tit. i. 5; iii. 12). The instructions given to the church officers referred to in the letters have to do with the distinctive moral qualities of the candidates, rather than with the functions of their office (I. Tim. iii. 1-13; v. 4-16; Tit. i. 5-9); while the offices themselves are presbyterial rather than monarchical (I. Tim. iii. 1-7; v. 17-19; Tit. i. 5-9). In fact, the church teaching accomplished among the people, though connected with the elder's office (I. Tim. iii. 2; v. 17; II. Tim. ii. 2-4; Tit. i. 9) is not confined to official hands, but is extended to individual members within the congregation who carry it on from house to house. It is this that the false teachers abuse (I. Tim. i. 3-7; vi. 3-5; II. Tim. iii. 6-9; Tit. i. 10-14). Clearly this organization is not what we find in the recorded New Testament history.

(2) As to these false teachers, they are evidently of two classes: (A) a class then at work among the people (I. Tim. i. 5-11; vi. 3-10; II. Tim. ii. 14, 16-18, 24-26; iii. 8, 9; Tit. i. 10-16) and (B) a class definitely predicted as to develop among them in later times (I. Tim. iv. 1-3; II. Tim. iii. 1-7; vi. 3, 4). (A) The present class is evidently further divided into two groups: (1) The main portion, working among the congregation, as members themselves of the churches (I. Tim. vi. 20, 21; II. Tim. ii. 17, 18; iii. 6-9; Tit. i. 10-16). (2) The smaller portion separated from all church membership (I. Tim. i. 19, 20; v. 11-15; Tit. iii. 10). (1) This first and larger group is described in the letters (a) as only nominally Christian (I. Tim. i. 4, 19; II. Tim. ii. 14-18; Tit. i. 9, 13, 16); (b) as having their chief occupation in teaching among the people of the parishes—going from house to house with their doctrines and making their teaching a business of money gain (I. Tim. vi. 3-10; Tit. i. 11); (c) as busying themselves in this teaching with affairs which ministered only to wordy disputes (I. Tim. i. 4; vi. 4; Tit. iii. 9) and within these disputes as having specifically to do with Jewish questions such as the contents and authority of the Mosaic law (I. Tim. i. 7); Tit. iii. 9), Jewish legends and genealogies (I. Tim. i. 4; Tit. i. 14; iii. 9). (d) At the same time it is evident that they are not identical with the Judaizers pictured to us in the Galatian and Corinthian Epistles. They are developed beyond them, especially in their indifference to the moral claims of the Christian life (I. Tim. i. 10; vi. 3-10; Tit. i. 15-16). On the other hand, they are not advanced to the full matured Gnostic doctrine of God. Formally they hold to the doctrine of God and grace, though practically denying them in life (II. Tim. iii. 5; Tit. i. 16). (2) The second and smaller group is more definitely referred to in the letter to Titus, but in the Timothy Epistles some appear to have been excommunicated on moral grounds (I. Tim. i. 19, 20), while certain younger women, who had rejected their first faith, seemed to have 'turned aside to Satan' (I. Tim. v. 11-16). (B) The future errorists arrange themselves in three groups: (1) The first is described in I. Tim. iv. 1-3 as carrying on an extreme form of

teaching and developing a hardness of character. (2) The second is described in II. Tim. iii. 1-5 as wholly demoralized in character and yet as nominally within the Church. (3) The third is described in II. Tim. iv. 3, 4 as not enduring wholesome teaching and consequently as turning definitely away from the truth to legends. Evidently these teachers, whether present or future within the Church or separated from it, are no reproductions of the errorists described in any of the accepted New Testament writings.

Inasmuch, however, as the instructions to Timothy and Titus are gathered largely around these two points of organization and false teaching, it is evident that should the development of the errors of the Church life show itself to be beyond what was possible in the Apostolic age, these letters which portray them—or at least those portions of the letters which contain their description—must themselves come under strong suspicion of being by a later hand than Paul's. At the same time it is generally recognized that, in proportion as the Church organization is seen to involve on the part of Timothy and Titus a representative and not an independent position, exercised over a large region of country, necessitating a more or less itinerant mission work, and this only for a temporary and not a permanent period, it shows an early rather than a later stage of Church life, which is confirmed by the fact that this organization involves in the instruction given to the officers qualifications in the line of moral rather than functional requirements and in the offices themselves the undeveloped presbyterial rather than the developed monarchical form, while the teaching function is carried on in this parish fashion rather than in any strictly official way. Further, in proportion as the teaching shows an unmatured and unschismatic form and is characterized by elements which are distinctively Jewish, it does not belong to the later full-fledged system of the Gnostics. The period of Church life and thought which these Epistles portray may be thus not only within the Apostolic age, but even within the period of Paul's possible lifetime, in spite of the fact that it lies beyond what is specifically disclosed to us in the New Testament writings.

Just how early this period may be, and whether or not it is within Paul's life, is the present problem before the critical investigation of these documents. It is clear, however, that should the results reached by a fair-minded study of the problem favor a possible origin from Paul, these writings would themselves stand as records of a later period of activity on the Apostle's part than that narrated in the Book of Acts and his acknowledged Epistles, and thus be indicative of a release from his first imprisonment and of a second imprisonment at Rome. In any case it is apparent that the bearing of the external evidence for or against a second imprisonment, as well as in favor of or opposed to the genuineness of the Epistles themselves, must be in the direction of a positive or negative support of the results obtained rather than in the direction of determining the results to be obtained.

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TIMOTHY GRASS (so called from *Timothy* Hanson, who introduced the seed into the Carolinas about 1720), *Phleum pratense.* The only grass of its genus that is valued for hay and pasturage. It is the herd's grass of New England and New York, and along with the other species of the genus, is in England often called cat's-tail grass. It is distinguished by a long cylindrical panicle so compact as to resemble a close spike, strong culms, attaining a height of 4 to 5 feet, but tender and nutritious, and much relished by cattle. It is perennial, but springs up rapidly, even in the year in which it is sown. The seed is very small. It varies in size according to soil and situation, succeeding best in moist rich soils. In the United States timothy hay is considered one of the most valuable hays made wholly from grass and is commonly used as the standard with which to compare other hays. (For its feeding value, see Grasses; Hay.) Timothy may be sown alone, or, as is more commonly the practice, in a mixture with clover, generally with red clover. It succeeds best on moist rich soils. Upon dry soils it is often bulbous at base, and this form, which is due to the conditions of growth, was once described as a distinct species (*Phleum nodosum*). See Plate of Grasses.

TIM'PERLEY, Charles H. (1794-c.1846). An English printer and author, born in Manchester, and educated at the free grammar school there. He served in the Napoleonic wars and was wounded at Waterloo. Returning to England, he worked under an engraver and copper-plate printer, and in 1821 he became a letterpress printer. Late in life he settled in London, where he died. His valuable publications connected with printing comprise *The Printer's Manual* (1838); *A Dictionary of Printers and Printing* (1839); and *Songs of the Press*, original and selected, the best collection of printers' songs in English (1845). The first two books were issued in 1842 as an *Encyclopædia of Literary and Typographical Anecdotes.* Timperley also published *Annals of Manchester* (1839).

TIM′ROD, Henry (1829-67). An American poet, born in Charleston, S. C. He was educated at the University of Georgia and studied law with the Union lawyer James Louis Petigru, but finally trained himself for the position of a private tutor in families, which gave him more leisure for developing his poetical talents. During the years immediately preceding the Civil War he formed one of the coterie presided over by William Gilmore Simms (q.v.), and contributed poems to *Russell's Magazine* and the *Southern Literary Messenger.* In 1859 he published a volume of poems which was favorably noticed. He served as war correspondent of the Charleston *Mercury* and in 1864 removed to Columbia, S. C. His later years were passed in poverty and physical pain. His friend Paul H. Hayne superintended an edition of his poems (1873), which was well received by competent judges. In 1899 a memorial edition of his works was undertaken. His fame as the best of Southern lyrists, after Poe, and probably Sidney Lanier, is now well established. Among his best poems are "Katie," "The Cotton Boll," "Charleston," and an admirable ode on the Confederate dead buried in Magnolia Cemetery, Charleston.

TIMSAH, tĭm′sä, Lake. A lake traversed by the Suez Canal (q.v.).

TIMUCUA, tė-mo͞o′kwȧ, or Timuquanan (ruler, master). A group of tribes, constituting a distinct linguistic stock, which formerly occupied central and northern Florida from about Tampa Bay and Cape Canaveral northward to Saint Mary's River. Their southern limit is unknown. When first known to the Spaniards they had from twenty to forty settlements, principally along the lower Saint John's River. Narvaez (1527) and De Soto (1539) both passed through their territory, meeting determined resistance in each case. The Huguenots, under Laudonnière, landing on the east coast in 1564, met with a friendly reception, the friendship continuing during the brief existence of the French colony. At this time there seem to have been at least five cognate tribes speaking as many dialects. On the expulsion of the French the Timucua tribes came under the dominion of the Spaniards, by whom they were compelled to work in large numbers upon the fortifications of Saint Augustine. In 1687, already greatly diminished, they made an unsuccessful attempt to revolt. In 1702-06 successive inroads of the English of Carolina, with their hundreds of Indian allies, wiped out the mission villages of the Timucua, who fled to the upper waters of the Saint John's, where Tomoco River in the present Volusia County preserves their name. The abandoned territory was afterward occupied by the Seminole (q.v.). Consult Pareja, *Arte de la lengua timuquana* (new ed. by Adam and Vinson, Paris, 1886).

TIMUR, tė-mo͞or′, Timur-beg, Tamerlane, or Timur-leng (Timur the Lame) (1336-1405). A Mongol conqueror, born at Kesh or Sebz, 40 miles from Samarkand. At this time the real power over Turkestan was in the hands of independent chiefs of Mongol blood, each of whom chose a prominent city of the kingdom, and thence ruled the surrounding country. One of these chiefs, Haji Berlas, the uncle of Timur, had established himself at Kesh, and here the future conqueror passed the first twenty-four years of his life. In 1360 the Kalmucks of Jettah, led by Tughlak Timur, subjugated Turkestan. Declining to accompany his uncle in his flight, Timur met Tughlak, who made him governor of Kesh, and appointed him one of the principal ministers of his son, the new monarch of Turkestan. The Kalmucks were ultimately expelled in 1365, and Turkestan was divided between its two liberators, Hussain and Timur. In 1369 war broke out between them, Hussain was defeated and slain, and Timur became lord of Turkestan. He did not, however, assume the rank of a sovereign, but, elevating one of the royal race to the throne, reserved for himself the real authority and the title of Emir. He then proceeded to take vengeance on the Kalmucks and turned westward to punish the predatory tribes of Khwaresm, who had plundered Bokhara. He spent the interval between these campaigns in supporting Toktemesh Khan, one of the claimants to the throne of Kiptchak, whom he placed in 1376 in undisputed possession. In 1383 the people of Herat, whom he had subdued a short time before, rebelled and murdered his envoys. In punishment for this 2000 of the garrison, built up with alternate layers of brick and mortar into the form of a pyramid, were left by Timur as a reminder of the consequences of rebellion. Seistan was next reduced, and the Afghans of the Suleiman Koh were conquered. In the following year he invaded Mazanderan, and by the close of 1387 the whole of the country east of the Tigris, from Tiflis to Shiraz, was subdued. Those chiefs who voluntarily submitted were mostly confirmed in their governments, but the inhabitants of Ispahan who, after a pretended submission, suddenly rose against the Tatar garrison and massacred 3000 of them, were almost completely exterminated.

Meanwhile, Toktemesh Khan invaded Timur's territories on the Amu. Timur brought him to bay on the banks of the Bielaya (a tributary of the Kama), June 18, 1391, where he almost annihilated his forces. In 1392 Timur crossed the Tigris, subdued the numerous and warlike principalities to the east of the Euphrates, then advanced northward, through the gates of Derbend, to the Volga, in 1395 again routed Toktemash on the banks of the Terek, and then turned west as far as the Dnieper, and then north to Moscow, returning by Astrakhan and the Caucasus, leaving death and desolation in his track. In 1398 Timur entered India by the passes of the Hindu Kush, near Kabul, and routed the armies which opposed him, till the number of prisoners became so great that four days before the great battle at Delhi he ordered the murder, in cold blood, of all the males (said to be 100,000 in number), and then took the capital. After advancing to the Ganges, Timur returned to Samarkand, where he expended the spoils of the expedition in the adornment of his city. In the following year he attacked the Egyptian Empire in Syria. He was as usual completely successful. Timur's aid was then invoked by the Emperor of the East and several princes of Asia Minor to help them defeat the Turks led by Bajazet I. (q.v.). The two hosts met at Angora on July 20, 1402, and after a long and obstinate contest the Turks were totally routed and Bajazet captured. The conquest of the whole of Asia Minor speedily followed. The Byzantine Emperor did homage to the victor, as did also the Turkish ruler of Thrace, and the Knights of Saint John were expelled from Smyrna. On his return Timur conquered Georgia, where he passed the winter, and, resuming his march in the following year by way of Merv and Balkh, he reached Samarkand in 1404. Here he resumed preparations for his long projected invasion of China, and was marching along the Sihun when he was attacked by ague, and died after a week's illness, February 17, 1405.

Timur did much to promote the arts and sciences throughout his dominions, and, despite his cruelty in war, was an able, politic, and kindly ruler in time of peace, although the speedy dissolution of his empire deprived his labors of any permanent utility. Two works are attributed to him, entitled *Malfūzāt*, or Annals, translated by Stewart (London, 1830), and *Tukūzāt*, or Ordinances, translated by Davy-White (Oxford, 1783) and Langlés (Paris, 1787). Their authenticity is neither proved nor disproved. In literature Timur is best known through Marlowe's drama *Tamburlaine the Great* (q.v.). Consult: Sharaf ud-din Ali Yazdi, *Zafarnāmah*, translated by Petis de la Croix, *Histoire de Timur-Bec, connu sur le nom du grand Tamerlan* (Paris, 1722); Manger, *Vita Timuri*, a translation of the Arabic biography by Ibn Arabshah (Leovardae, 1767-72); Horn, "Geschichte Irans in islamitischer Zeit," in Geiger and Kuhn, *Grundriss der iranischen Philologie*, vol. ii. (Strassburg, 1900).

TIN (AS. *tin*, OHG. *zin*, Ger. *Zinn*, tin; connected with Goth. *tains*, AS. *tān*, OHG. *zein*, twig, thin leaf of metal). A metallic element known since ancient times. Implements formed of an alloy of tin and copper have been found among ancient Assyrian remains, and the tin employed in the manufacture of such bronze was obtained by the Phœnicians from the islands called Cassiterides, somewhere off the west coast of Europe. It is known definitely that after the conquest of Britain by the Romans tin was carried from the Cornish mines through Gaul, by way of Marseilles, to Italy. Pliny distinguished tin as *plumbum album* or *candidum* from *plumbum nigrum* (lead), and about the fourth century the name of *stannum* was given to tin. The alchemists called it *jupiter*, and sometimes *diabolus metallorum*, owing to its property of forming brittle alloys. Native tin is said to have been found in small crystalline grains with corundum, gold, and platinum in superficial deposits in New South Wales, and it has been reported elsewhere, but it is extremely doubtful whether the metal occurs native. The principal ore is the dioxide, *cassiterite*, sometimes called 'tinstone;' tin is also found as the sulphide, with copper and zinc, the mineral being known as *stannite* or *tin pyrites*. Smaller quantities of tin are also contained in certain other minerals.

Tin (symbol, Sn, *stannum;* atomic weight, 119.05) is a silver-white, lustrous metal that has a specific gravity of about 7.3, and melts at 235° C. (455° F). It can be easily rolled or hammered out to thin foil and at 100° C. (212° F.) may be drawn into wire, which, however, possesses but little tenacity. Tin has a fibrous structure, and when bent emits a peculiar crackling sound, caused by the friction of the crystalline particles. It finds extensive use in the manufacture of tin plate (see below), in the preparation of vessels for household and technical purposes, for the manufacture of tin-foil, for tinning copper and iron, and in the manufacture of alloys, including amalgam for silvering mirrors, bell metal, bronze, gun metal, pewter, type metal, etc. It combines with oxygen to form two oxides, of which the stannous oxide, or monoxide, is an olive brown powder that is obtained when stannous oxalate is heated out of contact with air, and combines with basic radicles to form *stannates*, of which the sodium stannate is used in calico dyeing and printing. The stannic oxide, or dioxide, which is found native as cassiterite, is obtained as a white powder when tin is heated until it burns in the air. It finds some use, under the name of 'putty powder,' for polishing plate glass, and also for imparting a white color to glass and enamels. *Stannous chloride*, $SnCl_2$, and *stannic chloride*, $SnCl_4$, are both used as mordants in dyeing and calico printing under the name of 'tin salts' or 'tin crystals,' and are readily prepared by dissolving the metal in hydrochloric acid. Stannic sulphide, which is prepared by heating tin with mercury, sulphur, and ammonium chloride, is known commercially as 'mosaic gold,' and was formerly used for gilding, imitating bronze, etc. The beautiful purple-colored precipitate obtained by the reaction of gold chloride on stannous salts has been described under CASSIUS, PURPLE OF (q.v.).

OCCURRENCE AND PRODUCTION. Tin ore or cassiterite has been found in many localities in different parts of the world, but its occurrence from a commercial standpoint is quite limited. Its sources are veins in the older rocks, particularly a variety of granite called greisen. and alluvial deposits, the latter being formed by the erosion of rocks carrying the veins. The ores obtained from veins are commonly known as lode-tin, while those found in stream deposits are known variously as black tin, tin sand, stream tin, and *barilla*. The principal supplies of ore are obtained from the East Indies, in the islands of Banca, Billiton, and Sumatra, the Malay Peninsula, Australia, Bolivia, and Cornwall, England. Most of the ore from the East Indies and Malay Peninsula is obtained by washing alluvial gravels. There are also mines in Saxony, Bohemia, Russia, Spain, Portugal, and Japan, but the aggregate output of these countries is insignificant. The occurrence of tin in California, Texas, South Dakota, and North Carolina has been known for a long time, but so far it has not been mined anywhere on a commercial scale. A discovery of ore in the York district of Alaska has been the cause of active exploration in that region, and there is some prospect that it may lead to the successful inauguration of tin-mining within the territory of the United States.

The world's production of tin in 1901 as reported by *The Mineral Industry* was as follows:

	Metric tons
Austria	49
Banca and Billiton	19,365
Bolicia	14,932

	Metric tons
England	4,634
Germany	1,451
New South Wales	677
Singkep	793
Straits Settlements	51,339
Tasmania	1,818
Total	95,058

Metallurgy. The only ore of tin which is used for the extraction of the metal is tinstone or cassiterite. The extraction of tin is usually performed by dry methods, that is by a process of calcining and reduction in furnaces, but wet methods and electro-metallurgical methods are also employed to some extent. The ore when mined from veins has to be stamped to a very fine powder before the valuable portion can be effectually separated. This separation is performed by an elaborate series of washings whose effect is to remove the lighter impurities and to leave the heavy particles of tin where they can be collected. Various forms of washing apparatus are employed (see Ore Dressing), but the most common appliance is the buddle. In this device the ore and earthy matters, in the state of a thick mud, are conveyed by square pipes or channels to the circumference of a conical table on which, by the aid of water, the metallic portion separates, the lighter stony impurities flowing down toward the centre, and being carried away. There are also brushes for agitating the ore during the operation.

The tin ore thus far purified has next to be deprived of its sulphur and arsenic if these substances should be present; this is done in a reverberatory furnace, the flues of which are connected with large condensing chambers, in which the arsenic is deposited in a crystalline form. The sulphur which is present in the state of sulphide of iron is decomposed by the heat into sulphurous acid gas, and the remaining oxide of iron is removed by a subsequent washing. Sulphide of copper, when present, is converted by roasting, and afterwards exposing it to the air, into sulphate of copper, and is then easily dissolved out by lixiviation.

After this final washing the ore is ready for smelting in a reverberatory furnace. The charge consists of from 20 to 25 cwts. of ore mixed with one-sixth of its weight of powdered anthracite or charcoal, and a small quantity of lime or fluor-spar, to serve as a flux for the siliceous impurities. Before being put into the furnace, the mixture is moistened with water, to prevent the finely powdered ore being carried away by the draught. When the charge is placed on the hearth of the furnace, the doors are closed, and the heat gradually raised for about six hours; the oxide is then reduced by the carbon of the coal. At this stage the furnace door is opened, and the mass worked with a paddle, to separate the slag, which is raked off, and the richer portion of it melted over again. The reduced tin subsides to the bottom, and is run off into a cast-iron pan, from which it is ladled into molds, to produce blocks or ingots of a convenient size.

The tin has still to be purified, first by a process of *liquation*, and afterwards by that of *boiling*. 'Liquation' consists in moderately heating the blocks in a reverberatory furnace till the tin, owing to its comparatively easy fusibility, melts and flows into the refining basin, leaving on the hearth of the furnace a residuary alloy of tin with iron and other metals. More blocks are added and heated in the same way, till the refining basin contains about five tons. The tin is then ready for 'boiling.' In this operation billets of green wood are plunged into the melted metal, the disengagement of gas from which produces a constant ebullition, and so causes a scum (chiefly oxide of tin) to rise to the surface, which is then easily removed; at the same time, impure and dense parts fall to the bottom. When the agitation has gone on long enough, the bath is allowed to settle and cool. The tin then separates into zones—the upper consisting of the purest portion, the middle being slightly mixed with other metals, and the lower so much so that it requires to go through the refining process again. The residuary alloy of the liquation process has also its tin extracted and refined again.

In former times in Cornwall tin was smelted in a blast furnace (see Iron and Steel) instead of a reverberatory one; and this is still the case on the Continent. By this method a pure tin is obtained, but the loss of metal in the process is greater. It works best where coal is scarce and wood abundant.

Tin ores which contain the mineral wolfram (tungstate of iron and manganese) are treated by a special process, patented by R. Oxland, of Plymouth, England. This mineral and tin ore are so nearly the same in specific gravity that no mechanical process of washing will separate them. Oxland's process consists in roasting the dressed tin ore with sulphate of soda, for the purpose of converting the insoluble tungstate of iron and manganese into the soluble tungstate of soda, which is easily removed by lixiviation. The oxides of iron and manganese, which are left in a finely divided state, can then, from their lower density, be readily got rid of by washing. The tungstate of soda procured in the operation has been found to be one of the most valuable substances for rendering cotton cloths non-inflammable.

Tin Plate. A very large proportion of the tin obtained each year is employed in the plating of iron and steel sheets which are manufactured subsequently into cans for preserving and other purposes. The sheets from the rolling mills are cleaned in bran-water which has soured and in dilute sulphuric acid, after which they are plunged into baths of molten tallow and tin. The treatment with tallow prevents oxidation of the metal. After the sheets have taken on a sufficiently heavy plate, they are carefully cleaned with bran. An inferior quality of plate called terne plate is made by dipping sheets in an alloy of tin and lead.

Bibliography. For the occurrence and mining of tin, consult *The Mineral Industry* (New York, annual); Charleton, *Tin Mining* (London, 1884). For the metallurgy of tin, see Schnabel, *Handbook of Metallurgy*, vol. ii., Eng. ed. (London, 1878).

TINAMOU. The native, and now the popular, name for birds of the family Tinamidæ, inhabiting the tropical portions of South America, having many remarkable features in their internal organization, and the striking external character that the tail is exceedingly short or entirely absent. Like partridges in general appearance, and varying in size from that of a quail to the bigness of a large grouse, and prevailingly brown in color, they are classed as game-birds in South America, and are frequently called 'partridges.' Their flight is strong and swift, yet they haunt the undergrowth of dense forests or bushy and grassy flats, run with amazing rapidity, and conceal themselves with great skill, rather than take to flight. But they are rather stupid, and can be caught with a noose on the end of a stick, especially if they are approached on horseback. Their food is miscellaneous, like that of game-birds generally, and their voice a mellow whistle. The flesh is delicious. They make very simple nests on the ground, and lay eggs varying from reddish chocolate, wine-purple or liver-color, to dark blue or green, and burnished to a metallic sheen. A typical example of the group is illustrated on the Plate of CASSOWARIES, ETC. This is the 'great' tinamou (*Rhynchotus rufescens*), or 'perdiz grande,' of Argentina.

The tinamous have been regarded by many systematists as within or near the Ratitæ, but are placed by Gadow as a separate group of ordinal or subordinal rank among the Carinatæ, between the falcons and the quails. Consult: Gadow, "Aves," in Bronn's *Thier-Reich* (Leipzig, 1893); Evans, *Birds* (London, 1900); Newton, *Dictionary of Birds* (New York, 1896); Sclater and Hudson, *Argentine Ornithology* (London, 1889).

TINCTURE (from Lat. *tinctura*, a dyeing, from *tingere*, to dye, Gk. τέγγειν, *tengein*, to moisten, dye). A medicinal preparation of a drug by maceration or by dissolving non-volatile principles in alcohol. In some tinctures strong alcohol, in others dilute alcohol, is used. In almost all cases the resulting liquid is of a decided color; hence the name. Obviously tinctures must be kept in tightly closed bottles to prevent evaporation. They furnish a most convenient form for dispensing drugs, either alone or in combination. There are over 70 official tinctures in the United States Pharmacopœia. Among these are the once popular tincture of arnica, used for bruises and sprains, but much inferior to pure alcohol; compound tincture of cinchona, the equivalent of the old Huxham's tincture; tincture of the chloride of iron, the most widely used chalybeate; tincture of ipecac and opium, a liquid form of Dover's powder; compound tincture of lavender, an aromatic stimulant used in colic; tincture of myrrh, so largely employed in mouth washes and dentifrices; tincture of opium, or laudanum; camphorated tincture of opium, or paregoric; tincture of squill, familiar as a component of cough mixtures; and tincture of ginger, frequently known as 'essence of ginger.' There are also ethereal tinctures, in which the solvent used is ether in place of alcohol.

TINCTURE. The general designation for colors, metals, and furs in heraldry (q.v.).

TIN'DAL, MATTHEW (c.1653-1733). A deistical writer. He was the son of a clergyman at Beer-Ferris, in Devonshire, was educated at Oxford, and elected fellow of All Souls' College in 1678. After a brief lapse into Romanism during the reign of James II. he reverted to Protestantism, or rather, as events showed, into rationalism. It was not till 1706 that he attracted particular notice, when the publication of his treatise on *The Rights of the Christian Church Asserted Against the Romish and All Other Priests Who Claim an Independent Power Over It* raised a storm of opposition. On the Continent Tindal's work was quite differently received. Le Clerc, in his *Bibliothèque choisie*, praises it highly, as one of the solidest defenses of Protestantism ever written. In 1730 he published his most celebrated treatise, entitled *Christianity as Old as the Creation, or The Gospel a Republication of the Religion of Nature.* The design of the work is to strip religion of the miraculous element, and to prove that its morality is its true and only claim to the reverence of mankind. Tindal's book is written in excellent English, and is an able performance, giving its author a distinguished place among the eighteenth-century deists.

TINDER. An inflammable material, usually made of half-burned linen. It was formerly one of the chief means of procuring fire before the introduction of friction matches. The tinder was made to catch the sparks caused by striking a piece of steel with a flint; and the ignited tinder enabled the operator to light a match dipped in sulphur. This intermediate step was necessary in consequence of the impossibility of making the tinder flame. Partially decayed wood, especially that of willows and other similar trees, also affords tinder; and certain fungi furnish the German tinder, or amadou (q.v.).

TIN'EA (Lat., gnawing worm). A name given to several varieties of vegetable parasitic skin diseases. For *tinea favosa*, *see* FAVUS. *Tinea trichophytina* or *ringworm* may appear as an eruption on several parts of the body, receiving a modification of the name in each case, as *corporis, cruris, capitis, barbæ*, etc. It is very common among the poorer classes, and spreads with great rapidity in schools and asylums. Tinea of the scalp is often propagated by indiscriminate use of combs, hats, towels, and brushes, as well as by propinquity in sleeping. A red spot appears, marking the beginning of the eruption, which soon becomes scaly and enlarges, forming a ring possibly half an inch in diameter, leaving a clear centre. The margin of the circle is well defined, elevated, red, and covered with fine scales easily detachable. Mycelium and spores are seen in microscopic examination of the scales. There is seldom much irritation, except in the cases where the crotch or axilla is invaded. The *tinea trichophytina cruris* or *eczema marginatum* is not infrequent in the United States. In warm climates it is very common and severe, and is known as *Indian, Chinese*, or *Burmese ringworm*, also as *Dhobie's itch*. Hyposulphite of soda, bichloride of mercury, acetate of copper, and tincture of iodine are frequently efficacious in the *tinea corporis* and *cruris*. Bulkley recommended sulphurous acid for the latter. *Tinea capitis*, also called *tinea tonsurans*, is very intractable, and perseverance must be used in the application of carbolic acid, green soap, mercury, oil of cade, etc., always used in the form of an ointment. *Tinea versicolor*, or *Pityriasis versicolor*, is very common in warm countries, though also frequent in the United States. The front of the chest is most often attacked, the back next. The parasite

Microsporon furfur is probably the cause of tinea versicolor. The treatment consists of frequent bathing with strong soap, hyposulphite of soda applications, or the use of bichloride of mercury, salicylic acid, sulphur, and glycerin. The prognosis is good.

TINEIDÆ. See LEAF-MINER.

TINEL, tē'nĕl', EDGAR (1854—). A Belgian pianist and composer, born at Sinay. In 1863 he became a pupil at the Brussels Conservatory, and ten years later he received the first prize for pianoforte and published four nocturnes for solo voice with pianoforte. In 1877 he won the Grand Prix with his cantata *Klokke Roeland.* He succeeded Lemmens as director of the Institute for Sacred Music at Mechlin, in 1881, and in 1888 produced the oratorio *Franciscus,* which gave him fame. In 1889 he was appointed inspector of the State music schools of Belgium and in 1896 became professor of counterpoint and fugue at the Brussels Conservatory. He produced a *Grand Mass of the Holy Virgin of Lourdes* for five parts; *Te Deum* for four-part mixed choir with organ; *Alleluia* for four equal voices with the organ; the music drama *Godoleva* (1896); motets and sacred songs. He also published *Le chant grégorien, théorie sommaire de son exécution* (1895).

TINGHAI, tĭng'hī'. The chief town of the island of Chusan (q.v.), China.

TINGITIDÆ. See LACE-BUG.

TINGUAITE, tĭn'gwȧit (named from Sierra de Tingua, Brazil). An igneous rock of granular or porphyritic texture, characterized by the mineral combination alkali feldspar, nepheline, and ægerine, or ægerine-augite. It is a rock of very limited distribution, but generally occurs in dikes associated with nepheline syenite, to which it is genetically and chemically related.

TINGUIANE, tĭn-gwē-ä'nȧ. A brown people in northern Luzon. See PHILIPPINE ISLANDS.

TINITIAN. A Malay-Negrito people in Palawan. See PHILIPPINE ISLANDS.

TINKER-BIRD, or TINKER BARBET. See COPPERSMITH.

TINKER'S ROOT. See FEVERWORT.

TINNÉ, tē'nȧ' (Athapascan, people). A collective term sometimes used as synonymous with Athapascan stock (q.v.), but more usually employed to designate the tribes of that stock residing in the Canadian northwest, exclusive of the Kuchín (q.v.). In this restricted sense it includes the Sarsee, Taculli, Sicauni, Nehaunee, Beaver, Hare, Chippewyan, Montagnais, Slave, and others, who number in all about 12,000, chiefly on the waters of the Upper Yukon, Upper Mackenzie, Upper Fraser, Peace River, Athabasca River, and the lakes connected with them.

TINNÉ, tĭn'nȧ, ALEXINE (1839-69). A Dutch explorer in Africa, born at The Hague. In 1856 she visited Palestine, Syria, and Egypt, and having definitely removed to Cairo in 1861, started for the Upper Nile in January, 1862, and reached Gondokoro in September, but was compelled by sickness to return to Khartum. In February, 1863, she set out with an enormous train on a second expedition, with Bahr-el-Ghazal for its goal, in which Henglin (q.v.) and Steudner (1852-63) participated and which advanced as far as Dembo in the Bongo country. Steudner and Miss Tinne's mother having succumbed to the climate, the expedition returned to Khartum in March, 1864. Its results were described in the *Transcations of the Historical Society of Lancashire, etc.,* vol. xvi. (Liverpool, 1864). In 1865 Alexine Tinné visited Crete, Greece, and Italy, went to Algiers in 1866, traveled through the French Sahara in 1868, and in January, 1869, started with a strong retinue for the interior, intending to penetrate to the Nile via Bornu. Detained by sickness at Murzuk, she then proceeded toward Ghat by invitation of the Tuareg chief Ikhenukhen, but was assassinated by the Tuaregs escorting her, on August 1st. Consult: Henglin, in *Petermanns Mitteilungen, Ergänzungsheft 15* (Gotha, 1865); and id., *Reise in das Gebiet des Weissen Nil, etc.* (Leipzig, 1869).

TIN'NEVEL'LI or **TINAVELLY.** The capital of a district of Madras, British India, 99 miles southwest of Madura, on the left bank of the Tambraparni River (Map: India, C 7). It is connected with Palamcotta on the opposite bank by a handsome bridge. The most striking edifice is the Siva temple. There are two colleges, and the town has long been an important centre for Protestant missions. Cotton goods are extensively manufactured. Tinnevelli became a British possession in 1801. Population, in 1901, 40,469.

TINNI'TUS AURIUM (Lat., ringing of the ears). Ringing in the ears. In most cases it is an unimportant symptom, depending on some local temporary affection of the ear, or on some disturbance of the digestive system; but as it is also a common symptom of organic disease of the auditory nerve, it may indicate a dangerous condition, or may be a prelude to complete deafness. It may be a symptom of neurasthenia (q.v.), and may occur in a number of diseases. Hence, although commonly of no consequence, it is a symptom that, especially if permanent, must be carefully watched. It may be readily induced for a few hours by a large dose of quinine or of the salicylates.

TINOCERAS. A huge proboscidean, allied to Coryphodon, Dinoceras and Uintatherium, found fossil in the Middle Eocene (Bridges) formations of Wyoming. Its most prominent characteristic was the long, narrow, somewhat quadrangular skull, bearing six great protuberances, one pair on the nasal bones pointing forward, a second outward-bending pair on the upper jaw-bones (maxillaries), and a third over the eyes (on the parietals), where there was a semicircular upright crest of bone. These protuberances seem not to have been covered with ordinary horn. The typical species is *Tinoceras ingens,* described by Marsh, *Dinocerata, a Monograph of an Extinct Order of Gigantic Mammals* (Washington, 1884).

TINOS, tē'nŏs. One of the Cyclades. See TENOS.

TINTERN ABBEY. One of the most beautiful monastic ruins in England. It is situated in a green meadow on the right bank of the River Wye, nine miles below Monmouth, on the spot where Theodoric, British King of Glamorgan, was said to have fallen in battle against the heathen Saxons, A.D. 600. The abbey was founded in 1131 for Cistercian monks by Walter de Clare;

the church was begun a century later through the munificence of Roger de Bigod, Earl Marshall and dedicated in 1268. The tower and roof are gone; but the church remains one of the finest examples of the Decorated Style—the English High Gothic—beautiful in composition and delicate in execution. The nave is 228 feet long, the transept 150, and the width of nave and choir, 37 feet. The ruins of the convent buildings also remain. Tintern Abbey is well known through Wordsworth's celebrated "Lines" composed a few miles above Tintern Abbey.

TINTO, DICK. (1) An artist, the son of a village tailor, introduced in Scott's *Bride of Lammermoor,* and *St. Ronan's Well.* (2) The nom de plume of Frank Booth Goodrich.

TIN'TORET'TO, Il (1518-94). The name usually applied to Jacopo Robusti, one of the chief masters of the Venetian Renaissance. He was born at Venice, the son of a dyer (*tintore*), whence his name, and at an early age was placed with Titian. According to the traditional account, the jealousy of Titian soon forced him to leave; but their separation was more probably due to Tintoretto's different point of view, which saw in the plastic rendition of the human body in action, rather than in color, the chief problem of art. Taking an independent atelier, he subjected himself to one of the severest courses of training on record. Following his great aim, as announced in the motto upon the wall of his studio, to unite Michelangelo's design with Titian's color, he provided himself with casts from which he drew constantly, and he even brought Daniele da Volterra's models of Michelangelo's tomb from Florence. He dissected bodies to learn anatomy, studied foreshortening and motion from suspended figures, worked by day and lamplight to get light effects, and did not scorn to learn from house painters the secrets of their technique. Besides the color of Titian he studied especially the work of his friend Schiavone, from whom he acquired the technique of fresco, and perhaps also Bonifazio Veronese, whose influence appears in his early works.

After such extensive preparation his intense eagerness for activity led him to solicit work at low prices. His earliest works, which are rare, show progress from the dark manner of Schiavone and Bonifazio Veronese to a greater transparency of color. The first work to attract attention was a lost portrait of his brother and himself with night effect, but the most important surviving example is a "Circumcision" in Santa Maria del Carmine. Somewhat later he painted five subjects from Genesis for Santa Trinità, two of which, the "Fall," and the "Murder of Abel," are preserved in the Venetian Academy, the former especially being idyllic in sentiment, and almost equal to Titian in color. After a number of façades, none of which survive, his next work of importance was the decorations of the choir of the Madonna del Orto, 50 feet in height, and the "Last Judgment." Finally, his reputation was definitely established by the series of pictures in the Scuola di San Marco relative to the abduction of the body of the patron saint of Venice from Alexandria to Venice. The episodes represented the "Finding of the Body" (Brera, Milan), its "Abduction from Alexandria," "Saint Mark Saving a Saracen from Shipwreck" (both in the Royal Palace, Venice), and "Miracle of Saint Mark" (Academy, Venice). All show Tintoretto at the height of his powers, especially the last, which so good a critic as Taine esteemed the greatest painting in Italy. It is especially remarkable for the intense dramatic actions and the treatment of the light, which issues from the saint's head and shoulders, lending rich color to the well modeled groups.

Tintoretto very seldom dated his works, and there is, consequently, no record of his activity between 1550 and 1560. It is probable, however, that during this period he painted a large number of his easel pieces, and perhaps the three grand compositions in the Ducal Palace, which were burnt in 1577. In 1560 began his remarkable activity for the guild of San Rocco, whose *scuola* (guild house) forms a perfect museum of his works, of which it and the adjoining church contain fifty-six in all, painted at different periods of his life. In 1565 he finished the "Crucifixion," a splendid piece of naturalism, and one of his very best works; in 1577 the two panels of the ceiling of the great hall: the "Pascal Feast," and "Moses Striking the Rock." Meanwhile he had become a member of the guild, and in 1577 he was employed at a salary of 100 ducats to furnish three pictures a year, which he continued to perform until his death. Among the best are a series from the life of Christ, including a strikingly original "Visitation," "Annunciation," "Christ Before Pilate," "Christ Bearing His Cross," "Ecce Homo," and a "Resurrection."

In the decorations of the Ducal Palace, begun about the same time (1560), he was extensively aided by pupils, especially by his son Domenico. In the Sala del Scrutinio he painted the "Capture of Zara;" in the Antecollegio, four charming mythological representations: "Bacchus, Ariadne, and Venus," "Mercury and the Graces," "Minerva Expelling Mars," and the "Forge of Vulcan;" in the Sala del Collegio, four votive pictures of doges, the finest of which represents the "Marriage of Saint Catharine;" and in the Hall of the Senate, "Venice, Queen of the Seas." In the Hall of the Grand Council the Doge and Senate offer the spoils of the conquered cities to "Venice in Glory," and the four battle pieces of the ceiling show keenest effects of foreshortening. There, too, a whole wall is occupied by his last great work, the "Paradise," 74 × 30 feet, the largest oil painting in the world, but which has suffered so much from the ravages of time and restoration as to be scarcely enjoyable.

His altar-pieces and easel pictures are legion, and may be found in the churches of Venice and principal galleries of Europe. We can mention only the three fine examples in San Giorgio Maggiore; "Susanna's Bath," in Vienna, Paris, and Madrid; "Vulcan, Cupid, and Venus" (Pitti, Florence), and "Abraham's Sacrifice" (Uffizi); "Origin of the Milky Way," and "Saint George and the Dragon" (National Gallery, London); "Diana and the Hour" (Berlin); and "Christ Visiting Mary and Martha" (Augsburg), one of his loveliest works. During the same period he also designed for Saint Mark's Church a series of mosaics over the arch and elsewhere of subjects from the life of Christ.

Tintoretto shared with Titian the reputation of being the greatest portraitist of his day. His early portraits, indeed, are often confounded with

Titian's, but he soon developed a highly individual style, the keynotes of which are naturalism and simplicity. Eliminating all incident, even gesture, the great painter of motion produced likenesses in the highest sense typical. With incredible rapidity he painted the doges and the nobility of Venice, who were his sitters. Of these portraits over one hundred survive, to say nothing of the important examples which we know were lost, but many of which were probably executed by his son, Domenico. Among the best examples are his own likeness in the Louvre and in the Uffizi; Vincenzo Morosini, Paolo Paruto, Tomaso Contarini, and Niccolò Priuli, in the Ducal Palace; the doges Trevisan and Priuli, Jacopo Soranzo, Andrea Dandolo and Antonio Capello, in the Academy of Vienna; the Doge Niccolò da Ponte Sebastiano Venier, the hero of Lepanto, a "Young General," and a number of admirable unknown portraits, in the Vienna Gallery.

The adverse opinion of some critics upon Tintoretto's works is due to the effect of time upon them. He used a dark ground and applied the colors but lightly, with the result that they are greatly darkened. His marvelous rapidity of execution often impelled him to do work which was sketchy, sometimes even negligent; but in his best work he shows himself one of the greatest painters of all times. His was, in a way, the culmination of Renaissance painting, and he united in himself more than did any other man all of its different tendencies. Tintoretto extended the plastic character to the entire composition, and Titian's color harmony of flat surfaces became with him a light symphony of the whole painting. By his mastery of light and shadow he was enabled to put a world of poetry and sentiment in his pictures, without, however, degenerating into illustration. He possessed a fertility of imagination unexcelled in the history of painting. His most startling innovations, however, were in composition; for the problem is far more difficult in Tintoretto's plastic work than in the relief-like productions of other masters. Sometimes he separated foreground and background, using the action in the latter to concentrate attention on the principal action in the foreground. In dramatic power he is the worthy compeer of Michelangelo, his impetuous energy having gained him the title 'Il Furioso,' and like him he indicated emotion by the action of the body.

Excepting a year's stay at Mantua, Tintoretto passed all of his life at Venice. Before 1560 he married Faustina dei Vescovi, who seemed to have her share of worry in taking care of her spouse, who was impracticable in money matters. Of his eight children, MARIETTA, the eldest, a gifted artist and his favorite child, met with an early death in 1590, whence the beautiful tradition of the old painter painting his dead daughter. He did not long survive her, and died at Venice, May 31, 1594. His son and assistant DOMENICO painted many works in superficial imitation of his father.

BIBLIOGRAPHY. The chief literary source for Tintoretto's life is Ridolfi, *Meraviglie dell' arte* (Venice, 1648). The first among modern writers to establish his fame was Ruskin in *Stones of Venice* and other works. Janitscheck's biography, in Dohme, *Kunst und Künstler Italiens* (Leipzig, 1876), is a scholarly work, but not strong from the artistic side; see also Osler, in the *Great Artists Series* (London, 1879). Brief but more critical are Berenson, *Venetian Painters* (New York, 1894), and Pratesis in *Nuova Antologia* (1890). The latest works are those of Stearn (New York, 1894) and Thode (Bielefeld, 1901), the latter the best that has yet appeared.

TIN WEDDING. See WEDDING ANNIVERSARIES.

TINY TIM. In Dickens's *Christmas Carol*, a cripple, the little son of Bob Cratchitt.

TIPPECANOE, tĭp'pē-kȧ-nōō'. A popular nickname of General William Henry Harrison, due to his victory over the Indians at the Tippecanoe River in 1811.

TIPPECANOE, BATTLE OF. An engagement fought on November 7, 1811, near the site of the present village of Battle Ground, on the Tippecanoe River, in Tippecanoe County, Ind., between an American force of about 800, including 500 Indiana and Kentucky militiamen, under William Henry Harrison, then Governor of Indiana Territory, and an Indian force, estimated by Harrison at about 6000, but probably much smaller, under the actual command of White Loon, Stone Eater, and Winnemac. About 1808 Tecumseh and the Prophet, his brother, established a village on the Tippecanoe River, and with this as their headquarters endeavored to bring all the Indian tribes of the West and Southwest into a confederation which should decide, in any given case, upon the alienation of Indian lands. Much discontent was caused among the followers of Tecumseh and the Prophet by the Indian land cessions of 1809, and the danger of an Indian outbreak became daily more imminent. On October 11, 1811, while Harrison was building a stockade on the site of Terre Haute, one of his sentinels was killed from ambush, and Harrison, considering this the beginning of hostilities, soon afterwards marched against the town on the Tippecanoe, where the Prophet was supposed to be inciting the Indians to attack the whites. On the night of November 6th he encamped within about a mile of the town, and posted his troops in the form of an irregular parallelogram, having previously arranged with the Prophet for a conference on the following day. Before dawn on the 7th the Indians attacked the camp with great ferocity and bravery, but after more than two hours of stubborn fighting were driven from the field. On the following day Harrison advanced to the town, found it deserted, and almost completely destroyed it. He then returned to Vincennes. The loss of the whites in the battle in killed and wounded was about 190; that of the Indians, though undoubtedly large, is not definitely known. At the time of the battle Tecumseh was in the South endeavoring to persuade the Creeks, Choctaws, and Cherokees to join his projected confederation. The battle rendered virtually impossible the realization of Tecumseh's plans, weakened and almost destroyed the prestige of the Prophet, hastened the general outbreak of hostilities by the Indians against the Americans in the Northwest, and greatly enhanced the reputation of General Harrison, who later, partly on the strength of this success, was placed in command of the American troops in the West. Consult Pirtle, *The Battle of Tippecanoe* (Louisville, 1900), No. 15 of the "Filson Club Publications."

TIP'PERA'RY. An inland county of the Province of Munster, Ireland, lying north of Waterford (Map: Ireland, C 4). Area, 1659 square miles. The county for the most part is in the basin of the river Suir. Other rivers are the Shannon, the Nore, the Nenagh, and the Brosna; lakes are numerous, but of small size. The surface is generally level. The Galtees Mountains which diversify it are rather groups than portions of any connected range; these mountains rise to 3000 feet. The soil of the plain is fertile; there is a considerable amount of bog in the central and eastern districts. The mineral productions are coal (anthracite), copper, and lead, also zinc and good fire-clay; slates of an excellent quality are quarried near Killaloe. Wheat was formerly grown in large quantities; but of late years its cultivation has been superseded by dairy-farming and the raising of cattle. Population, in 1841, 438,150; in 1891, 185,217; in 1901, 159,754.

TIPPERARY. The capital of Tipperary County, Ireland, on the Arra, 111 miles southwest of Dublin (Map: Ireland, C 4). It occupies a central position in a fine country, and carries on an extensive trade in butter. The town, of ancient origin, is well built, and contains Roman Catholic and Protestant churches, national schools, and a school of the Erasmus Smith endowment. In 1890 the foundation of a New Tipperary, now in ruins, was an attempt, under the Irish League's plan of campaign, to boycott the land proprietor of the old town. It proved abortive within a year. Population, 7000.

TIPPU SAHIB, tē-pōō' sä'hīb (1749-99). Sultan of Mysore, in India. He was a son of Hyder Ali (q.v.). He was actively engaged in the wars of his father, and routed the British at Perimbakum (September 10, 1780), and on the banks of the Kolerun in Tanjore (February 18, 1782). On the death of his father in 1782 he was crowned Sultan and returned at once to the head of his army, which was then operating against the British near Arcot. On April 28, 1783, he captured and put to death the garrison of Bednore. The peace between England and France deprived him of his French allies and he made a treaty in 1784 on the basis of the *status quo*. He then gave his attention to the internal affairs of Mysore, establishing a splendid court at Seringapatam. He sought, in 1787, to bring on a renewal of the war between France and England, and failing, invaded in 1790 the protected State of Travancore. In the ensuing war (1790-92) the British, under Colonel Stuart and Lord Cornwallis, were aided by the Mahrattas and the Nizam, who joined in the struggle against their powerful neighbor both out of fear and religious hatred, Tippu being a fanatical Mohammedan. The Sultan laid waste the Carnatic and advanced almost to the gates of Madras, but was defeated near Seringapatam in March, 1792, and compelled to cede one-half of his dominions, pay an indemnity of 3000 lacs of rupees, restore all prisoners, and give his two sons as hostages for his fidelity. Nevertheless, his secret intrigues against the British were almost immediately resumed. Hostilities began in March, 1799, and two months after Tippu was driven from the open field and attacked in his capital of Seringapatam, which was stormed on May 4th, the Sultan himself being slain after an heroic resistance. His dominions and property were confiscated, a portion of Mysore, however, being assigned to the Nizam. Consult Bowring, *Haidar Alí and Tipú Sultán* (London, 1893).

TIP'TON. A town in South Staffordshire, England, 4½ miles southeast of Wolverhampton, with collieries, blast furnaces, and iron manufactures. Population, in 1891, 29,314; in 1901, 30,543.

TIPULIDÆ. See CRANE-FLY.

TIPWORM. The larva of one of the gall-midges (*Cecidomyia oxycoccana*), which occurs in the terminal buds of the cranberry plant and causes them to become unusually prominent and to stop the development of the leaves. After attack the tip usually dies. The adult fly has a red abdomen and a grayish thorax, and is about one-sixteenth of an inch in length. The female has a long. extensive ovipositor by means of which she thrusts her eggs into the heart of the young shoot. The larva is a minute orange-red or yellow grub. See also HOP INSECTS.

TIRABOSCHI, tē'rā-bōs'kē, GIROLAMO (1731-94). An Italian author, born at Bergamo. He studied at Monza, and became a Jesuit. He was appointed professor of rhetoric at Milan, where he wrote his first work, *Vetera Humiliatorum Monumenta* (1766), and in 1770 succeeded Father Granelli as librarian to the Duke of Modena. Tiraboschi now availed himself of the rich stores of the ducal library, besides making extensive researches in other archives, to compose his *Storia della letteratura italiana* (1770-82, in 14 vols.). It embraces the history both of ancient and modern Italy, and is especially valuable for the light it throws upon the intellectual condition of the Peninsula during the Dark Ages, and the brilliant period from Dante to Tasso. Tiraboschi ends his elaborate survey with the close of the seventeenth century. Abridged translations have appeared in French and German. Other works by him are *Biblioteca modenese* (1781-86) and *Memorie storiche modenesi* (1793).

TIRASPOL, tē-räs'pôl. A town in the Government of Kherson, South Russia, on the left bank of the Dniester, 73 miles by rail northwest of Odessa (Map: Russia, C 5). It manufactures flour, brick, pottery, and ironware, and has a large trade. Population, in 1897, 27,585.

TIRARD, tē'rär', PIERRE EMMANUEL (1827-93). A French statesman, born in Geneva, where he learned the goldsmith's trade. He went to Paris about 1846, and in 1870 became mayor of the Sixth Arrondissement. In 1876 he entered the Chamber of Deputies as a radical Republican and he was successively Minister of Agriculture and Commerce (1879-81, and in 1882), Minister of Finance (1882-85), and Premier (1887-88 and 1889-90). Subsequently he resumed the seat in the Senate to which he had been elected in 1883. From December, 1892, to April, 1893, he was Minister of Finance in Ribot's Cabinet.

TIREE, tī-rē', or **TYREE.** A Scottish island, one of the Inner Hebrides (q.v.), included in Argyllshire, 20 miles northwest of Iona (Map:

Scotland, B 3). It is 13 miles long, and over 6 miles in extreme breadth. The surface is low and destitute of trees; but the soil is fertile. There are interesting antiquities which include Scandinavian forts, standing stones, ruined churches, and ancient graves. The inhabitants support themselves by rearing cattle, fishing, and exporting poultry and eggs. Population, in 1901, 2195.

TIREH, tē′re. A town of the Turkish Vilayet of Smyrna, Asia Minor, 25 miles southeast of the city of Smyrna, with which it has railway connection (Map: Turkey in Asia, B 3). It is the ancient *Tyrrha* of the Kingdom of Lydia. Tapestry and cotton manufacturing constitute the chief industries. Population, estimated at from 13,000 to 20,000.

TIRE′SIAS (Lat., from Gk. Τειρεσίας, *Teiresias*). In Greek legend, a famous Theban seer. He is called son of Eueres and Chariclo, and was blind from early youth, because he had seen Athena bathing. To recompense him for his loss of sight, the goddess gave him power to understand the voices of birds. Another legend represents Hera as depriving him of his sight because, being made arbiter in a dispute between her and Zeus, he had decided in favor of the latter; when Zeus as a compensation gave him unerring power in interpreting omens, and prolonged life. He appears prominently in the Theban cycle of legends, and was said to have died from a draught of water from the prophetic spring Tilphusa, after the capture of Thebes by the Epigoni, while accompanying some of the vanquished Thebans to another home. In the *Odyssey* (book xi.) we are told how Odysseus went to the lower world to consult him.

TIRHAKAH, têr-hä′kȧ. A king of ancient Ethiopia. See TAHARKA.

TIRLEMONT, têrl′môɴ′ (Flem. *Tienen* or *Thienen*). A town in the Province of Brabant, Belgium, 29 miles east by south of Brussels, on the Geete River (Map: Belgium, C 4). Its walls, which had a circumference of about six miles, were dismantled early in the nineteenth century. The chief objects of interest are the recently restored churches of Saint Germain and Notre Dame du Lac. The former is a composite of the Romanesque and early Gothic, and was begun in the ninth century. Its most striking feature is the altar-piece by Wappers. The Church of Notre Dame du Lac dates partly from the thirteenth and partly from the fifteenth century. There are manufactures of engines, leather, cotton and woolen goods, etc. Population, in 1900, 17,855.

TIRNAU. See TYRNAU.

TIRNOVA, tēr′nô-vȧ (Bulgarian *Trnova*). A district town in the Principality of Bulgaria, situated on the Yantra and the Sofia-Varna Railway, 124 miles northeast of Sofia (Map: Balkan Peninsula, E 3). It contains a number of mediæval churches. The chief industries are dyeing and the manufacture of copper ware. Tirnova was the capital of Bulgaria for about two centuries until 1393, when it was taken by the Turks. Population, about 13,000.

TI′RO, MARCUS TULLIUS. Slave, pupil, and subsequently amanuensis of Cicero, whose life he wrote and whose letters he collected. He is known chiefly as the inventor of the ancient stenography (see SHORTHAND), called after him *notæ Tironianæ*. He died at almost a hundred years of age.

TIROL, tē-rōōl′. A crownland of Austria. See TYROL.

TIRSO DE MOLINA, tēr′sō dȧ mō-lē′nȧ. The pseudonym of the Spanish dramatist Gabriel Tellez (q.v.).

TIRURAYE, tē′rōō-rä′yȧ. A Malay people in Cotabato Province, southwestern Mindanao. See PHILIPPINE ISLANDS.

TI′RYNS (Lat., from Gk. Τίρυνς). An ancient city of Argolis, in the Peloponnesus, situated a short distance southeast of Argos, near the head of the Argolic gulf. According to tradition it was founded by Prœtus, a mythic king of Argolis; and its massive walls, like other rude massive structures in Greece of unknown antiquity, were reputed to be the work of the Cyclopes. Later, Perseus was said to have ruled here, and the place was the residence of Hercules while in servitude to Eurystheus. At the time of the Dorian conquest Argos seems to have secured the supremacy over the plain, though during the Persian Wars Tiryns appears independent and sent troops to Platæa. Some time subsequently, probably about the year B.C. 468, the city was taken by the Argives; after this period Tiryns remained uninhabited, the walls of the citadel only being left standing, the wonder and admiration of later ages. The acropolis or citadel of Tiryns was built on the summit of a low, flat, rocky hill, about 980 by 330 feet in extent, which rises abruptly out of the dead level of the plain of Argos to a height of from 30 to 60 feet. It consists of three terraces, of which the highest was occupied by a prehistoric palace, the middle by lesser buildings, while the lowest has been scarcely explored, but seems to have contained only small structures. This hill was surrounded by a massive wall of huge blocks of limestone of irregular shape, laid in a clay mortar. The original height is uncertain, though in some places it is still nearly 25 feet. The thickness around the lower terrace is not quite uniform, but does not exceed 26 feet; around the upper terrace it varies from 16 to the prodigious figure of 57 feet. A part of this wall was occupied by galleries and chambers probably for the storing of provisions. The main entrance was on the east, and was reached by a ramp; on the west was a postern gate with a stairway in the rock. The palace on the summit was excavated by Schliemann and Dörpfeld in 1884-85, and until the recent discoveries in Crete was the most complete example of the home of a Mycenæan king. After passing the entrance gate, the way leads to a large propylæa, which opens into a great open court; from this a second gateway leads to another paved court (αὐλή, *aulē*), surrounded by colonnades. On one side low steps and a door lead to a vestibule, which again opens into the great hall (μέγαρον, *megaron*), with a circular hearth in the centre. Around this central structure is a complex of passages and lesser rooms, including a bath, and a smaller court with its own *megaron*, possibly the women's apartments. The essential identity of this palace with that described in the Homeric poems lends peculiar interest to the discovery. Consult: Schliemann, *Tiryns* (London, 1886); Schuchhardt, *Schliemann's Excavations*, trans. by

E. Sellers (London, 1891); Perrot and Chipiez, *Histoire de l'art dans l'antiquité*, vol. vi. (Paris, 1894).

TISCHBEIN, tĭsh'bīn. A German family of artists who lived in Hesse during the eighteenth century. Johann Heinrich, the Elder (1722-89), a painter, born at Haina, was first a pupil of the Court painter Freese, in Cassel, and then studied under Van Loo, Boucher, and Watteau at Paris. In 1748 he entered the studio of Piazzetta in Venice. Returning to Cassel in 1751, he became Court painter to the Landgrave and director of the New Academy (1776). His historical pictures and portraits were weak, but there were few better among the best works of the time in Germany. Examples are: "Lessing" (c.1760; Berlin), "Count Waldner von Freundstein" (1761; Versailles), "Augustus and Cleopatra" (1769; Cassel), and "Belisarius" (1786; Oldenburg).—Johann Friedrich August (1750-1812), also a painter, nephew of the preceding, was born in Maestricht. He studied with his uncle and in Paris and Italy. Afterwards he became Court painter in Waldeck and then director of the Leipzig Academy (1800). His canvases include nine portraits of princes and princesses of Orange-Nassau (Amsterdam), and a portrait of Schiller (1804; Leipzig).—Johann Heinrich Wilhelm, the Elder (1751-1829), a painter and etcher, also known as "the Neapolitan," cousin of the preceding, the most celebrated of the family, was born at Haina. He studied with his uncle, Johann Heinrich, and in Hamburg, Bremen, and Holland. Through the aid of Goethe he went to Italy, and accompanied the poet to Naples in 1787. There he was patronized by Sir William Hamilton and served as director of the Academy (1789-99). In 1809 he was made Court painter to the Duke of Oldenburg. At Eutin he painted the 43 "Idyls" (Oldenburg) which Goethe celebrated in verse. Among his paintings are a portrait of Goethe (Frankfort); "Conradin of Swabia Hearing His Sentence" (1784); "An Italian Landscape" (1819; Oldenburg); and a portrait of himself (Hanover). Tischbein issued about 150 etchings and engravings in connection with various publications. Consult Michel, *Etude biographique sur les Tischbeins* (Lyons, 1881).

TISCHENDORF, tĭsh'en-dôrf, Konstantin von (1815-74). One of the most eminent biblical scholars of the nineteenth century, born at Lengenfeld, Saxony. He was educated at the Gymnasium of Plauen and at the University of Leipzig. In 1840, now a privat-docent at Leipzig, he published his Greek Testament (dated 1841), and then went to Paris, where for over two years he labored incessantly among the manuscript treasures of the National Library. In 1842 the publication of the Greek text of the palimpsest Codex Ephraemi, followed soon after by his edition of the Codex Claromontanus, marked him as a textual scholar of the first rank. Though he became a professor of theology at Leipzig, the greater part of his time was spent in journeys in search of biblical manuscripts or in the work of editing and publishing the same. The great triumph of his life was the discovery (in 1859) in the library of the monastery of Saint Catharine, at Mount Sinai, of the second oldest manuscript of the Greek Old and New Testaments known, the fine uncial *Codex Sinaiticus*. A sumptuous edition of the whole manuscript in four large folio volumes was published in 1862 at the expense of the Emperor of Russia. The crowning work of Tischendorf's life was his eighth edition of the Greek Testament with its large critical apparatus, the indispensable *vade mecum* of every student of the text of the New Testament. Tischendorf's numerous publications may be found, with a sketch of his career, in the Prolegomena to the eighth edition by Dr. C. R. Gregory.

TISHRI, tĭsh'rē. A month in the Babylonian, Persian, and Jewish calendars corresponding to the Seleucid *Hyperboretaios*, September-October. The Babylonian name *tish-ri-tum* is regarded as derived from *shurru*, to begin, to dedicate, the civil year having begun in the autumn with this month, while the ecclesiastical year seems to have begun in the spring with the month of Nisan. Tishri is not mentioned in the Bible, but the name is found in the Mishna treatise, *Shekalim*, iii. 1, and probably in Josephus, *Antiquities*, viii. 4, 1. The Jewish civil year begins with the month of Tishri.

TISIO, tē'zē-ō, Benvenuto. The correct name of the Italian painter called Benvenuto Tisio da Garofalo (q.v.).

TISSAPHERNES, tĭs'sȧ-fẽr'nēz (Lat., from Gk. *Τισσαφέρνης*, from OPers. **Cithrafarnā*, possessed of manifold glory) (?-B.C. 395). A Persian, appointed satrap of the coast-lands of Asia Minor by Darius II. in B.C. 414. He played a part by intrigue and arms in the Peloponnesian War. He became the jealous rival of Cyrus the Younger on the latter's arrival in Asia Minor in B.C. 407, and when it became manifest that Cyrus was plotting against his brother, King Artaxerxes II., and aiming at the throne, Tissaphernes was the first to inform the King of the impending danger. He held a command in the Persian Army and distinguished himself at the battle of Cunaxa. After the death of Cyrus he entrapped the generals of the Greek mercenaries of the Prince. He then succeeded to the provinces that had been held by Cyrus, but was unsuccessful in an attempt to establish his authority over Ionia. Finally, through the influence of Parysatis, the King's mother, Tissaphernes was put to death at Colossæ, in Phrygia, in B.C. 395.

TISSERAND, tĭs'räN', François Félix (1845-96). A French astronomer, born at Nuits-Saint-Georges, Côte-d'Or. In 1863 he entered the Ecole Normale Supérieure. In 1866 he became professor in the lycée at Metz, where he only remained one month, being called by Leverrier to the Paris Observatory as adjunct astronomer. He received his doctor's degree in 1868, presenting a very remarkable thesis on the method of Delaunay, which he showed to be applicable to the calculation of the inequalities of all the planets and thus of a wider application than had been supposed by the inventor. In 1873 he became director of the observatory at Toulouse and professor of astronomy in the Faculty of Sciences in the university. In 1878 he succeeded Leverrier as member of the Academy of Sciences and became member of the Bureau des Longitudes. In the same year he was appointed professor of rational mechanics at the Sorbonne, which he later exchanged for the chair of celestial mechanics. In 1892 he succeeded Mouchez as director of the Paris Observatory.

Besides the generalization of the method of Delaunay which he continued till his death, he made observations for the determination of planetary orbits, on the ring of Saturn, on the perturbations of Pallas, the origin of comets and their capture by the larger planets, and gave also a valuable criterion for identifying a periodic comet. He also observed the shifting of the orbital plane of Neptune's satellite as a result of Neptune's ellipsoidal shape. In consequence of this shifting of orbit, the retrograde motion of the pole of the satellite completes a cycle in 500 years. His principal work, *Traité de mécanique céleste* (1889-96), gives a complete account of the state of knowledge of that branch of astronomy up to the time of his death. Since 1884 he edited the *Bulletin astronomique.* His other writings include: *Recueil d'exercises sur le calcul infinitésimal* (1876; 2d ed. 1896). Consult Poincaré, "La vie et les travaux de F. Tisserand," in *Revue générale des sciences* for 1896.

TISSOT, tĭs′sō′, JAMES JOSEPH JACQUES (1836-1902). A French painter, born at Nantes. He studied at the Ecole des Beaux-Arts under Lamothe and Flandrin, and first exhibited in 1859. After the Commune, in which he was accused of having taken part, he went to London and spent twelve years in England, where he became known as an etcher and a painter of portrait and genre subjects. Until he was fifty years old Tissot's work dealt principally with the worldly aspects of Parisian life. The drawing in these works is always careful, and the coloring exact and finished. Examples of this style are "Faust and Marguerite" (Luxembourg) and "La Femme à Paris." Experiencing a change in his religious views about 1886, he left Paris and passed ten years in Palestine. The results of this were the 300 and more water-color studies representing the life of Christ, which are now in the possession of the Brooklyn Institute. It is an attempt to portray the real environment of Christ, the cities, buildings, and habits of the country, as they must really have been in His time, instead of their ordinary conventional treatment by artists. The details are painted with miniature faithfulness, and the Oriental character of the subject is fully carried out. At the time of his death Tissot had begun a similar set of illustrations from the Old Testament.

TISSUE, ANIMAL. See HISTOLOGY.

TISZA, tĭs′sŏ, KÁLMÁN (KOLOMAN) (1830-1902). An Hungarian statesman, born at Geszt, County of Bihar. He studied law and entered the Government service. In 1855 he accepted a semi-ecclesiastical position in the Reformed Church and in 1859 he vigorously combated the attempt of the Austrian Minister of Public Worship, Count Leo Thun, to curtail the autonomy of the Protestant Church in Hungary. In 1861 he was elected to the Diet from the city of Debreczin and soon became the recognized leader of the opposition. Long opposed to the Ausgleich, Tisza finally, in 1875, united his followers with the Deák party and organized the new Liberal Party, which recognized the existing situation and sought to make the most of it for Hungary. In the Wenckheim Cabinet he assumed the portfolio of the Interior (March, 1875), becoming Premier in October. He held this position for fifteen years, having at his back a more harmonious political support than any other leader in the dual monarchy. He retired from the Ministry in 1890, but continued his political leadership and was regularly returned as a Deputy from the city of Grosswardein until 1901. His leadership throughout his administration was conspicuously successful. He was an upright patriot and an able financier, and to him more perhaps than to any other one man was due the industrial and financial progress of his country. Consult his biography by Visi (Budapest, 1886).

TITA′NIA. (1) An epithet of Latona, as the daughter of the Titan Cœus. Ovid uses the name of Diana and of Pyrrha, daughter of Epimetheus. (2) In Shakespeare's *Midsummer Night's Dream*, the fairy queen, wife of Oberon.

TITANIC IRON ORE. See ILMENITE.

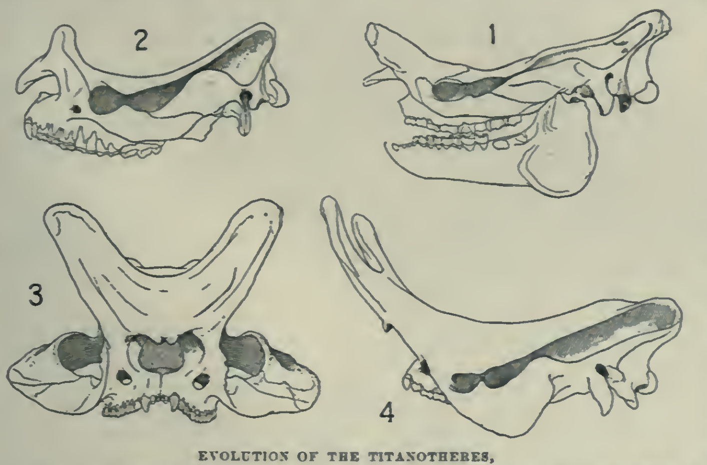
TITANITE (from *titanium*). A mineral calcium-titanium silicate crystallized in the monoclinic system. It has a resinous lustre, and is brown or black in color. It usually occurs in crystals embedded in granite, gneiss, mica schists, granular limestone, or in beds of iron ore and volcanic rocks. It is found in the Saint Gotthard region, in Switzerland, Finland, and Ireland. In the United States it occurs in numerous localities along the Appalachian Mountains from Maine to North Carolina. The name titanite is usually given to the brown or black varieties in distinction from the lighter colored titanite called *sphene.* The transparent and colorless varieties are frequently cut as gem stones.

TITANIUM (Neo-Lat., from Lat. *Titan*, from Gk. *Τιτάν*, Titan). A metallic element discovered by Gregor in 1789. It is not found native, but as the oxide in the minerals anatase, brookite, and rutile; in combination with iron as ilmenite, and as the silicate with calcium in titanite. In smaller quantities it also occurs in other minerals. It is prepared by heating the potassium titanofluoride (obtained from rutile) with potassium or sodium out of contact with air.

Titanium (symbol, Ti; atomic weight, 48.15) is a dark-gray amorphous powder resembling reduced iron, with a specific gravity of 1.25. When heated to redness in the air it burns with an intensely brilliant white light. It decomposes boiling water, and is soluble in dilute acids. Metallic titanium is distinguished from almost all other elements by its peculiar capacity for uniting with nitrogen at a high temperature. This promises a cheap means of preparing ammonia direct from the atmosphere. Titanium gives hardness and toughness to steel and a fine lustre to silver, while added to carbon used for arc lamps, it increases the brilliancy of the light. It combines with oxygen to form a dioxide, a trioxide, and a sesquioxide. Of these the dioxide is found native and combines with bases to form titanates.

TITANOSAURUS, or ATLANTOSAURUS. A genus of extinct, sauropodan, herbivorous dinosaurs (q.v.), found fossil in the Jurassic rocks of the Rocky Mountain region and Dakota, whose species were among the most gigantic land animals ever existed, one specimen exhumed in Colorado by O. C. Marsh, measuring about 60 feet long and standing about 30 feet high. The characteristics of the genus were similar to those of its near relatives Brontosaurus and Diplodocus (qq.v.).

TI′TANOTHE′RIUM (Neo-Lat., from Gk. Τιτάν, Titan + θηρίον, *thērion*, diminutive of θήρ, *thēr*, wild beast). The type genus of a family, Titanotheridæ, of ungulates, occurring in the Oligocene formations of North America, and comprising a number of species of gigantic animals somewhat resembling the rhinoceros in general form. Though belonging to the perissodactyles, they approximate the artiodactyles or even-toed ungulates in certain structural points, especially of the vertebræ and limb-bones. The most striking feature of the titanotheres is a pair of bony processes resembling horn-cores, which grow upward and outward from the maxillary bones above the snout. These prominences are variable in development according to age and sex, and also differ in size and form in different species to such an extent that many generic names, such as *menodus, brontotherium, brontops*, and *titanops*, have been bestowed upon forms which later study has shown to be only different stages in the evolution of the same genus. Careful comparative study of the remains from the White River Beds of Canada, South Dakota, Colorado, and Nebraska shows that during the Oligocene period the genus increased in size, and the horns, which are mere knobs in the (presumably) earlier types, such as *Titanotherium heloceras*, increase greatly in length, and became flattened and wide-spreading in the later species, culminating in the highly specialized *Titanotherium ramosum* and *Titanotherium platyceras*—the last survivors of their race. Of some forty specific names which various writers have proposed, often on the basis of a single fragmentary skull, only a few designate sharply marked species. One of the best-known titanotheres is *Titanotherium robustum*, a form with moderately developed horns, which measured nearly 14 feet in total length, and eight feet in height at the shoulder.



EVOLUTION OF THE TITANOTHERES,

1, Skull of *Titanotherium bucco*: 2, cranium of *Titanotherium coloradense*; 3, Front view of cranium of *Titanotherium platyceras*; 4, lateral view of same. (OSBORN.)

TITANS (Lat., from Gk. Τιτάν, *Titan*, and Τιτανίς, *Titanis*, connected with Lat. *titio*, firebrand, and perhaps with Lith. *titnagas*, flint, Skt. *titha*, fire, glow). The offspring in Greek mythology of Uranus (heaven) and Gæa (earth). Their names as given by Hesiod were: Oceanus, Cœus, Crius, Hyperion, Iapetus, Cronos, Theia, Rhea, Themis, Mnemosyne, Phœbe, and Tethys; Dione, Phorcys, and Demeter are added by some writers. As Uranus imprisoned in the earth the Cyclopes and Hekatoncheires (hundred-headed monsters), Gæa in anger instigated the Titans to revenge. Cronos alone ventured to act. He surprised and mutilated his father and reigned in his stead. As Uranus had called down a like fate on the Titans, Cronos swallowed his children by Rhea as soon as they were born. Only Zeus escaped, his mother giving Cronos a stone wrapped in swaddling clothes. On growing up, Zeus forced Cronos to disgorge his offspring, and then began a war, in which he was aided by Themis, Mnemosyne, Styx, Prometheus, the Cyclopes and Hekatoncheires, as well as his own brothers and sisters. Iapetus and Cronos are the representative Titans. After a long struggle the conquered Titans were cast into Tartarus and guarded by the Hekatoncheires. In the *Prometheus Unbound*, Æschylus represented the Titans as released and reconciled to Zeus, now firmly established as King of Heaven. The name Titian is also given to the descendants of the Titans, such as Prometheus, Hecate, Helios, Selene, etc. The whole story seems the result of an endeavor to account for the obvious signs of natural convulsions so frequent in Greek lands. It is certainly not a tradition of the supplanting of an old Cronos religion by a new Zeus religion.

TITCHENER, tĭch′nēr, EDWARD BRADFORD (1867—). An American psychologist, born at Chichester, England. He was educated at Malvern School and at Brasenose College, Oxford, where he took the B. A. and M. A. degrees in due course. After studying at Leipzig, he became assistant professor of psychology in 1892, and professor in 1895 at Cornell University. There he built up the laboratory of experimental psychology to a point of almost unexcelled efficiency. He made numerous original investigations in the spheres of sensation, affective process, attention, and action. He wrote: *An Outline of Psychology* (1896), *A Primer of Psychology* (1898), and *Experimental Psychology* (2 vols., 1901); and translated Külpe's *Outlines of Psychology* and other works. Professor Titchener became the American editor of *Mind* in 1894, and associate editor of the *American Journal of Psychology* in 1895.

TIT′COMB, TIMOTHY. A *nom de plume* used by J. G. Holland.

TITE, Sir WILLIAM (1798-1873). An English architect. He was born in London, where he was educated, and studied architecture under David Laing. His first work, assisting in rebuilding the Church of Saint Dunstan-in-the-East in the Gothic style (1817-20), established his fame. Among his best designs was that of

Edward Irving's church in London (1827-28), and he was the architect of the Royal Exchange (1841-44), and of several palatial railway stations in France and England. He was knighted in 1869. He was a man of varied attainments, a member of several learned societies, and published *A Catalogue and Description of the Antiquities Found in the Excavations for the Royal Exchange* (1848), and several essays and lectures.

TITHES (AS. *tēoþa*, a tenth part, from *tēon*, *tīen*, *tȳn*, ten, Goth. *taíhun*, OHG. *zehan*, Ger. *zehn*, ten; connected with Lat. *decem*, Gk. δέκα, *deka*, Ir. *deich*, Skt. *daśa*, ten). A tenth part of the produce of the land, which has from the earliest times been a rate in a system of taxation for civil and religious purposes. Tithing is still the prevailing method of taxation in Mohammedan countries. It was established and definitely regulated for the support of religion among the Hebrews. For the details of the Hebraic institution of tithes see Lev. xxvii. and Deut. xiv., where it is provided that the tribe of Levi, not having lands assigned to them as was the case with the other tribes, should draw their support from this system of taxation.

In the usage of the Christian churches tithes have been one of the methods employed in providing for the support of the clergy. (See STIPENDS, CLERICAL.) The system, though strongly urged as of moral obligation by the Apostolic canons, the Apostolic constitutions, and the writings of the Fathers, was for many centuries purely voluntary; and the legislation of the first Christian emperors, while it presupposed the duty of maintaining the clergy, did not extend to any general enactment for the payment of a tenth of the produce of the land. Many Church councils in the sixth, seventh, and eighth centuries confirmed the system; and at length the Emperor Charlemagne, by his capitularies at the beginning of the ninth century, formally established the tax within that portion of the ancient Roman Empire to which his legislation extended.

The introduction of tithes into England is ascribed to Offa, King of Mercia, at the end of the eighth century; and the practice was made general for all England by Ethelwulf, about the year 850. It would seem that at first, although all were required to pay tithes, it was optional with each to select the church to which payment should be made; but by a decretal of Pope Innocent III. addressed to the Archbishop of Canterbury in the year 1200, all were required to pay tithes for the support of the clergy of their respective parishes, and this parochial distribution of tithes has ever since obtained in England. Consult Whitehead, *Church Law* (London, 1892).

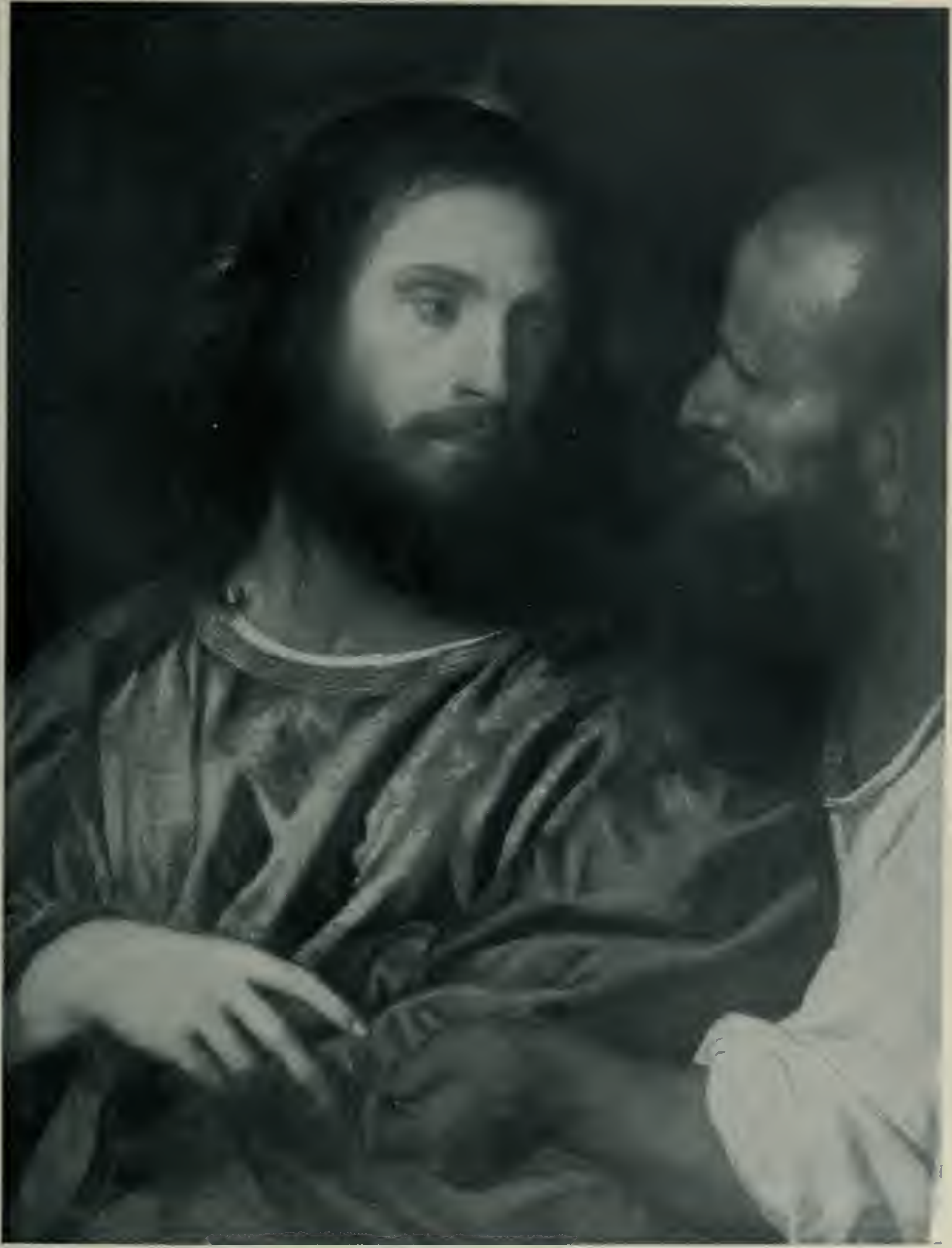
TITHING. A territorial or personal division in early English history. The territorial tithing, a tenth part of the hundred (q.v.), dates from early Anglo-Saxon times. The personal tithing probably came in with the Normans, though many give it a place in Anglo-Saxon polity. It consisted of ten men mutually responsible for one another, with a head pledge or tithing man to represent the whole. (See FRANK-PLEDGE.) This officer survived as a petty parish official long after the system to which he owed his origin had decayed.

TITHO'NUS (Lat., from Gk. Τιθωνός). In Greek legend, a son of Laomedon and brother of Priam, who was carried off by Eos (the Dawn). She bore him Memnon, and obtained from the gods for him the gift of immortality. The Homeric hymn to Aphrodite adds that as Eos forgot to ask for eternal youth as well, Tithonus withered into helpless old age, until he remained in her chamber behind closed doors, and only his piping voice was heard. A very late account told of his final transformation into a cicada.

TITIAN, tĭsh'*an* (It. Tiziano Vecelli or Vecellio) (1477-1576). The most celebrated and important painter of the Renaissance in Venice. He was born at Pieve di Cadore, a small town in the Alps of Friuli. The year of his birth has been variously given, the most probable assumption (1477) being based upon his own statement in a letter to Philip II. of Spain. His family, the Vecelli, belonged to the petty nobility, and had long been identified with the public service in Pieve, Titian's father, Gregorio, being honorably known as a magistrate and military commander. At nine the lad was sent to Venice to be educated. He was first apprenticed to the mosaicist Sebastiano Zuccato, then to Gentile and Giovanni Bellini, having Giorgione and Palma Vecchio as fellow pupils. Titian was slow to develop. While Giorgione lived, he was content to follow in his footsteps. His work also had much in common with that of Palma Vecchio, but in this case Titian was probably the controlling influence.

During the first part of Titian's early period, lasting till 1512, his style resembles that of Giorgione; but Titian is a more rugged individuality, and his lines and colors are not so soft and melting. Among his earliest surviving paintings are a "Madonna with Saints" (Liechtenstein Collection, Vienna); a "Holy Family" (National Gallery, London); and the so-called "Gypsy Madonna" (Imperial Gallery, Vienna). They show uncertainty of drawing, but high charm of color. The first of his pictures that can with surety be dated is "Pope Alexander VI. Commending Jacopo Pesaro to the Madonna" (1502-03, Antwerp). A higher phase of technical development is shown by the "Madonna with the Cherries" (Imperial Gallery, Vienna), and the Madonnas with Saints at Dresden, Paris, Florence (Uffizi), and London (National Gallery). The "Concert" in the Uffizi has been attributed to him and the "Tribute-Money" (Dresden), representing the well-known incident between Christ and the Pharisee (see GIORGIONE), is the most carefully finished of his pictures. Only Leonardo has created a Christ type that can vie with this in gentleness, intellect, and majesty, and the contrast between it and the cunning coarseness of the Pharisee is especially striking. The Uffizi also possesses his "Daughter of Herodias," for whom Titian's daughter sat as model. Other celebrated works are the beautiful allegory of the "Three Ages" (Bridgewater Gallery, London), and at the end of the period, summing up its best qualities, is "Sacred and Profane Love," perhaps more properly called "Medea and Venus." In the midst of a beautiful landscape two maidens of similar mien sit at a sculptured antique fountain, while a Cupid plays in the water. One maiden is clothed, the other is nude, and the picture gives fine opportunity for the contrast in the play of light upon the two figures.

The façade frescoes of the Fondaco dei Tedeschi



TITIAN

"THE TRIBUTE MONEY," FROM THE PAINTING IN THE ROYAL GALLERY, DRESDEN

(1507-08), which Titian executed as an assistant of Giorgione, have perished, but of those in Padua several survive, though not well preserved. One is in the Scuola del Carmine, and in the Scuola del Santo he depicted three miracles from the life of Saint Anthony (1511). It was probably after his return to Venice in 1512 that he painted the well-known altar-piece of Santa Maria della Salute, representing "Saint Mark Enthroned" with four other saints.

In 1513 Titian was summoned to Rome by Pope Leo X., but, preferring to remain at Venice, he petitioned the Senate to grant him a position like that of Giovanni Bellini, who was official painter to the State, and a commission to paint a large battle-piece in the Hall of the Grand Council. This petition was granted, but when, upon the death of Bellini, Titian was named his successor, with a yearly pension of 300 crowns, he neglected the promised battle-piece. He did, however, complete Bellini's picture, the "Submission of Barbarossa," in 1522, and executed a series of frescoes in the Chapel of the Ducal Palace—both of which were destroyed in the great fire of 1577, but his fresco of "Saint Christopher" (1523) still survives.

The work executed between 1513 and 1530 may be classed as belonging to a second part of Titian's early period. It still shows reminiscences of Giorgione, but also an increasing realism, breadth of treatment, and mastery of color. To this period belong most of his great religious altar-pieces, beginning with the "Assumption of the Virgin," formerly over the high altar of the Church of the Frari. Its position called for an over life-size figure and great breadth of treatment, the effects of which are lost in the present position of the picture in the Venetian Academy. The lower part is a scene of great exaltation among a group of the Apostles, the figures of Peter and John being particularly strong. Above, the Virgin rises to the heavens in an effulgence of golden light, surrounded by hosts of the most beautiful angels imaginable. The chief attraction of the Madonna painted for San Niccolò dei Frari (1523. Vatican Gallery) is the six fine figures of saints in the lower part of the picture. The most perfect and important of his madonnas is probably the "Pesaro Madonna" (1526), still in the Frari. This very original composition represents the Madonna seated on the side of the picture at the base of a mighty column, where several saints commend to her the members of the Pesaro family. The celebrated "Death of Peter Martyr" (1530), destroyed by fire in 1867, showed in its violent dramatic action the influence of Michelangelo. To the same period, probably, belong the "Noli me tangere" (Christ appearing to Magdalen), in the National Gallery, London; the delightful "Madonna with the Rabbit," "Holy Family," and the grandly dramatic "Entombment"—all in the Louvre.

Among Titian's mythological pictures of this period, chiefly painted for Alfonso, Duke of Ferrara, are the "Worship of Venus," in which numberless little Cupids disport themselves before a statue of Venus, a "Bacchanal" (both at Madrid), and "Bacchus and Ariadne" (National Gallery. London), a highly dramatic representation. As State painter he had the monopoly of portraying the Doge. His official portraits perished in the fire of 1577; but many replicas survive, like that of the Doge Gritti (Czernin Collection, Vienna). He found also a generous patron in Alfonso d'Este, Duke of Ferrara, whose reputed portrait, lately declared to be that of his son, Ercole II., is at Madrid. At Ferrara he also painted the fine likeness of the poet Ariosto (National Gallery), and perhaps the idealized portrait widely known as "Alfonso d'Este (Ercole II.?), and Laura Dianti" (Louvre), formerly called "Titian's Mistress." The same model is portrayed in the Flora (Uffizi) with wonderful effect of light draperies. Other celebrated portraits belonging to this period are the "Young Man with a Glove" (Louvre), the portrait of an unknown man (Munich), and the so-called Alessandro de' Medici (Hampton Court).

The death of his wife, Cecilia, in 1530 was the cause of change in Titian's mode of life. In the quiet northeastern quarter of Venice he purchased a house which he furnished with great magnificence, and which speedily became the centre of a famous literary and artistic circle, which even kings were glad to join. Titian has been much blamed for his friendship with Aretino, whose advice perhaps increased his besetting sin, the love of wealth. In painting, his treatment grew broader and his work more powerful, and while his ideals grew more sensuous and realistic, it was a gracious and dignified sensuality. In 1531 he painted in the Ducal Palace the celebrated picture of the "Doge Andrea Gritti Presented to the Virgin by Saint Mark," and in 1537 he at length finished the great battle-piece of Cadore, both destroyed in the fire of 1577. The celebrated "La fede" (1555), a votive offering of Doge Andrea Grimani, had a better fate. Other decorative works are the ceiling of the choir and sacristy of Santa Maria della Salute, and the wonderful figure of "Wisdom," on the ceiling of the library of Saint Mark (now the Royal Palace). Splendid decorative canvases of unusual size are the "Presentation of the Virgin in the Temple" (Venetian Academy) and the realistic "Ecce Homo" (Vienna).

In 1532 he was summoned to Bologna to portray Charles V. and performed his task with such success that he was named Court painter, Knight of the Golden Spur, and Count Palatine, with the privileges of the Spanish Court, and his children were made nobles of the Empire. One of his portraits of the Emperor painted at this time (1533), representing him with his dog, is at Madrid. Other celebrated portraits of this period are those of "Ippolito de' Medici" (Pitti Palace, Florence), the "Maltese Knight" (Madrid), and a "Young English Nobleman" (Uffizi). Very fruitful for Titian's art were his relations (1532-38) with the Duke of Urbino, whose portrait in full armor, as well as that of his wife, Eleanora Gonzaga, is in the Uffizi. With most subtle flattery he portrayed the lady's rejuvenated features in the celebrated "La bella di Tiziano," perhaps his finest female portrait, in the "Girl with a Fur Cloak" (Vienna), and in the world-renowned "Venus of Urbino" (Uffizi), a rival of Giorgione's Venus, and the most beautiful representation of refined voluptuousness in modern painting. For the Duke he also portrayed Francis I. (Louvre). In 1545, after invitations from the Pope, Titian visited Rome, where he was received with highest honors. Of his portraits of Paul III. an original is at Saint Petersburg and an excellent copy in the Naples Museum, which also possesses his unfinished picture of the Pope and his two nephews. At Rome he met Michelangelo, whose influence may be seen in the "Danaë" (Naples), painted there. Other famous works executed about this time are the more realistic "Venus" of the Uffizi and a similar figure listening to music, at Madrid.

In 1548 Titian was summoned by the Emperor Charles V. to Augsburg, and there he painted his equestrian portrait in full armor (Madrid)—a wonderful characterization of the irresistible but disappointed master of Europe and the New World. Another portrait of Charles V. (1548), in black costume, is at Munich. At the same time Titian portrayed the captive John Frederick, Duke of Saxony (Vienna), and Cardinal Granvella (Besançon). On a second summons to Augsburg, in 1550, he painted the portrait of Philip II. as prince in armor (Madrid). He enjoyed the extreme intimacy of the world-weary Charles V., and together they designed the "Trinity," the Emperor's last commission. After his death Titian continued to serve his son, Philip II.

It is impossible to mention even the important works of Titian during the last period of his long career (1530-76). Among religious pictures some of the most celebrated are a "Magdalen" (Pitti Palace); a "Madonna with Saint John and Catharine" (National Gallery), celebrated for the landscape; "Christ at Emmaus" (Louvre); "Saint Margaret," and several others at Madrid. His mythological subjects include the celebrated "Venus and Cupid" (Borghese Gallery, Rome), and "Venus del Pardo" (Louvre), representing in reality "Jupiter and Antiope." Of his innumerable portraits we mention only those of his beloved daughter Lavinia with a dish of fruit in Berlin, as a bride and as a matron—both at Dresden; of himself at Berlin, Florence, and Madrid; his friend Aretino (1545, Pitti); Doctor Parma and the antiquarian Strada, in Vienna; and the splendid Cornaro family (Duke of Northumberland).

Titian's last pictures were chiefly religious, like the "Saviour of the World" (Saint Petersburg) and the grand "Pietà" (Academy, Venice), finished after his death by Palma Giovane. In his hundredth year he was stricken by the plague, August 17, 1576. He was buried in the Frari Church, where a fine modern monument marks his resting place. His son Orazio, an able painter and his faithful assistant, soon followed him. For Titian's pupils, see PAINTING.

If, as is the modern custom, painting be judged by the pictorial qualities only, then surely Titian is the greatest painter of Italy, if not of all times. All Venetian art centred in him. Certain painters of Venice and of other schools have equaled Titian in single pictorial elements, but no one united all these qualities with the same degree of excellence. His color is bright, but deep and transparent; a splendid golden tone suffuses his pictures, which only in his later works tends toward a more sombre brown. Light and shade, atmosphere and perspective are all perfectly rendered, and his rapid, sweeping handling, in place of the ancient detailed finish, revolutionized painting, preparing the way for Rembrandt and Velazquez. Being a Venetian, he was not as scientific a draughtsman as the Florentines, though at best his drawing is good. His composition is always good, and at best it is excellent. He did not attempt, like the Tuscans, to make art the vehicle of intellectual ideas, but his grasp upon life was firmer than theirs, and his art was wider in scope. He preferred an art that was tranquil and serene, though at times—witness the "Assunta" and the "Peter Martyr"—he could be profoundly dramatic.

If Giorgione was the founder of the modern landscape, Titian did more for its development, achieving the highest perfection before Poussin and Claude. Eliminating the detail of former painters, he rendered the typical in a landscape with high poetic charm. Though he used landscape as only a setting for his figures, he rendered it in itself perfect and complete. His favorite subjects were the Alps of his native Cadore and the lagoons of Venice. Titian was one of the greatest portrait painters of all times. He could render a portrait with the baldest realism, but at the same time with noble and striking characterization. He was the great painter of kings and nobles.

BIBLIOGRAPHY. Among the earlier works on Titian are those of Ticozzi (Milan, 1817), Hume (London, 1829), and Northcote (ib., 1813). By far the most complete and erudite contribution is that of Crowe and Cavalcaselle (ib., 1879-81), which should, however, be corrected by Morelli, *Italian Painters* (London, 1892). The other chief work on Titian, that of Lafenestre (Paris, 1888), is remarkable for its acute criticism. Consult also Max Jordan, in Dohme, *Kunst und Künstler Italiens* (Leipzig, 1878); Heath, in *Great Artists Series* (London, 1879); Barfold (Copenhagen, 1889); the very excellent contributions of Phillips, in the *Portfolio* (1897-98); the monographs by Knackfuss (Bielefeld, 1897) and Gronau (Berlin, 1900); and the popular commentary by Hurll (Boston, 1901). See also the notes in Blashfield and Hopkins's translation of Vasari's *Lives* (New York, 1896).

TITICACA, tē′tē-kä′kȧ, LAKE. The largest lake in South America (Map: America, South, C 4). It is situated on the boundary of Peru and Bolivia, being about equally divided between the two countries. It lies in a large and lofty lacustrine basin inclosed between the main Andean range and the Cordillera Real, with cross ranges on the north and south. This basin has an average elevation of 13,000 feet, and the surface of the lake itself lies about 12,500 feet above the sea. The lake has a length of 130 miles with an average breadth of 30 miles. It is divided by promontories into three unequal parts, and contains several islands. The depth in some places reaches 700 feet, but large portions of it are shallow, and the shores, especially in the south, are lined with marshy tracts covered with reeds. The vegetation along the shores is otherwise scanty, and the surrounding country is bleak and treeless. The lake receives a number of streams from the surrounding mountains and discharges through the Desaguadero into Lake Aullagas, whose waters finally evaporate in the great salt marshes in the southern part of the closed basin. In former ages the lake occupied the whole of the basin. Its surface stood then much higher, and it discharged eastward into the Amazon. The region around Lake Titicaca was one of the seats of early Indian civilization, and contains many interesting architectural remains, some of which antedate the Incan periods. The most imposing of the ruins are those of Tiahuanaco (q.v.). (See Peruvian Antiquities; Peruvian Archæology.) The lake was formerly navigated only by crude Indian rafts, but since the opening of a railroad to Arequipa and the Pacific Coast steamboats have plied on it. Consult: Pentland, *The Laguna de Titicaca* (London, 1848); *Proceedings of the American Academy of Arts and Sciences* (Philadelphia, 1876).

TITIENS, tēt′yĕns, Theresa. See Tietjens.

TITIES. One of the three patrician tribes of ancient Rome, the others being the Luceres and Ramnes.

TITI-MONKEY, or Tee-tee. A small South American squirrel-monkey (q.v.) of the genus Chrysothrix or Callithrix; but the word is often used for a marmoset. They are gentle, beautiful, playful little creatures in great repute as pets in their own country, but too delicate to survive in cold climates.

TITLARK (from *tit*, from Icel. *tittr*, little bird, probably connected with Eng. *tit*, small thing + *lark*). A small, brown, terrestrial bird (*Anthus Pennsylvanicus*) of the wagtail or pipit family (Motacillidæ), allied to the larks, and familiar throughout North America during its migrations. It breeds, nesting on the ground, in the far north, and winters in the tropics, and in spring gives a pleasing song. A near relative is the 'Missouri skylark' (*Neocorys Spraguei*), of the Western plains, whose habits and song, uttered while soaring in the air, closely resemble those of the skylark. In this group come the numerous European wagtails (Motacilla), which keep near streams and flirt their long tails incessantly, and the pipits (Anthus), several species of which are among the most pleasing of European summer birds, frequenting fields, open spaces, and rocky slopes, and singing much like finches. Consult Coues, *Birds of the Northwest* (Washington, 1874).

TITLE (OF. *title*, *titre*, *tiltre*, Fr. *titre*, title, from Lat. *titulus*, title, superscription, token). The union of all the elements which constitute legal ownership of property, or the means by which a person holds property. The common-law authorities are to the effect that there are three essential elements to a complete title: possession, the right of possession, and right of property. This is technically true, but the latter two requisites are practically interchangeable, and it is customary to speak of title as consisting of possession with right of possession. (See Possession.) Title to property may be vested in one or a number of persons. All titles to real estate are acquired by *descent* or *purchase*. A title by descent is one which is acquired by an heir of a deceased person by virtue of the laws of intestacy and succession. Any other source of title is said to be by *purchase*. The latter term is used technically, as it includes other means than a bargain and sale, as, for example, a devise of property in a will. By virtue of the statute of limitations, twenty years' adverse possession of real estate will give the occupant a good title in most States. Title to patentable inventions is said to vest in the inventor by virtue of *original acquisition*, but the real source of ownership is really derived from the protection secured by the patent laws. A title may be capable of being established in a court of law and yet have such apparent defects as not to be readily salable. A court of equity will not compel a purchaser to accept a title which is not marketable. Consult the authorities referred to under Property; Real Property; Possession; etc.; and also see Tenure; Occupancy; Title, Registration of; etc.

TITLE, Registration of. A system of official examination and registration of titles to real estate prevailing in England and some of the United States. The present English system is the result of agitation and experimental legislation for upward of fifty years. The common-law methods of land transfer involved great expense and delay for searches, etc., and no satisfactory assurance of security on the passing of title. Prior to the legislation hereinafter mentioned, the practice in England was for a vendor to give a purchaser of land what was called a 'sixty years title,' that is, an abstract of his chain of title for a period of sixty years last past. A search made for a purchaser was not used again upon another sale, except possibly by way of comparison, and the enormous expense attendant upon the transfer of land was prohibitive of the conveyance of small tracts, and thus tended to keep lands in the hands of a few. The first act in England providing for registration of titles was passed in 1862. An immense amount of property was registered under this act. It was superseded in 1875 by a Land Transfer Act, which was designed to 'simplify titles and facilitate the transfer of land.' The act provided for the establishment of a Registry Office, to be in charge of an officer known as the Registrar, who was required to be a barrister of at least ten years' standing. Under its provisions any owner or person having power to sell land may apply to the Registrar to be registered as having an absolute or possessory title. If a purchaser applies for registration, the vendor must consent thereto. The Registrar is required to examine into the title, and the vendor may be required to establish his title by a *prima facie* case before the Registrar is obliged to pass on the validity of the title. Due notice of a hearing before the Registrar must be given to persons who have lodged 'cautions,' or notices of claim to the land, with the Registrar. The latter can compel the production of deeds and other documents to aid him in his determination. The land register should show all incumbrances on registered freehold property. Provision is made for indemnity for loss sustained through error in registration. A person registering property is given a certificate of that fact, and a purchaser is entitled to a land certificate. A proposed act for compulsory registration, introduced in 1895, was defeated. An important amendment to the act of 1875 was passed in 1897. One of its most important provisions is for the establishment of a 'real representative' of a deceased owner of real estate. The language of the act explains clearly this innovation: "Where real estate is vested in any person without a right in any other person to take by survivorship it shall, on his death, notwithstanding any testamentary disposition, devolve to and become vested in his personal representative or representatives from time to time as if it were a chattel real vesting in them or him." Another provision is for the administration of real estate as if it were personality—the personal representative carries out the wishes of the testator subject to any claims against the estate, and this simplifies the system of registration. The English system is not yet perfect and titles are not as freely transferred there as in the United States.

Several of the United States have registration acts somewhat resembling the Torrens system (q.v.). Massachusetts has established a system under which two judges conduct hearings to establish title, and, on being convinced that a person has a valid fee simple title, they may confirm the title and order its registration. Many of the English colonies have registration systems. Germany has a peculiar system under which a sort of ledger account of a title is kept. Most of the United States have systems for recording deeds and other instruments affecting real estate. A record of a deed or incumbrance serves merely to give constructive notice of its existence to the public, and does not involve any public guaranty as to the title. Consult: Morris, *A Summary of the Law of Land and Mortgage Registration*; Morris, *Registration of Titles.*

TITLE DEEDS. The instruments in writing which constitute the evidences of the title of the owner of real property. See DEED; CONVEYANCE; ABSTRACT OF TITLE.

TITLE INSURANCE. An agreement or undertaking by which the insurer, for a valuable consideration, contracts to indemnify the insured in a specified amount against loss or damage suffered because of defects of title to real estate in which he has some insurable interest. The business of title insurance is of comparatively recent growth. The first title insurance company was organized in Philadelphia in 1876, but the development of the business has been most rapid since about 1885. Contracts of title insurance are subject to the same rules as govern other classes of insurance contracts. The policy is usually granted upon written application, which is made a part of the policy and which contains statements or promises which are deemed to be warranties or conditions of the policy.

Generally the liability of the insurer is not limited in point of time, and the undertaking is to indemnify the insured against all loss or damage resulting from any defect in the title not known or specified in the policy, including defects in the chain of title and incumbrances of every description existing at the time the insurance is effected. When the undertaking of the policy is to indemnify against loss or damage only, the obligation incurred by the insurer is substantially like that of a grantor whose deed contains the usual covenants of warranty. (See COVENANT.) It is not unusual for the policy of title insurance to provide that the insurer shall take the property at an appraised valuation in the event that any defect of title is discovered rendering the title unmarketable.

There are also usually provisions contained in the policy that the insured shall notify the insurer of any claim or demand against the property founded on any defect of title insured against, and that the insurer shall be permitted to bring or defend actions in the name of the insured, but at its own expense, for the purpose of establishing that the title is free from such defect. When the insured is a mortgagor, provision may be made in the policy for the protection of a mortgagee of the property by a mortgagee's clause making the loss payable to the mortgagee, or the same result may be accomplished by issuing an independent policy in favor of the mortgagee.

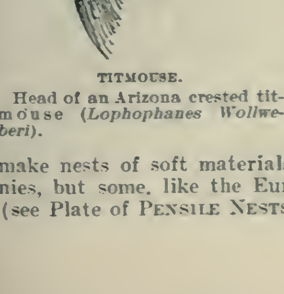
There is no fixed method of ascertaining the amount of premiums in title insurance as is the case in life insurance. Experience has shown that the losses under title insurance contracts have been comparatively small, and that in fact an important benefit to be derived from the policy of title insurance in addition to the insurance features is the painstaking and exhaustive examination of the title made by the insurer. In many cases, however, the insurance feature is of great importance, since there may always be defects of title which an examination of the record title may not disclose. Many title insurance companies possess complete records and title maps of all real estate within the territory where they do business and have other special facilities for the expert examination of titles. The prospective purchaser of real estate within such territory, by applying for title insurance, may thus procure a complete examination of the title before the conveyance is made. The policy issued may, with the consent of the insured, be transferred to a subsequent purchaser of the property. This, however, is not customary except upon the payment of an additional premium. See INSURANCE; CONVEYANCE; DEED; COVENANT; RECORDING OF DEEDS. Consult Frost, *The Law of Guaranty Insurance* (Boston, 1900).

TITLES OF HONOR. Designations to which certain persons are legally entitled in consequence of possessing particular dignities or offices. Titles of honor may be divided into those of sovereignty, superior and inferior, nobility, greater and lesser, and titles of peculiarly official significance. Superior sovereign titles are emperor and king (qq.v.) and, in Turkey and Persia, sultan, and shah (q.v.). Czar and kaiser (qq.v.), from *Cæsar*, correspond to emperor. Inferior sovereign titles include grand duke (ranking next to king), duke, and prince (qq.v.) in some of the German States, and prince in Bulgaria, Montenegro, and Monaco. Eastern equivalents of the inferior titles are bey, khan (both post-positive), khedive, raja (qq.v.). Greater nobility titles include, in descending scale, prince, duke, marquis, count (earl in Great Britain), viscount, and baron (qq.v.). In Great Britain there is no title prince outside of the royal family. In Austria there is no duke, except archduke (q.v.) (of the Imperial family), and in a few princely houses, where the term remains as a subtitle, but is not used; in Germany, no viscount; in Russia, no viscount, marquis, or duke, except grand duke (of the Imperial family). Lesser nobility titles include baronet and esquire (qq.v.), peculiar to Great Britain, and knight (q.v.), chevalier, and ritter, the last three being practically equivalent terms. There are also lesser nobility titles for the chiefs of Scottish and Irish clans, and such Eastern titles as bey, effendi, and pasha (qq.v.), all three postpositive. The titles of honor having peculiarly official significance are largely such ecclesiastical, military, and governmental terms as archbishop, general, governor, etc. Courtesy titles, distinct from true titles of honor, since their validity rests in custom rather than law, are given to the sons of the British nobility. A noble takes his highest title and is permitted to set aside an inferior title, usually his second, to be assumed by his eldest son. The younger sons of dukes and marquises have the courtesy title lord (q.v.) prefixed to their given name or surname, and the daughters of dukes, marquises, and earls prefix lady. The younger sons of earls and the sons and daughters of viscounts and barons are called honorable.

Certain forms of reference are used in respect to various titles. Majesty is attributed to emperor and king, and to the former often Imperial Majesty; Imperial Highness to title of child of an emperor; royal highness to title of child of a king (in Great Britain also grandchild of the sovereign), and to grand duke and prince reigning; Highness, alone or variously qualified, to prince; in Great Britain, Grace to duke, lordship to any other peer (q.v.). See FORMS OF ADDRESS; PRECEDENCE.

TITMARSH, MICHAEL ANGELO. The *nom de plume* under which Thackeray published the *Yellowplush Papers* and other works.

TITMOUSE (from *tit*, from Icel. *titte*, little bird + ME. *mose*, AS. *māse*, OHG. *meisa*, Ger. *Meise*, sort of song-bird). One of a family (Paridæ) of small active birds allied to the nuthatches, and familiar in the United States as 'chickadees.' The family is widely distributed and exhibits much variety in appearance and habits. Typical colors seem to be black, gray, and white, but many Old World species are distinctly marked, or suffused, with tints of blue, red, brown, or yellow, or several of these; and the Western American genus Auriparus (see GOLDTIT) is thus gayly colored. The females and young are closely like the males. These cheerful little birds are everywhere familiar, coming about gardens and roads, and nesting year after year in orchard trees, or some in garden bird-boxes, as well as in the forest. Their food consists mainly of insects, and they are everywhere of great service by their consumption of these, and, especially in winter, of the eggs and hibernating larvæ of aphids and other minute pests. Most of them make nests of soft materials in holes and crannies, but some, like the European penduline tit (see Plate of PENSILE NESTS OF BIRDS in article NIDIFICATION), the long-tailed tits of the genus Acredula, and the Western American bush-tits (Psaltriparus), weave bag-shaped pouches of hempen materials, or of moss or grass, suspended beneath a tree branch. The breeding habits of the whole group are interesting. Their notes are sharp, quickly repeated exclamations, varied by a few sweeter calls, and are well illustrated by the familiar chickadees (*Parus atricapillus*, *Hudsonius*, and others), which are among the most characteristic of North American resident birds. Consult: Evans, *Birds* (London, 1900); and American ornithologies.



TITMOUSE.

Head of an Arizona crested titmouse (*Lophophanes Wollweberi*).

TITMOUSE, TITTLEBAT. See TEN THOUSAND A YEAR.

TITULAR BISHOPS (from Lat. *titulus*, title, superscription, token). In the Roman Catholic Church, bishops other than diocesan, who take their titles from some formerly existing but now extinct see. The practice of so designating them is due to the ancient principle of not consecrating bishops without a definitely assigned sphere of labor. With the multiplication of suffragan and missionary bishops, some such system of nomenclature was naturally, therefore, adopted. When the territory occupied by the Crusaders fell once more into Mohammedan hands, the expelled bishops were utilized in various parts of Europe, retaining their former titles; and these titles, with those of sees which broke away from communion with Rome in the great Eastern schism, are still employed to designate coadjutor or missionary bishops. In England until 1850, and in Scotland until 1878, the Roman Catholic bishops bore such titles, owing to legal and other difficulties in the way of assuming territorial titles. Titular bishops were formerly often known as bishops *in partibus infidelium;* but in 1881 Leo XIII. abolished the use of this name, on the ground that many of these sees had come into the hands of States which, if not Catholic, were Christian, and that the designation was inappropriate. See SUFFRAGAN.

TI'TUS. One of the most trusted and devoted of the disciples and fellow-workers of the Apostle Paul. Nothing is said of Titus in the Acts, and all we know of him is contained in scattered notices in Paul's Epistles, especially Galatians and II. Corinthians. He was of Gentile origin (Gal. ii. 3), converted to Christianity through Paul (Tit. i. 4), and was one of the brethren taken along by Paul and Barnabas on their mission from the church of Antioch to the mother church of Jerusalem at the time of the Apostolic Council (c.49 A.D.; cf. Gal. ii. 1 and Acts xv. 2). At Jerusalem, though he was uncircumcised, he appears to have been allowed to mingle freely with members of the mother church. It is reasonable to suppose that he returned to Antioch with Paul and accompanied him thence on his third missionary journey. From the notices in II. Corinthians we learn that he was sent by Paul from Ephesus on two, perhaps three, missions to Corinth, bearing letters and intrusted with the management of delicate and important business. In all respects he was completely successful. The Corinthians contributed liberally toward the great collection Paul was raising for the Jerusalem church, willingly obeyed Paul's injunctions in regard to cases of discipline, and evidenced most sincere love and loyalty to the Apostle. These results were supremely satisfactory to Titus and his report to Paul, who had left Ephesus (spring of A.D. 55) expecting to meet Titus at Troas, but, disappointed in this, had pressed on anxiously into Macedonia, so cheered the Apostle that he at once sent back the warm-hearted message contained in II. Cor. i.-iv. We know no more of Titus's movements until the time of the letter written to him by Paul. The date of this Epistle, presupposing its genuineness, must be placed between Paul's first and second imprisonments. (See NEW TESTAMENT CHRONOLOGY.) Titus had accompanied Paul to Crete, where he had been left by the Apostle to further organize the churches there planted. He was summoned thence to join Paul at Nicopolis where Paul planned to winter. We do not know whether this plan was carried out. Titus is next mentioned in II. Timothy (iv. 10), the last of Paul's letters, as having departed, presumably from Rome, for Dalmatia. Nothing more is said of Titus in the New Testament. The impression made by the references given is that he was a true and capable assistant to the great Apostle, one of the foremost of that circle of loyal disciples through whom Paul accomplished his great work. Tradition makes him Bishop of Crete, but of this there is no early evidence.

TITUS (TITUS FLAVIUS SABINUS VESPASIANUS) (c.40-81 A.D.), Roman Emperor (A.D. 79-81). He was the eldest son of the Emperor Vespasian and Flavia Domitilla, and was born at Rome. Brought up at the Court of Nero, he received an excellent training, and subsequently, as *tribunus militum* in Germany and Britain, and commander of a legion in Judæa under his father, proved his qualities as a soldier and a general. On his father's elevation to the Imperial throne, Titus was left to prosecute the Jewish War, which he brought to a close by the capture of Jerusalem (September 8, A.D. 70) after a long siege. The news of the success was received with the utmost joy, and Vespasian's too jealous temper was awakened. However, Titus by returning to Rome, and laying the trophies of victory at the Emperor's feet, removed his unfounded suspicions, and father and son obtained the honor of a joint triumph (A.D. 71). About this time Titus became his father's colleague in the Empire. He gave himself up to the pursuit of pleasure in all its forms, put to death various suspected persons very summarily, and even caused one of his guests, whom he justly suspected of conspiracy, to be assassinated as he left the palace. On the death of his father (A.D. 79), whom he was at that time believed by a few to have poisoned, the Romans had satisfied themselves as to the advent of a second Nero. But Titus's behavior after his hand grasped an undivided sceptre completely belied their anticipations. The very first act of his reign was to put a stop to all prosecutions for *læsa majestas*, which had abounded since the time of Tiberius (q.v.). The ancient and venerated buildings of Rome were repaired; new ones, as the baths which bore his name, were erected; and the prominent tastes of the populace were abundantly gratified by games on the most stupendous scale, which lasted for 100 days. Titus's beneficence was unbounded, and it so happened that during his brief reign there was the most urgent need of its exercise. In A.D. 79 occurred the eruption of Vesuvius which overwhelmed Herculaneum and Pompeii and ruined numerous other towns and villages; in A.D. 80 a fire broke out in Rome, which raged for three days, destroying the Temple of Jupiter Capitolinus, which had just been rebuilt, and other public edifices, besides numerous houses; and in the tracks of these calamities followed a dreadful pestilence. Titus dealt out gifts with lavish hand to the houseless and ruined sufferers; he even despoiled his palaces of their valuable ornaments, to obtain money for distribution, and schemed and planned to furnish occupation for them. He was now the idol of his subjects, the 'love and delight of the human race;' but, unfortunately, in the commencement of the third year of his reign he became suddenly ill, and died at his patrimonial villa at Reate, in the Sabine country. The reign of Titus was marked by the extension of the Roman dominion in Britain by Agricola.

TITUS, ARCH OF. A triumphal arch in Rome at the highest point of the Sacred Way, facing the Forum, and situated between the platform of the Temple of Venus and Roma and the Temple of Jupiter Stator. It was erected by Domitian in A.D. 81 in commemoration of the taking of Jerusalem, and is adorned with fine reliefs on the inner sides of the archway, representing the triumph of Titus, and the spoils of the temple, including the seven-branched candlestick and the table with shewbread. During the Middle Ages the arch was built into the fortifications of the Frangipani; and when these were demolished, the arch was taken down in 1822 and rebuilt to insure its safety, the missing portions being supplied by travertine instead of the original Pentelic marble.

TITUS, BATHS OF. Extensive baths northeast of the Coliseum at Rome, built by Titus on the ruins of the Golden House of Nero and supplied by the Aqua Marcia. Their exact situation was long a matter of dispute, and they were generally conceived to be identical with the Baths of Trajan and to have been called by the latter name because restored by him. Excavations in 1895 finally determined their topography and showed them to be distinct from the adjoining Baths of Trajan. All remains of the building of Titus disappeared in the sixteenth century.

TITUS, EPISTLE TO. A letter in the New Testament, attributed to the Apostle Paul. See TIMOTHY AND TITUS, EPISTLES TO.

TITUS ANDRONICUS. The name of a tragedy usually included among Shakespeare's works, though it is now generally considered to have been only retouched by Shakespeare in 1589-90, on the foundation of an earlier play. It is alluded to by Meres in 1598 among Shakespeare's tragedies; but, though a quarto edition is said to have been printed in 1594, no extant copy is earlier than the quarto of 1600. Crude as it is, it belongs to the same type of play as *Hamlet;* both are dramas of revenge, after the fashion of Kyd.

TI'TUSVILLE. A city in Crawford County, Pa., 18 miles north of Oil City; on Oil Creek, and on the Pennsylvania and the Dunkirk, Allegheny Valley and Pittsburg railroads (Map: Pennsylvania, B 2). It has a public library and a hospital. In August, 1859, the first oil well in the United States was sunk here, and the city is largely interested still in the oil industry. It has oil refineries, large iron works, radiator works, cutlery works, a silk mill, saw and planing mills, engine works, etc. It is also the shipping centre for a productive farming section. Under the charter of 1899, the government is vested in a mayor, elected triennially, and a bicameral council. The water-works and the electric light plant are owned and operated by the municipality. Titusville was settled in 1796, and was incorporated as a borough in 1847, and as a city in 1866. On June 5, 1892, Oil Creek, swollen by a cloudburst, flooded the lower part of the city. Soon afterwards several oil tanks gave way. The liberated oil, covering nearly the whole surface of the flood, became ignited, and the fire and flood together destroyed about 60 lives and fully one-third of the city. Population, in 1890, 8073; in 1900, 8244.

TIUMEN or **TYUMEN**, tyo͞o-mȧn′y′. A town in the Government of Tobolsk, Western Siberia, situated on the Tura, at the eastern end of the Perm-Tiumen Railway line (Map: Asia, F 3). It is an important centre in the transit trade of Siberia and has shipbuilding yards, woolen mills, and tanneries. Population, in 1899, 29,621.

TIV′ERTON. A municipal and Parliamentary borough and market-town in Devonshire, England, 14 miles north of Exeter (Map: England, C 6). There are important weekly markets, and great animal markets for cattle. There is a large lace factory, in which nearly 2000 hands are employed. The town owns the gas and water-works. Lord Palmerston was its Parliamentary representative for thirty years. Population, in 1901, 10,382. Consult Harding, *The History of Tiverton* (Tiverton, 1845-47).

TIV′OLI (Lat. *Tibur*). An old town of Central Italy, Province of Rome, 19 miles east-northeast of Rome. It stands on the slope of Monte Ripoli, one of the Apennines. Tivoli is walled, and has a fortress. The surrounding hills are covered with olive trees. The vines of Tivoli are famed for a peculiar sort of grape, in great request for its firmness and luscious flavor, noticed as early as the time of Pliny the Elder. The stone called travertine, of which a great part of Rome is built, comes from quarries just below Tivoli. On the western slope of the town lies the famous Villa d'Este, of the sixteenth century. Within and without the city there are many monuments of antiquity. In a commanding position above the falls of the Anio stand the remains of two temples, one circular (so-called 'Temple of the Sibyl'), and one rectangular (so-called 'Temple of Tiburtus'), the former of which antedates the Christian Era. In the neighborhood there are extensive remains of the Emperor Hadrian's magnificent villa, the 'villa of Mæcenas,' remains of mausoleums, aqueducts, bath, etc. The place is much visited by tourists for its waterfalls, which are lofty and very picturesque. The Anio furnishes excellent water power, which since 1892 has been utilized for electric lighting both at Tivoli and at Rome, and for iron works at the former town. Tibur existed as a town (according to ancient tradition) long before the building of Rome, under whose dominion it fell about B.C. 335.

TIXTLA, tēks′tlȧ, or Tixtla de Guerrero. A town of the State of Guerrero, Mexico, five miles east of the capital, Chilpancingo (Map: Mexico, J 9). The town is in a fertile, well-watered valley, with silver mines in the vicinity. It was formerly the capital of the State. Population, in 1895, 6588.

TLACOTALPAN, tlä‵kô-tăl′pȧn. A Gulf seaport of Mexico, 50 miles southeast of Vera Cruz, at the mouth of the Papaloapán (Map: Mexico, L 8). Population, in 1895, 5770.

TLÁLPAM, tlăl′pȧm. A town of the Federal District, Mexico, 10 miles south of the capital (Map: Mexico, J 8). It is a noted summer resort and each spring at Whitsuntide its Church of San Antonio de las Cuevas is visited by thousands of pilgrims. Population, in 1895, 5846.

TLATLAUQUITEPEC, tlȧ-tlou‵kē-tȧ-pĕk′. A town of the State of Puebla, Mexico, 42 miles northwest of Jalapa. Population, in 1895, 8754.

TLAXCALA or **TLASCALA**, tlȧs-kā‵lȧ (Mex., land of maize). The smallest State of Mexico, bounded by the State of Hidalgo on the north, Puebla on the east and south, and Mexico on the west. Area, 1595 square miles (Map: Mexico, K 8). The State lies within the central plateau of Mexico at an elevation of about 7000 feet above the sea. Several mountain peaks rise on the western and the southern frontiers and reach in the Sierra Malinche an altitude of 13,475 feet. The rivers are short and unnavigable. Tlaxcala has a comparatively cool climate, and frosts are not infrequent. The chief industry of the State is agriculture and the principal products are cereals, especially maize; maguey also flourishes. The State has good transportation facilities. Population, in 1900, 172,217. Capital, Tlaxcala.

The natives of Tlaxcala were of Nahuatlan stock (q.v.) and spoke the same language as the Aztecs, the dominant people of the Mexican Empire, but maintained their independence in spite of repeated attempts of the Aztec emperors to subjugate them. On the arrival of Cortez in 1519 he was at first fiercely resisted by the people of Tlaxcala, but they were defeated, and, submitting, furnished a large contingent to assist in the conquest of Mexico. In recognition of their services they were accorded special privileges under the Spanish Government, and on account of their loyalty and fighting qualities numbers of them were afterwards colonized at Saltillo, in Coahuila, and at Izalco, in Salvador, as a check upon the hostile inroads of the native tribes. The present population of Tlaxcala is chiefly of the aboriginal stock and language. They maintain many of their ancient beliefs and customs, including faith in witches and weather doctors, with an interesting Feast of the Dead.

TLAXCALA or **TLASCALA**. A Mexican town, the capital of the State of the same name, 58 miles east of the City of Mexico, on a branch of the Mexican Railway, running between Puebla and Apizaco, in the valley of the river Atoyac (Map: Mexico, K 8). The modern town, near the site of the Indian capital, has lost much of its former greatness. It contains the State-house, and the ancient bishop's palace, probably the oldest Franciscan building in America, while near it are many remains of former Indian structures. The magnificent sanctuary of Ocotlán is one of the landmarks of the surrounding country. The principal exports are grain, hides, and cloth. Population, in 1895, 2847.

TLAXIACO, tlä-syä'kō. A town of the State of Oaxaca, Mexico, 63 miles northwest of the city of that name, on the headwaters of the Atoyac (Map: Mexico, K 9). It is an important commercial centre. Population, in 1895, 8535.

TLEMCEN, tlĕm-sĕn'. The capital of an arrondissement in the Department of Oran, Algeria, near the Moroccan frontier. It is 80 miles southwest of the city of Oran, with which it is connected by rail, and stands in an undulating country, everywhere irrigated and highly cultivated (Map: Africa, D 1). It is also connected by rail with its port, Rashgun, 37 miles distant. The town is accessible only from the southwest, the other sides presenting steeply escarped fronts. It is protected from the south wind by a range of mountains, 4200 feet in height, and is surrounded by the ruins of its ancient battlemented wall. It contains Catholic and Protestant churches, magnificent mosques, synagogues, and a museum of interesting antiquities. The town is well supplied with spring water, and a basin under the walls 720 feet long by 490 feet wide and 10 feet deep, used for naval exhibitions by the ancient Tlemcen rulers, is now a reservoir. The district is covered with fruit trees of all kinds, of which the olive is one of the most valuable; cereals, tobacco, etc., are extensively produced. Besides the special markets, a daily market is held, at which cattle, wool, grain, and oils are sold. Ostrich feathers and cork are exported; and woolen goods, leather, saddles, slippers, and arms are manufactured. Population, in 1901, 35,468, of whom 24,234 were of native origin. Dating from 1002, Tlemcen has an interesting history under Berber, Arab, Spanish, and Turkish rule. It had about 100,000 inhabitants in the thirteenth century. It has been on the decline since the early part of the sixteenth century. The French ultimately occupied it in 1842.

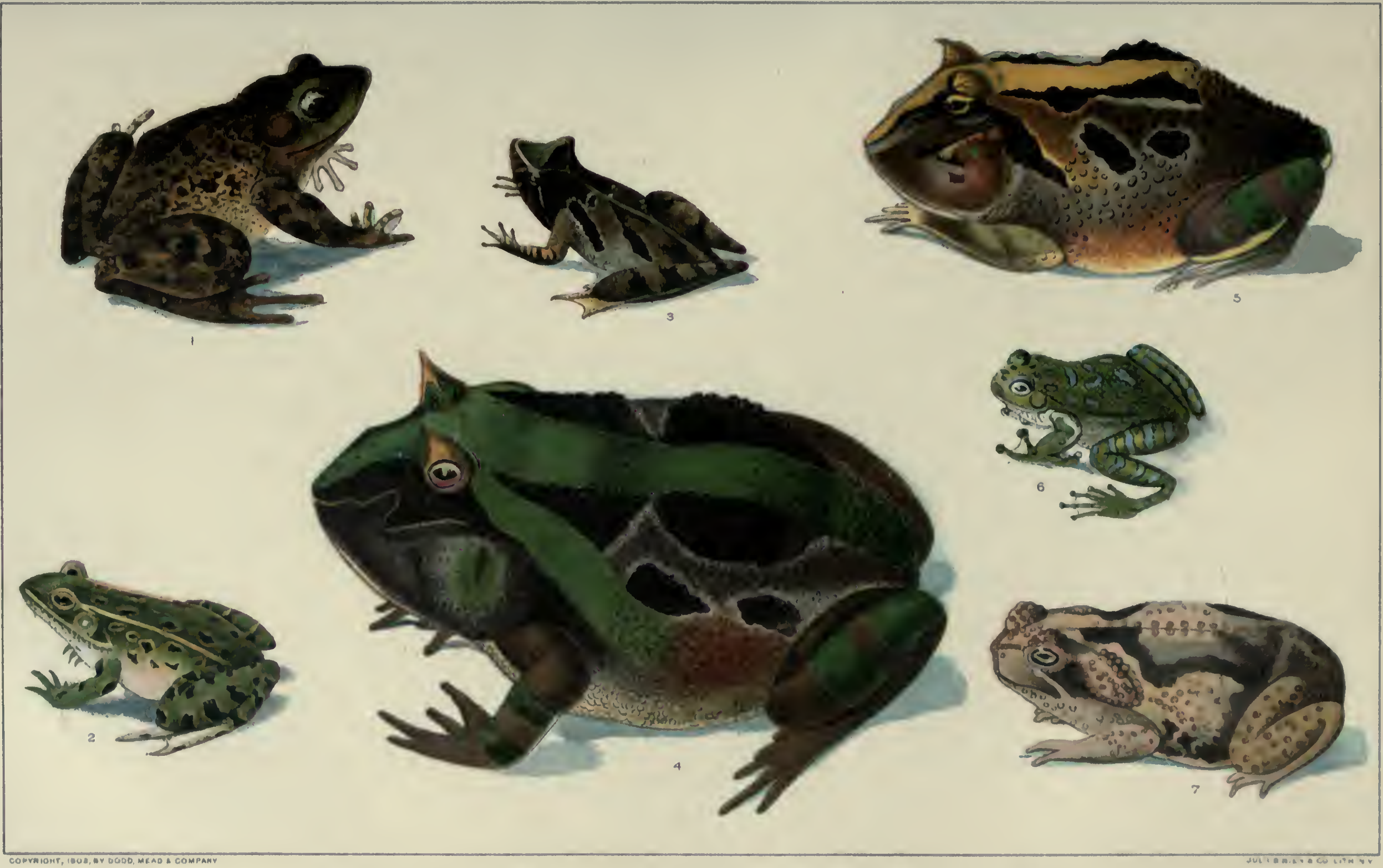
TLIN'KIT (people), or KŌLOSH (Russ., from Aleut *kalosh, kaluga*, little trough, in allusion to the enormous and peculiarly shaped labrets worn among them, especially by the Sitka). A group of tribes, of which the Chilcat, Sitka, Stikine, and Yakutat are the most important. They constitute a distinct linguistic stock known as the Kolushan, occupying the coast and islands of Southern Alaska from Mount Saint Elias southward to the entrance of the Nass River. The Tlinkit are a seafaring people with strongly marked characteristics. Before the demoralization wrought by the advent of the white man they lived in permanent villages of solidly constructed houses built of massive beams and great planks of cedar, each with its tall totem pole in front, and with the corner posts also carved in totemic designs. Their canoes were hewn from cedar trunks, and their mats and cordage were woven from the bark fibre of the same tree. They were expert stone-carvers and copper-workers. They were enterprising traders and controlled the trade from the coast to the interior tribes, using dentalium shells as a currency medium and setting great store upon the acquisition of property. They had three clans, the Raven, Wolf, and Whale, with descent in the female line, but the chieftainship was elective, being usually accorded to the most generous distributor at the great ceremony of the potlatch (q.v.). Slavery was an established custom, slaves from other tribes being a staple article of trade and treated by their masters with great cruelty. The dead were cremated, excepting in the case of priests, whose bodies were wrapped in mats and deposited with their sacred belongings in grave houses perched upon commanding cliffs. Their principal mythologic hero was the Raven, who brought fire to the people and set the sun and moon in their courses. The flesh of the whale was tabooed, excepting among the Yakutat. They did not flatten the head, as did the more southern tribes, but were addicted to labrets, which were considered marks of distinction and honor in proportion to their size, the insertion of each successive larger labret being the occasion of a potlatch distribution. They were a warlike race, strong and well built, and regarded by the Russians as of superior intellect, but have greatly deteriorated by contact with civilization. They may number now altogether 5000, and derive a large part of their subsistence by labor in the salmon canneries. Consult Krause, *Die Tlinkit Indianer* (Jena, 1885). See also SITKA; YAKUTAT.

TOAD (AS. *tādige, tādie*, toad; of unknown etymology). The common name applied to any one of the numerous species of tailless Amphibia belonging to the family Bufonidæ and a few kindred families. More than 100 species belong to the typical genus Bufo, which is nearly cosmopolitan, but most numerously represented in tropical America, and absent from Madagascar, Papuasia, and the islands of the Pacific Ocean. Toads differ from typical frogs (Raninæ) in the absence of teeth, in having the sacral diapophyses dilated, and the sternum wholly cartilaginous. Most have a short-limbed, thickset figure and warty skin, and the majority are quite terrestrial or burrowing, but some are aquatic and others arboreal or aberrantly modified. There are seven genera containing 15 species in the family, besides Bufo. Noticeable among these are the common Australian toad (*Myobatrachus Gouldi*), which has a smooth skin; the repulsive egg-shaped, long-tongued, termite-eating Mexican species (*Rhinophrynus dorsalis*); and the large, warty, swimming toads of the East Indian genus Nectophryne.

The common toad of Eastern North America (*Bufo lentiginosus*) is a fair type of the group. It reaches a length of about 3½ inches, and is brownish olive, with a yellowish vertebral line and some brownish spots; but it is exceedingly variable. The skin of young toads is nearly smooth, but that of adults is very warty. It contains many poison glands from which a milky somewhat acrid fluid exudes when the animal is roughly handled. This and the urine are harmless so far as man is concerned, but have a protective value in making the creature distasteful to many predatory animals.

The food of the toad consists of worms, insects, and snails, which must be alive and moving in order to attract its notice. These are seized by the darting out of the tongue (see FROG), which is done so rapidly as to baffle all but very attentive observation. This fare is

AMERICAN FROGS AND TOADS



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1 BULLFROG - RANA CATESBIANA.
2 LEOPARD - FROG - RANA VIRESCENS
3 CRICKET-FROG - ACRIS GRYLLUS.
4 HORNED FROG (FEMALE) CERATOPHRYS DORSATA
5 HORNED FROG (MALE) CERATOPHRYS DORSATA
6 FLORIDA TREE-FROG - HYLA GRATIOSA
7 AGUA TOAD - BUFO MARINUS.

captured mainly during twilight and at night. The list of known foods embraces every sort of insect and larva that can be captured, including many most injurious to horticulture; and there is no doubt that a reasonable number of toads in a garden gives a valuable assistance in keeping down pests. They do no harm at all. They molt the outer skin several times a year, struggling out of it, and then swallowing it. When cold weather comes on they dig a hole in the ground, or find some warm, dry crevice among rocks, in a cellar or the like, and become dormant. This power of hibernation, and their ability to endure deprivation of food and water, tend to a longevity very unusual in so small an animal, for toads under favorable conditions will live thirty years or more. The stories told of buried toads surviving for long intervals in solid clay, rock, and the like, are usually unworthy of belief. Experiment has shown that no toad can long endure deprivation of air, water, and food, although Buckland found that specimens immured in blocks of porous stone and buried in moist soil remained alive after eighteen months. As soon as the toads emerge in the early spring their melodious piping is heard, and they make their way to water, where fighting between males and the mating of the sexes begin. After a few days long gelatinous ropes of black holoblastic eggs, each about one-fifteenth of an inch in diameter, are to be found coiled or matted in warm ponds and roadside pools. Each female begins to breed when about four years old, and lays six to ten thousand eggs annually. These eggs rapidly increase in size, and hatch in four weeks or less, according to weather. A detailed history by R. Wright of their development may be found in the *Standard Natural History*, vol. iii. (Boston, 1885). The larvæ are considerably advanced when freed from the egg, and are provided with a peculiar temporary organ in place of the yet undeveloped mouth, by which they cling to weeds and similar supports; and with bushy external gills as breathing organs. There is no trace of limbs, but a swimming organ is present in the form of a large fin-bordered tail. Development proceeds rapidly. The true mouth is soon formed, and the tadpoles begin to feed upon the minute algæ coating the bottom and floating on the surface, and later eat animal substances. They are the best scavengers for an aquarium. They keep in shallow water near shore, but are preyed upon by newts, turtles, fishes, and predacious aquatic insects. Gradually growth advances, the fore legs appear, and later the hind legs are developed and the tail and gill-tufts are gradually absorbed. (For experiments in rearing tadpoles under various food-conditions, see *Factors of Evolution*, under EVOLUTION.) By midsummer the limbs are perfected, lungs have been formed, the tail is reduced to a mere stump, and the tadpoles creep out of the water as small toads. Here they encounter a host of enemies, birds, snakes, turtles, etc., so that a very small proportion escape to develop into adulthood, when they have few enemies except snakes.

The common toad of the Old World (*Bufo vulgaris*) is very similar to the American toad. It inhabits almost the whole Palæarctic region, eastward to China and Japan. India and the Malay Archipelago have a widely prevalent and very rough-skinned species (*Bufo melanostictus*), which has considerable power of changing color. The green toad of the Mediterranean region (*Bufo viridis*) is highly variable in color; and the natterjack and pantherine toads (qq.v.) of Western Europe much resemble it. The largest member of the genus is the huge agua toad of tropical America. (See AGUA.) Various more distantly related amphibians are called 'toads,' as for example 'tree-toads' (see HYLA; TREE-FROG); the South American horned frogs (q.v.) of the cystignathine genus Ceratophrys; the Surinam 'toad' (see PIPA), and others. Compare FROG; SPADEFOOT.

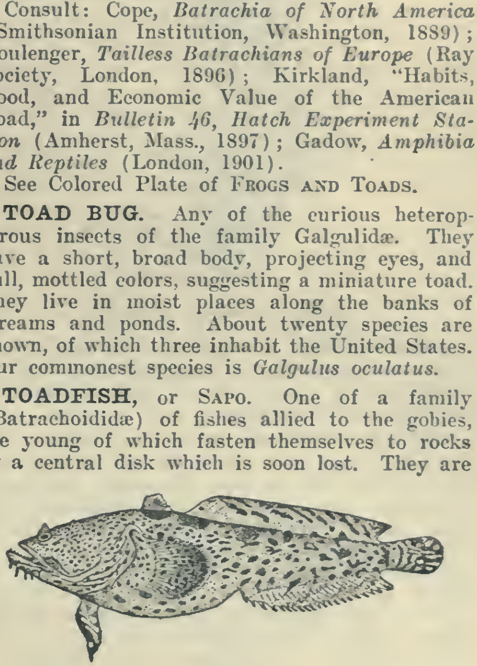
Fossil toads are quite rare, but are found scattered through the Tertiary formations from the Eocene upward, especially in Europe. Some very fine skeletons of toads, and even remains of tadpoles, have been found in the fresh-water Miocene deposits of Germany.

Consult: Cope, *Batrachia of North America* (Smithsonian Institution, Washington, 1889); Boulenger, *Tailless Batrachians of Europe* (Ray Society, London, 1896); Kirkland, "Habits, Food, and Economic Value of the American Toad," in *Bulletin 46, Hatch Experiment Station* (Amherst, Mass., 1897); Gadow, *Amphibia and Reptiles* (London, 1901).

See Colored Plate of FROGS AND TOADS.

TOAD BUG. Any of the curious heteropterous insects of the family Galgulidæ. They have a short, broad body, projecting eyes, and dull, mottled colors, suggesting a miniature toad. They live in moist places along the banks of streams and ponds. About twenty species are known, of which three inhabit the United States. Our commonest species is *Galgulus oculatus*.

TOADFISH, or SAPO. One of a family (Batrachoididæ) of fishes allied to the gobies, the young of which fasten themselves to rocks by a central disk which is soon lost. They are small carnivorous and scavenging coast fishes of all warm seas, abundant about weedy rocks and coral reefs. They have a robust form, are inactive, and resemble toads in the mingled browns and yellows of their coloration. The species illustrated (*Opsanus pardus*) inhabits the Gulf of Mexico.


A TOADFISH.

TOADFLAX, or BUTTER-AND-EGGS (*Linaria*). A genus of plants of the natural order Scrophulariaceæ, distinguished chiefly by the spur at the base of the corolla and the capsule opening by valves or teeth. The species are herbaceous, natives chiefly of the colder and temperate parts of the Old World. Common toadflax (*Linaria vulgaris*) has an erect stem one to three feet high, with glaucous, linear-lanceolate leaves which thickly cover the stem, and terminal spikes of yellow flowers. It grows in fields along roadsides, etc., in Europe and America, where it has been introduced and where it is usually considered a troublesome weed. A very remarkable monstrosity called peloria is sometimes seen in this plant, the flower presenting five spurs and five usually imperfect stamens.

TOADFLAX (*Linaria vulgaris*).

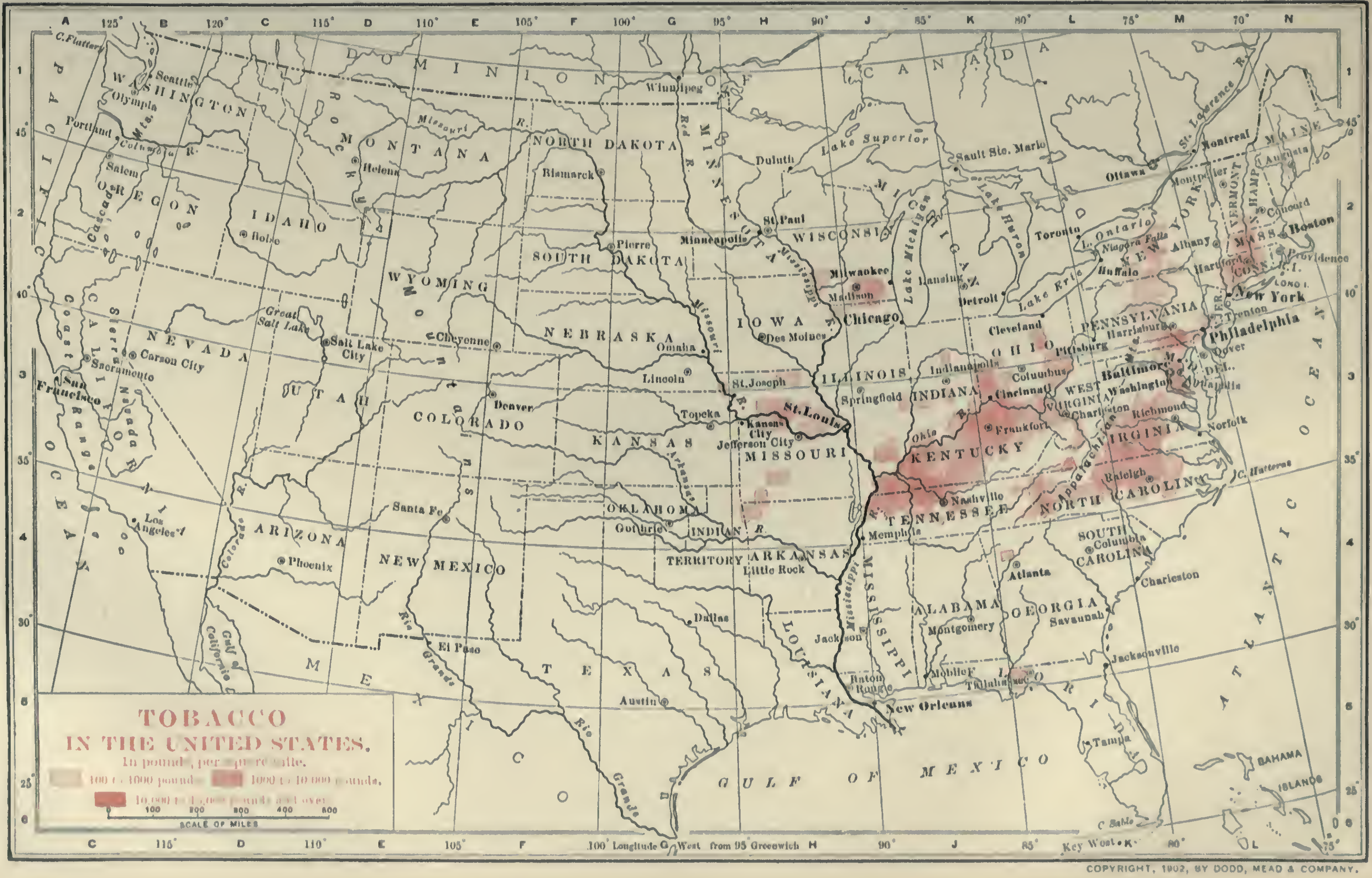
TOADSTOOL. A fungus of the group Basidiomycetes (q.v.), whose fructification is usually a stalk bearing a cap. See FUNGI, EDIBLE AND POISONOUS; MUSHROOM.

TOAST (OF. *toste*, from ML. *tosta*, toast, Lat. fem. sing. of p. p. of *torrere*, to dry; connected with Gk. *τερέσθαι*, *teresthai*, to become dry, Skt. *tarṣ*, to thirst, and ultimately with Eng. *thirst*). Originally the name given to bread dried or scorched before the fire. As early as the sixteenth century toast formed a favorite addition to English drinks, especially sack and punch. The application of the word to a lady whose health is drunk, and thence to any sentiment mentioned with honor before drinking, is said to have originated from an incident described in *The Rambler* (No. 24), as having happened at Bath in the eighteenth century, when it was the fashion for ladies to bathe publicly, in elegant dresses made for the purpose. "It happened that on a public day a celebrated beauty of these times was in the Cross Bath, and one of the crowd of her admirers took a glass of the water in which the fair one stood, and drank her health to the company. There was in the place a gay fellow, half fuddled, who offered to jump in, and swore, though he liked not the liquor, he would have the toast" (meaning the lady). In the later sense, the word has been adopted both in French and German.

TOBA, tō′bȧ (opposite, so called by the Guarani, as living on the opposite or western bank of the Paraguay). A powerful and savage people of Guaycuran stock, the most important tribe of the Chaco region of Northern Argentina. They rove along the Pilcomayo and Vermejo rivers. Their language is a dialect of that formerly spoken by the Abipone (q.v.), whom they exterminated about a century ago. They hunt and fight on horseback with the lance and bow, and are warlike and untamably hostile to all whites who attempt to enter the region.

TOBACCO (Sp. *tabacco*, *tabaco*, from the Carib name, of uncertain meaning; perhaps the name of the pipe smoked by the Indians, or of the tubes into which the leaves are rolled for smoking, or the Haitian name of the plant, or the old name of the island now called *Tobago*, near Trinidad, or the name of a province *Tobaco*, said to be in Yucatan), *Nicotiana Tabacum.* A plant of the natural order Solanaceæ. It has broad leaves, terminal panicles of flowers, and two-celled, five-valved fruits (many-seeded capsules). The numerous varieties differ more or less in the size and form of the leaves, and in the form and color of the flowers. Its generic name is in honor of Jean Nicot, who introduced it into France. Whether the use of tobacco as a narcotic was known in the East before the discovery of America is somewhat doubtful. Probably the habit has been long practiced in China, but it is not certain. If it was so, the custom did not extend among neighboring nations, whereas, on the introduction of the use of tobacco from America, where the Indians have smoked the leaves since remote antiquity, it rapidly extended throughout Europe, and soon became extensively prevalent among Oriental nations. The Indians used it in their important transactions. Thus the calumet (q.v.), or pipe of peace, is indispensable to the ratification of a treaty; and smoking together has even greater significance of friendship than eating together has among the nations. Tobacco seed was first taken to Europe by Gonzalo Fernandez de Oviedo, who introduced it into Spain, where it was first cultivated as an ornamental plant, till Nicolo Manardes extolled it as possessed of medicinal virtues. It was introduced into Italy in 1560. Its use as snuff soon followed its introduction for smoking. There is no reference to the use of tobacco in Shakespeare, yet it is certain from other evidences that it then was well known in England, although, on account of its high price, its use was

TOBACCO (*Nicotiana tabacum*).



TOBACCO IN THE UNITED STATES.

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confined to the wealthy. It was smoked in very small pipes and the smoke was expelled, not from the mouth, but through the nostrils. Tobacco was at first recommended for medicinal virtues, but soon became an article of luxury. The Popes Urban VIII. and Innocent XI. fulminated against it the thunders of the Church; the Sultans of Turkey declared smoking a crime, Sultan Amuret IV. decreeing its punishment by the most cruel kinds of death; and King James I. of England issued a *Counterblaste to Tobacco*, in which he described its use as "a custom loathsome to the eye, hateful to the nose, harmful to the brain, dangerous to the lungs, and in the black, stinking fumes thereof nearest resembling the horrible Stygian smoke of the pit that is bottomless." Although the habit did not become prevalent in the East till the seventeenth century, the Turks and Persians are now the greatest smokers in the world. In India all classes and both sexes smoke; in China the practice is universal.

In America the culture of tobacco began in Virginia with the earliest settlement of the colony. It is recorded that in 1615 the gardens, fields, and even the streets of Jamestown were planted with tobacco, which immediately became, not only the staple crop, but the principal currency of the colony. In 1619 "ninety agreeable persons, young and incorrupt," and in 1621 "sixty more maids, of virtuous education, young and handsome," were sent out from London on a marriage speculation. The first lot of these ladies was bought by the colonists for 120 pounds of tobacco each; the second lot brought 150 pounds each. The culture of tobacco was introduced into the Dutch colony of New York in 1646, though it never gained the same prominence there as farther south. Maryland, the Carolinas, Georgia, and later Kentucky, made it the leading crop almost from their first settlement. It long constituted the most valuable export of the colonies. From 1744 to 1776 the exports of the crop averaged 40,000,000 pounds a year. None of the cotton States now produce much tobacco, but one county in Florida, Gadsden, has long been celebrated for the production of Cuban tobacco, which always brings a high price. As a commercial crop tobacco is confined to rather limited areas in a few States. In the production of wrapper leaf for cigars Florida and Connecticut take the lead. Pennsylvania and Wisconsin produce a great deal of filler leaf for cigars. Other classes of tobacco are grown extensively in Kentucky, Virginia, North Carolina, Maryland, Ohio, Indiana, and Missouri in the order named.

The United States produces more tobacco than any other country in the world, and exports more than one-third of the product, chiefly to Germany, England, France, Italy, Austria, and Holland, in the order named. The value of the tobacco exported in 1850 was $6,417,251, in 1899 $25,467,218. The amount received by the United States Government from the internal revenue tax on tobacco products is a large one. In 1890 it amounted to $33,949,997. The value of tobacco imported in 1899 was $9,900,253, at an average price per pound of 70.2 cents.

The product of tobacco in Europe is nearly equal to the average production of the United States. Austria-Hungary produces about one-third of it, Russia one-tenth, Germany nearly as much, France about 35,000,000 pounds, and the other countries a small quantity. Europe can easily produce all the tobacco required, but American tobacco is largely imported, because it is cheap and is considered valuable for mixing with and fortifying European leaf.

In America tobacco is divided commercially into four classes: (1) cigar; (2) cigarette; (3) manufacturing (chewing, smoking, and snuff); (4) export.

Cultivation. The variety of tobacco planted depends upon soil, climate, and market demands. The different types of tobacco are grown upon a wide range of soils differing mainly in their physical characters. Wet soils composed largely of clay produce large heavy plants that cure to a dark brown or red. Light sandy soils produce plants having a light thin leaf curing to a bright red, mahogany, or fine yellow. The influence of soil, climate, and manures on the quality of the produce is almost beyond what is known in any other cultivated plant. In the more northern regions the seed is sown in a hot-bed and protected from frost by cheese cloth. The young plants are very tender and require frequent watering with weak liquid manure. They will be ready for transplanting in five or six weeks. For cigar tobacco the plants are grown rather close, 14 inches in Florida giving leaves of desirable size, quality, and appearance. For manufacturing tobacco the distance should be greater. Cultivation should be frequent and shallow and should cease when the plants begin to button. Where the production of seed is not desired the plants are topped to prevent flowering, that their whole strength may be directed to the leaves except in the case of that grown for cigar wrappers when a thin leaf is the more valued. Fertilizers affect the quality of tobacco more than the yield. Barnyard manure produces a rank growth but poor quality. Potash is the most important element to be supplied in growing tobacco, and the best forms are the carbonate and the sulphate. Nitrogen is best supplied in cottonseed meal, bone meal, and dried blood.

When the leaves begin to turn yellow the plants are ready to harvest. This is usually done by cutting down the stalk near the ground. In the better grades of cigar tobacco the leaves are primed off, beginning with the lower as they ripen, a process requiring more labor, but giving a more uniform and valuable product. The time generally chosen for cutting is in mid-day, or when the sun is powerful. The cutting is done by hand, and only such plants are chosen as are ready. If the plants are very large, the stalk is often split down, to facilitate the drying. They are then removed from the field to the tobacco-house, around which are erected light scaffolds, from which the plants are suspended without touching each other. After drying the leaves are removed from the stalks and tied up in bundles called hands. The losses in curing are about 85 per cent. of weight at cutting. After curing tobacco goes through the process of fermentation or ageing. This consists primarily of a reduction in the per cent. of nicotine and the development of aroma. The action is caused by unorganized ferments or enzymes inherent in the leaf and may extend through a period of a few weeks or of two years, depending upon the method of handling. In the slow fermentation the tobacco is packed in cases and stored in warehouses. In a quicker and better method, as practiced in Cuba and the cigar districts of the United States, the tobacco is piled under suitable conditions of moisture and the process of fermenting is hastened by the heat developed. The tobacco is repiled when the temperature rises to a certain point, and so continued until the proper flavor and aroma are developed. Tobacco for cigarettes is cured by heating it for a short time in large ovens. The product is of light color and a small nicotine content and without the agreeable aroma of cigar tobacco.

Tobacco, owing to the high rate of duty when in any manufactured form, is mostly imported in the leaf; but small quantities are brought in, chiefly for reëxport, in various states of manufacture.

Tobacco Diseases. Among the various diseases of tobacco perhaps the best known is calico or mottled top, a Connecticut name for the mosaic disease of Holland. The 'spotting' of tobacco in Connecticut, the spot disease of Russia, and the *nielle* of France are somewhat similar. The mosaic disease as described by Mayer, one of the first to investigate it in Holland, is characterized by mottled light and dark green leaves a few weeks after the plants are set. The tissue in the darker parts of the leaves grows faster and soon is much thicker than the light-colored areas. As the disease progresses some of the thin areas die out, giving a decidedly mottled appearance to the leaf. The diseased plants are usually irregularly distributed throughout the field. The cause has been the subject of much controversy. By many observers it is said to be of bacterial origin. Others claim it to be due to certain enzymes which disturb the balance between the normal functions of certain cells. Beijerinck claims to have produced the disease by inoculating healthy plants with the sterilized fluid from diseased leaves. Others claim it to be due to soil and water conditions. The evidence now at hand seems to favor the theory of the unorganized ferments as the probable cause. The spot disease is characterized by white or brown spots of various size and shape upon the leaves. In some cases the leaves resemble the spotted condition which is considered so desirable in some tobaccos, as the Sumatra wrapper leaf. The cause of the spot is not definitely known. In Australia the fungus Peronospora hyoscyami produces a common and destructive disease of the plants, and in Java and Sumatra the dark spots are attributed to Phytophthora nicotianæ. Both these diseases may be prevented by thorough application of Bordeaux mixture. In the curing of tobacco two diseases, pole burn and stem rot, are common. Pole burn is likely to develop if long continued damp, sultry weather occurs while the plants are being cured. It first attacks the veins, turning them black, but spreads to the rest of the leaf, blackening it and making it very bitter. Certain fungi seem always present in this disease, as well as many bacteria. It is believed the fungi are the principal cause of the injury, in which the bacteria doubtless assist. This disease may be prevented by artificial heat and ventilation. The stem rot is due to the fungus Botrytis longibrachiata. It attacks the stems and veins, producing patches of velvety white fungus and causing more or less decay. The spores ripen upon the stalks that are thrown aside as worthless. These should be carefully collected and burned, and the tobacco barn thoroughly fumigated with sulphur fumes before and after curing a crop.

Cigars and Cheroots are forms of manufactured tobacco. Cuba supplies the best cigar tobacco, the best cigars being made from that grown in Vuelta Abajo and hence known as Vuelta tobacco. The greater proportion of genuine Havana cigars smoked in this country are not manufactured in Cuba, but in Florida by Cuban workmen from genuine imported tobacco, under the system used in Cuba and known to the trade as 'Cuban hand-work.' This term characterizes a very careful method, by which each piece of leaf is so graded that the entire cigar is of the same color throughout, with each vein of the leaf running in the same direction, in order to insure even and perfect burning.

Next to Cuban ranks the tobacco grown in Florida, while the product of Borneo, Ceylon, and the Philippine Islands is considered little inferior. Persia also produces a good article. Turkish tobacco is very aromatic. The name Turkish is loosely applied to the leaf grown in Syria, Rumelia, Karamania, and about the Persian Gulf. A light yellow tobacco is smoked in China, and some of it is exported. Very excellent tobacco is grown in Java and Sumatra and shipped to Amsterdam, where the best cigars in Europe are most readily obtained. Burmese tobacco is fair. In Germany inferior tobacco is produced along the Rhine, near Baden and at Mainz, and is used for home consumption. In France tobacco is a Government monopoly and can be grown only by those who receive a special license. These producers have the choice of selling their tobacco to the Government manufacturers or of exporting it. The best cigars made in Europe of European tobacco are those manufactured in Spain.

Cigarettes. Of late years cigarette smoking has increased greatly, but in the United States the increased manufacture of little cigars has caused an apparent decrease in the number of cigarettes made. Under the classification in the revenue returns, it is difficult to secure satisfactory statistics. The manufacture is now practically in the hands of a single 'trust.' In France there are several factories exclusively devoted to the production of cigarettes, employing over 2000 women and turning out more than 400,000,000 cigarettes a year. In Spain the consumption of cigarettes is very great, but the practice is for the smoker to roll his own, rather than to smoke the manufactured article.

Snuff was originally made in Spain, and later in England, Scotland, Holland, and Belgium. It was at first made by grinding the leaf tobacco in mortars, and scenting the powder in various ways. It is now ground in metal mills by steam power. The United States produces a small amount of snuff, but the practice of taking snuff is annually declining. In the reports of the manufactures of tobacco, snuff is classed with chewing tobacco. Chewing tobacco is put up in pressed cakes called 'plug tobacco,' and in a spongy mass of fine threads known as 'fine cut.' Usually flavoring matters, as vanilla, sugar, syrups, glycerin, etc., are added in small amounts. Different manufacturers have various formulas, considered as trade secrets, for improving their products. Smoking tobacco for pipes is put up in twists or rolls of the natural leaf or is cut fine and put up in small packages.

Indian tobacco (*Lobelia inflata*) has nothing in common with the subject of this article.

Tobacco has been used as a sedative or narcotic over a larger area and among a greater number of people than any similar substance, opium ranking next, and hemp third. Tobacco leaves, when submitted to chemical analysis, yield nicotine (q.v.), which is its most characteristic constituent, albumen, a gluten-like substance, gum, resin, malic and citric acids, and a large amount of inorganic constituents, 100 parts of the dry leaf yielding from about 19 to 27 per cent. of ash, in which potash, lime, and silica preponderate. Nicotine, the alkaloid contained in tobacco and considered a violent poison, does not appear in tobacco smoke. It is split into pyridine and collodine. Of these the latter is said to be the less active and to preponderate in cigar smoke, while the smoke from pipes contains a larger amount of pyridine. If tobacco possesses, like alcohol, opium, tea, coffee, etc., the power of arresting oxidation of the living tissues, and thus checking their disintegration, it follows that the habit of smoking must be most deleterious to the young, causing in them impairment of growth, premature manhood, and physical degradation. Before the full maturity of the system is attained, even the smallest amount of smoking is hurtful; subsequently, the habit is generally prejudicial. Smoked just after a meal a cigar is said to act as a digestive stimulant, and as a food when other forms of nourishment are not procurable. In some persons smoking increases, in other diminishes mental activity. Chewing is considered the most deleterious form in which to use tobacco. The different kinds of tobacco exert a different influence on the smoker according to the amount of noxious ingredients which they contain. Those which yield a small proportion are termed mild tobaccos.

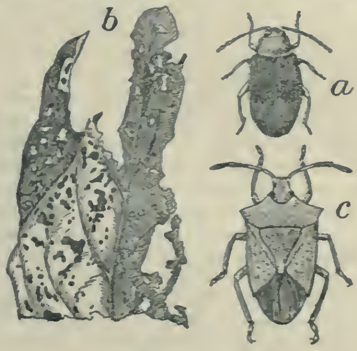
Tobacco has been used in medicine with the view of relaxing the muscular fibres, in cases of strangulated hernia, intestinal obstruction, asthma, strychnine poisoning, tetanus, etc.; but is no longer so employed on account of its dangerous depressant action.

Consult: Killebrew and Myrick, *Tobacco, Its Culture, Cure, Marketing, and Manufacture* (New York, 1897); Lock, *Tobacco Growing, Curing, and Manufacture* (London, 1886); Seuseney, *Tobacco from the Seed to the Warehouse* (Chambersburg, Pa., 1878); United States Department of Agriculture, Washington, Farmers' Bulletin No. 60, *Methods of Curing Tobacco;* No. 83, *Tobacco Soils;* No. 120, *Insects Affecting Tobacco;* Division of Soils, Report No. 62, *Cultivation for Cigar Leaf Tobacco in Florida;* No. 63, *Work of the Agricultural Experiment Stations on Tobacco;* Arnold, *History of the Tobacco Industry in Virginia* (Baltimore, 1897); A. M. and J. Ferguson, *All About Tobacco, Including Practical Instruction in Planting, Cultivating, and Curing* (Colombo, Ceylon, 1889); Ragland, *Tobacco, How to Raise It and How to Make It Pay* (Hyso, Va., 1895); Sim, *Tobacco From Seed Bed to Packing Case* (Ettiwanda, Col., 1897).

TOBACCO-BOX SKATE. The common small American skate (*Raja erinacea*). See Plate of RAYS AND SKATES.

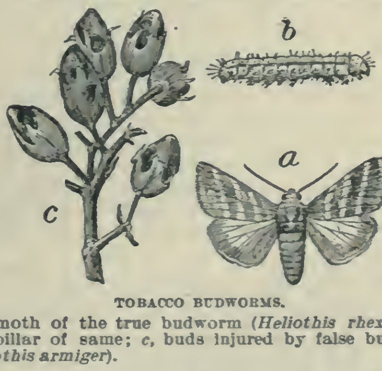
TOBACCO-HEART. A name used of the cardiac condition occurring in many persons who use tobacco to excess. Irregularity of action and debility are the chief symptoms. See TOBACCO.

TOBACCO PESTS. The tobacco flea-beetle (*Epitrix parvula*) is generally distributed throughout the United States. It is a minute, oval, reddish-brown species occurring upon many solanaceous plants, which makes its appearance in July, attacking the tobacco leaves, which soon present a spotted appearance. Afterwards these spots become holes and the leaf is practically destroyed. In the larval state the insect feeds upon the roots. The small holes eaten by the beetles become the entrance points of bacteria, which start a leaf-disease which may be more injurious to the plant than the actual work of the beetles.



TOBACCO BEETLES.

a, tobacco flee-beetle (*Epitrix parvula*), greatly enlarged; b, leaves, as damaged by this flee-beetle; c, green bug (*Euschistus variolarius*).



TOBACCO BUDWORMS.

a, moth of the true budworm (*Heliothis rhexiæ*); b, caterpillar of same; c, buds injured by false budworm (*Heliothis armiger*).

The so-called horn-worms, or 'horn-blowers,' of tobacco are the larvæ of two sphingid moths (*Protoparce carolina* and *Phlegethontius celeus*), large green caterpillars with oblique white stripes on the sides of the body, and the anal end of the body armed with a horn. These larvæ live upon tobacco leaves, transform to pupæ under the ground, and the moths issue in May or June. The eggs are laid singly on the under side of the tobacco leaf just at nightfall. There are two generations each summer in a large part of the tobacco-growing region. Two insects, both larvæ of noctuid moths, are known as 'bud-worms' in tobacco fields. They are *Heliothis armiger* (also known as 'bollworm' (q.v.), corn-ear worm, and tomato fruitworm), which preferably lives in the ears of corn until the grain becomes hard, and therefore works in tobacco usually only toward the end of the season, and *Heliothis rhexiæ*. The latter is the true budworm. (See Colored Plate of AMERICAN MOTHS.) The adult is a small greenish moth, and the larva is found in the bud of the plant about the time it is ready to top. They transform to pupæ under the surface of the ground. A true bug (*Dicyphus minimus*) damages the second crop in late tobacco by puncturing the leaves and sucking the cell sap. Infested leaves become yellowish in color, somewhat wilted, and the older ones eventually split in places, becoming ragged. The bug, when immature, lives on the under side of the leaves, but the adults live both above and below. The eggs are deposited singly in the tissues of the leaf and hatch after four days. One entire generation is produced in fifteen days. Several other sucking bugs puncture tobacco leaves, but are not serious enemies of the crop, except, perhaps, the 'green bug' (*Euschistus variolarius*).

The tobacco leaf-miner, or 'split worm' (*Phthorimœa operculella*) hatches from eggs laid upon the leaves by a minute grayish moth, and bores between the surfaces of the leaf, making a flat mine often of considerable size. This insect is a cosmopolitan species and works upon potatoes as well as upon tobacco, boring into the tubers as well as the leaves. Several species of cutworms (q.v.) damage the tobacco plant early in the season. A mealywing (q.v.) (*Aleyrodes tabaci*) damages the leaves of tobacco in Europe and in the Southern United States. The common mealy-bug (*Dactylopius citri*) affects the plant, as also do several species of plant-lice. The tobacco thrips (*Thrips tabaci*) is an important enemy of tobacco in Bessarabia. It occurs upon many plants in the United States, especially upon onions, but has not been found upon tobacco.

Most of the insects mentioned may be destroyed by spraying the plants with an arsenical mixture. Nearly all of them feed upon solanaceous plants, and an excellent remedial measure is to allow a few weeds of this family, such as *Solanum nigrum* or *Datura stramonium,* to grow in the immediate vicinity of the field which is to be planted in tobacco. These weeds will act as traps for nearly all of the early tobacco insects, and they can be treated with heavy doses of Paris green for the leaf-feeding species, and with a spray of kerosene emulsion and water for the sucking bugs. Large numbers of these insects can be killed in this way, greatly to the protection of the young tobacco plants when they are set out.

Dried tobacco is attacked and frequently ruined, even after having been made up into cigars and cigarettes, by the so-called cigarette beetle (*Lasioderma serricorne*), an insect which works not only in tobacco, but in many other dried herbs as well as certain dried foods. It is a cosmopolitan species, and multiplies rapidly throughout the greater part of the year, feeding both as larvæ and as adults. The 'drug-store beetle' (*Sitodrepa panicea*) and the common rice weevil (*Calandra oryza*) also feed upon dried tobacco. These insects are destroyed by fumigating the rooms or the establishments in which they occur with bisulphid of carbon or hydrocyanic acid gas.

All of the species above mentioned occur in the United States, although several of them are cosmopolitan. In Europe 144 species are recorded as occurring in tobacco fields. The most important of these, among the species which do not occur in America, is a tenebrionid beetle (*Opatrum intermedium*), which injures the plant by attacking the stems under ground. Consult Howard, *The Principal Insects Affecting the Tobacco Plant* (Washington, 1900).

TOBACCO PIPE. An implement for the smoking of tobacco. The use of a pipe for smoking herbs of various sorts dates from a period when these plants were burned in a container and the smoke employed for sacrifices or for healing. Aside from the specimens discovered in ancient sites in Europe, the greatest prehistoric distribution of the pipe is in America. Here the widespread primitive form is a drilled tube of stone, wood, bone, or pottery, in the form of a large cigar holder, evidently taking its shape from that of a tube of cane. This type is found almost exclusively west of the Mississippi, and its early use was for blowing out smoke and not for drawing it into the mouth. This form, when put into clay, shows a later transition toward the modern pipes by bending the stem. In the Eastern United States the prehistoric pipe shows considerable modification of the original tube, and some of the varieties are the monitor pipe with the bowl set on a flat base perforated as a stem, hour-glass pipes, biconical pipes, etc. The peace pipe or calumet (q.v.) descends from the monitor form. The red stone called catlinite, commonly used for calumets, came into use in historic times. The Alaskan Eskimo pipe is of Asiatic form, with a very small cavity in a mushroom bowl attached to a stem, while the Labrador Indian pipe is of a well-marked type consisting of a separate bowl of stone beautifully worked and a short stem. Numerous examples of sculptured pipes have been found in Ohio and Illinois, and have been attributed to the so-called 'mound-builders.' The tomahawk pipe was introduced through trade by the French, English, and Spanish, and certain tribes affected a certain style of this pipe.

The ethnographic study of the pipe or its modification and adaptation to their uses by different peoples shows not only that the spread of the pipe into different environments has given rise to a great number of inventions connected with this utensil, but that their forms, materials, and artistic conceptions have taken upon themselves racial or tribal individuality, as e.g. Turkish and Chinese pipes. Most of the inventions have grown out of the desire to cool the smoke and relieve it of acrid principles, giving rise to the great class of water-pipes widespread in Asia and Africa, as the hookah or narghile, and the ornate Chinese water pipe, and in other countries resulting in absorbing bowls, as the meerschaum, clay, brier root, or other substances, as well as devices for condensing the nicotine in a receptacle below the bowl, as in the German *lange Pfeife.* The same result is attained by the long stem of the pipe and by the long coiled tube of the narghile. Numerous evidences of taste are shown in the decoration of the bowls, stems, and mouthpieces and in the tobacco pouches, strike-a-light, match-boxes, and cleaners, which are smokers' accessories. The bowl is often covered for protection against the wind, and is frequently carved or molded in the form of human or animal heads, as in the European characteristic or grotesque pipes, especially those of Holland and Germany. The opium pipe of China is a special development with a large cylindrical bowl having a small aperture, and a large flute-shaped stem designed for the inhalation of a small quantity of fumes from a pellet of burning opium. The hemp pipe of India is a form of water pipe in which tobacco or a mixture of tobacco and hemp may be smoked. The Chinese and Japanese prefer a pipe with a very small bowl in which a pellet of finely shredded tobacco is smoked. The Koreans use a larger bowl with an extremely long stem. In Africa the water pipe is rudely made of a cow's horn perforated for stem and bowl holder. It is said that a Kafir lacking a pipe will often dig a small hole in the ground in which he puts tobacco, fit a stem in position below it, and, lying on his belly, enjoy a smoke. Consult: Nadaillac, *Les pipes et le tabac* (Paris, 1885); McGuire, *Pipes and Smoking Customs of the American Aborigines* (Washington, 1897).

TOBA'GO or **TABAGO.** An island of the British West Indies, belonging to the colony of Trinidad, and situated 22 miles northeast of the island of that name (Map: West Indies, R 9). Area, 114 square miles. It is of volcanic origin and is mountainous, with peaks rising about 2000 feet above the sea. The climate is warm, and the rainfall on the windward side amounts to 66 inches. Sugar and coffee have been the staple products, but cotton, tobacco, and cacao are now receiving more attention, and a large number of rubber trees have been planted. The volume of trade amounts to about $150,000 annually. Population, in 1901, 18,750, chiefly negroes. The chief town, Scarborough, has about 1000 inhabitants. The island was discovered by Columbus in 1498, and became a British possession in 1763.

TOBERENTZ, tō'be-rĕnts, Robert (1849—). A German sculptor, born in Berlin, where he frequented the Academy in 1867-69. He then studied under Schilling in Dresden and from 1872 to 1875 in Rome. After his return to Berlin he became a follower of Begas, in whose manner he executed, among other works, the bronze figure of a "Shepherd Resting" (1878, National Gallery). In 1879 he was appointed director of a master studio for sculptors connected with the Breslau Museum, resigned in 1884, and after living in America in 1885-89, returned to Berlin in 1890 and became professor in 1895. He completed the "Luther Monument" of Paul Otto, in Berlin, modeled the equestrian statue of Frederick Barbarossa for the Kaiserhaus at Goslar, and made the statue of Frederick the Great for the Royal Palace in Berlin. He also fashioned several masterly life-size nude figures, such as an "Ancient Greek Maiden Sculptor" and "Girl Asleep on a Couch."

TO'BIT, Book of (Gk. Τωβειτ, *Tobeit*, Τωβειθ, *Tobeith*, from Heb. *Tōbiyāh*, Yahweh is good). One of the books of the Old Testament Apocrypha. The Catholic Church regards it as in the canon and historical. The personage around whom the story of the book centres is Tobit of the tribe of Naphtali, who was carried away to Assyria by Shalmaneser. Here he obtains an official position with the King, but loses it under Sennacherib, and because he has buried certain Jews killed by order of the King, he flees from Nineveh. His nephew, Achiacharus, pleads with the successor of Sennacherib, and under Esarhaddon Tobit returns to Nineveh. Again he buries the dead, and while in an 'unclean' condition he sleeps outside the wall of his courtyard and loses his eyesight. In his misfortune he is supported by his nephew Achiacharus, but, taunted by his wife, Anna, he sends his son Tobias to collect an outstanding debt in Ragæ in Media. Tobias takes with him as guide one Azarias (in reality Raphael, the angel). On the way Tobias is attacked by a fish, whose heart, liver, and gall he takes at the command of Raphael. They come to the house of Raguel, a kinsman of his, and Tobias marries Sara, the only daughter of Raguel. By burning the heart and liver of the fish in the bridal chamber the evil spirit, Asmodeus (q.v.), who has already killed seven husbands of Sara, is driven away. The debt collected, the three return to Nineveh, and Tobias applies the gall of the fish to his father's eyes and their sight is restored. Tobit dies at Nineveh and is buried there, but Tobias dies at Ecbatana, yet not before he has heard of the destruction of Nineveh by Nebuchadnezzar. The date of the composition of the book is variously given as the fourth century B.C. (Ewald), third century (Reuss), and second century (Schürer, Nöldeke). The latter is probably correct. The story is a pure romance, and the vividness of the descriptions is but a proof of the artistic ability of the writer. The book exists at present in Greek, Latin, Syriac, Aramaic, and Hebrew manuscripts, the texts of which differ considerably. The oldest and most valuable text is that contained in the Alexandrine codex of the Septuagint and probably represents the original text. The Hebrew versions, of which there are three, are late and based on the Greek text. The purpose of the book is to emphasize God's Providence toward pious Jews who remain faithful to their religion with all its ceremonial obligations. Consult: Kautsch, *Apokryphen* (Tübingen, 1900); Wace, *Apocrypha* (London, 1888); Neubauer, *The Book of Tobit* (Oxford, 1878); and for the text, Nestle, *Septuaginta-Studien* (Leipzig, 1899).

TOBLER, tō'blĕr, Adolf (1835—). A Swiss Romance philologist, born at Hirzel, in the Canton of Zurich, and educated in the schools of that town and at the University of Bonn. In 1867 he became professor at the University of Berlin. His monographs on philological subjects are many, and his researches have contributed greatly to the knowledge of Old French syntax. His publications include: *Gedichte von Jehan de Condet* (1860); *Mitteilungen aus altfranzösischen Handschriften* (1870); *Li dit du vrai Aniel* (1871 and 1884); *Vom französischen Versbau alter und neuer Zeit* (3d ed., 1894; French translation, 1885); *Das Buch der Uguçon des Laodho* (1884); *Das Spruchgedicht des Girard Pateg* (1886); *Vermischte Beiträge zur französischen Grammatik* (three series, 1886-94); an edition of *Li proverbe Vilain* (1895).

TOBLER, Titus (1806-77). A Swiss Oriental scholar. He was born at Stein, Canton of Appenzell, studied and practiced medicine, traveled in Palestine, and after taking part in the political affairs of Switzerland, settled in 1871 at Munich. His principal work is *Topographie von Jerusalem und seinen Umgebungen* (1853-54), which was supplemented by *Beitrag zur medizinischen Topographie von Jerusalem* (1855); *Planographie von Jerusalem* (1858); *Dritte Wanderung nach Palästina* (1859); *Bibliographia Geographica Palestinæ* (1867). Consult his *Life* by Heim (Zurich, 1879).

TOBOGGAN (North American Indian *otobanask, odabagan*, sled). A vehicle used for coasting, which differs from the ordinary coasting sled in that it has not runners beneath its flat surface. It seems to have been improvised by the Indian hunters, who used it to bring in their dead game over the snow. With them it was simply a strip of bark turned up at the front to facilitate its passage over rough ground and braced by strips or pieces of wood running both crosswise and along the edges. Among the Eskimos it was made from strips of whalebone. It is of the same primitive pattern to-day, except that in some cases a light rail runs along its sides. For sporting purposes it is usually made of thin strips of ash, maple, or hickory, slightly oval on the bearing surface, placed side by side and fastened at the ends, the under surface being highly polished. The ordinary toboggan is about 18 inches wide and 6 to 8 feet long. The usual number of occupants is four. One sits in front with his feet under the hood, two in the centre, and the steersman at the back. The latter sits crouching, one leg bent, the other stretched behind him to be used as a rudder, for which purpose his moccasin has a hard leather steering-tip. In some cities, especially Montreal, chutes are constructed for this sport. Great speed is attained on them; a distance of 900 yards has been traveled in 30 seconds. See Coasting.

TOBOLSK′, *Russ. pron.* tô-bôl′y'sk. A government of Western Siberia, bounded by the Arctic Ocean on the north, the governments of Tomsk and Yeniseisk on the east, the territories of Akmolinsk and Semipalatinsk on the south, and European Russia on the west (Map: Asia, G 2). Area, estimated at 535,000 square miles. The surface is flat with the exception of the northwestern part, which is covered with offshoots of the Ural Mountains, attaining an altitude of over 4000 feet. The larger part of the north belongs to the region of polar tundras and is practically uninhabited. The southern part is somewhat undulating and consists to a large extent of vast steppes, well watered and with a rich black soil which makes that part of the government one of the richest agricultural regions in the Empire. The chief waterway is the Ob (q.v.), which, with its great tributary, the Irtysh (q.v.), drains almost the entire region. Lakes are very numerous and some of them are salty. The climate is continental and severe, the average annual temperature varying from 24° at Berezov (q.v.) in the north to about 32° at Tobolsk in the south. The immigration into Tobolsk has latterly been very strong, and some parts in the south are as densely populated as any rural part of European Russia. The agricultural holdings are comparatively large, and considerable quantities of grain are exported. Wheat and rye are the principal products. Dairying is a growing industry and the export of butter exceeds $1,500,000 per annum. The manufactures are chiefly paper, cloth, spirits, leather, and glassware. Of the population of 1,438,484 in 1897, the non-Russian element numbered only about 90,000, composed chiefly of Tatars, Ostiaks, Samoyeds, and Voguls.

TOBOLSK. The capital of the government of the same name in Western Siberia, situated on the Irtysh at its junction with the Tobol and 172 miles north of Tyumen, the terminal of the North Siberian Railway (Map: Asia, F 3). It is well built and has a picturesque appearance with its Kremlin and numerous churches. Its importance has greatly diminished since the construction of the Trans-Siberian Railway. Its chief industries are fishing and fur-making. Tobolsk was founded in 1587 and is one of the oldest Russian settlements in Siberia. Population, in 1897, 20,427.

TOBY. The name of Punch's dog, in the Punch and Judy shows.

TOBY, Uncle. A leading character in Sterne's *Tristram Shandy.* He is a retired sea-captain, simple, kindly, and gallant, said to have been modeled on Sterne's father.

TOCANTINS, tō′kån-tēns′, *Pg. pron.* tō′käɴ-tēɴsh′, Rio. A large river of Brazil, often considered as a branch of the Amazon (Map: Brazil, H 4). It rises in the southern part of the State of Goyaz, and flows northward, emptying into the Atlantic Ocean through the large estuary known as the Rio Pará (q.v.), which communicates with the estuary of the Amazon. The total length of the Tocantins is about 1700 miles. About 600 miles from its mouth it receives the Araguayá (q.v.), which flows nearly parallel with, and exceeds in length, the main river from the point of confluence. The Tocantins is obstructed in several places by rocky reefs formed by spurs of the cordillera which it skirts. The last of these, the Falls of Itaboca, are situated below the confluence of the Araguayá, only 130 miles above the estuary, and completely obstruct navigation. Small steamers, however, ply on the upper reaches, though the country along the banks is very sparsely populated and almost undeveloped.

TOCCATA, tô-kä′tå (It., touched). In music, a term originally applied to compositions written for keyed instruments, thus having a somewhat more restricted meaning than sonata, a composition for any instrument. The oldest toccatas preserved are some written for the organ by Claudio Merulo (published 1598). They generally begin with full chords which gradually give way to passage-work among which small fugato sections are interspersed. The modern toccato does not materially differ from that of Merulo. See Sonata.

TOCHER, tô′gẽr (Ir. *tochar*, Gael. *tochradh*, dowry, portion). In the Scotch law, an ancient name for money or property given or settled by a father on the marriage of his daughter.

TOCHIGI, tō′chê-gê. A town in the Prefecure of Tochigi in Central Hondo, Japan, 55 miles by rail north of Tokio (Map: Japan, F 5). It is of some industrial importance and had in 1898 a population of 22,379.

TO′CORO′RO. A Cuban trogon (*Priotelus temnurus*) named from its cry. It breeds in holes abandoned by woodpeckers, and is remarkable for the concave outline of the end of its short tail.

TOCQUEVILLE, tôk'vēl', ALEXIS CHARLES HENRI CLÉREL DE (1805-59). A French statesman and political philosopher, born at Verneuil, in the Department of Seine-et-Oise. At the Restoration his father was made a peer of France. His mother was a granddaughter of Malesherbes, the academician, political writer, and magistrate, who defended Louis XVI. at the bar of the Convention. Alexis de Tocqueville studied law, was admitted to the bar in 1825, traveled in Italy, and on his return became an assistant magistrate at Versailles. In 1831 he gave up his appointment at Versailles, and with his colleague there, Gustave de Beaumont, accepted a Government mission to America, to study the working of the penitentiary system. The commissioners, after their return to Europe, published their report (*Du système pénitentiaire aux Etats-Unis*, 1832; Eng. trans., Philadelphia, 1833)—an admirable work, which modified all the ideas previously entertained in France regarding prison discipline. But this was not the most important result of their inquiries. In 1835 De Tocqueville published his great work, *De la démocratie en Amérique.* In his introduction he sought to show that a great democratic revolution had for centuries been going on in Europe. There is a general progress toward social equality, which must be looked on as a providential fact. In France it has always been borne on by chance, the intelligent and moral classes of the nation never having connected themselves with it, in order to guide it. In America he found that the same revolution had been going on more rapidly than in Europe, and had indeed nearly reached its limit in the absolute equality of conditions. There, accordingly, he thinks we may see what is about to happen in Europe. He points out that the people in America may be strictly said to govern. They make the laws and administer them. He draws from what he has observed the conclusion that democracy may be reconciled with respect for property, deference for rights, safety to freedom, and reverence for religion. The work made a profound impression. Its author was elected to the Academy of Moral Science in 1836 and to the French Academy in 1841.

In 1835 De Tocqueville visited England, where he received an enthusiastic welcome from the leaders of the Whig Party. In the same year he married Miss Mary Mottley, an Englishwoman. In 1837 he was defeated as a candidate for the Chamber of Deputies from Valognes, but two years after he was elected by an overwhelming majority, and ranged himself with the Moderate Opposition Party. After the February Revolution he was a formidable opponent of the Socialists and extreme Republicans, as well as of the partisans of Louis Napoleon. He became, in 1849, vice-president of the Legislative Assembly, and from June to October in the same year was Minister of Foreign Affairs. During that time he defended the policy of the expedition to Rome, on the ground that it would secure liberal institutions to the States of the Church. After the coup d'état of Decembeer, 1851, he retired to Tocqueville, where he devoted himself to agricultural pursuits. In 1856 appeared his second great work, *L'ancien régime et la révolution.* In June, 1858, he took up his abode at Cannes, where he died. De Tocqueville's *Œuvres et correspondance inédites* were published (1860), by his friend De Beaumont, who prefixed a biographical notice. His *Mémoires* are a valuable contribution to the history of the Revolution of 1848 and the coup d'état. An English translation, *The Recollections of Alexis de Tocqueville,* was published in New York in 1896.

TOCUYO, tô-ko͞o'yô. A town of the State of Lara, Venezuela, 180 miles southwest of Carácas, on the Tocuyo River (Map: Venezuela, D 2). The valley of this river is one of the richest agricultural and grazing districts of the Republic, producing in abundance sugar-cane, wheat, coffee, and cacao. Besides exporting these products Tocuyo has wool and leather manufactures, salt works, and household weaving. Tocuyo was founded in 1535. Population, about 15,000.

TODAS, tō'dȧs. A people of the Nilgiri Hills in Southern Hindustan, who have been the subject of much discussion by ethnologists. The majority of the authorities consider them to be of Dravidian stock. The Todas are tall, well-built, dolichocephalic, with prominent nose, features approaching the Caucasian, full beard, black hair, and rather light brown skin. Consult Marshall, *A Phrenologist Among the Todas* (London, 1873).

TODD, CHARLES BURR (1849—). An American author, born at Redding, Conn. He was prevented by poor eyesight from entering college, and became a journalist and historical student. In 1877 he was appointed commissioner for the erection of a suitable memorial on the side of the winter quarters of Gen. Israel Putnam's division of Continentals in Redding, Conn. In 1895 he was secretary of the committee appointed by Mayor Strong for the printing of early records of New York City. His publications include: *History of Burr Family* (1879); *Life and Letters of Joel Barlow* (1886); *The Story of the City of New York* (1888); and other works.

TODD, DAVID PECK (1855—). An American astronomer, born at Lake Ridge, N. Y., and educated at Amherst College. He was chief assistant to the United States Transit of Venus Commission in 1875, and his reductions of the observations were the first derived from the American photographs. He took charge of the Lick Observatory observations of the transit of Venus in 1882. In 1887 he conducted the American Eclipse Expedition to Japan and there organized a subsidiary expedition to the summit of Fujiyama for meteorological observations. He returned to Japan in 1896 as head of the Amherst Eclipse Expedition. His publications include: *A Continuation of De Damoiseau's Tables of the Satellites of Jupiter to the Year 1900* (1876; also extended back to 1665), used by American and foreign nautical almanacs; *A New Astronomy* (1897); and *Stars and Telescopes* (1899).

TODD, JOHN (1800-73). A Congregational minister. He was born at Rutland, Vt.; graduated at Yale College in 1822, and at Andover Theological Seminary in 1826. He was pastor at Groton, Mass., in 1827-31; Northampton, 1833-36; Philadelphia, 1836-42; Pittsfield, Mass., 1842-72. He was one of the founders of Mount Holyoke Female Seminary. He had a vigorous and original mind, much practical shrewdness and wit, and fine descriptive power. Some of his works had immense circulation, especially *The Student's Manual* (1835; 20th ed. 1853). He wrote many books for children and young people. His complete works appeared in London (new ed. 1882, 6 parts). Consult *Autobiography* (New York, 1876).

TODD, Robert Bentley (1809-60). An Irish physician, born in Dublin, and educated there at Trinity College. In London he lectured on anatomy for a short time at the Aldersgate Street School of Medicine and then went up to Oxford. About this time he projected the *Cyclopædia of Anatomy and Physiology*—a work which did much to advance the study of comparative and microscopic anatomy. The first number was published in 1835 and the entire work was completed in 1859. He was appointed professor of physiology and general and morbid anatomy at King's College, London, in 1836. In 1849 he gave the Lumleian lectures and in 1853 he resigned his professorship in King's College. He was known for his pioneer work in the treatment of fevers and inflammations. His publications include: *Gulstonian Lectures on the Physiology of the Stomach* (1839); *Practical Remarks on Gout, Rheumatic Fever, and Chronic Rheumatism of the Joints* (1843); *Description and Physiological Anatomy of the Brain, Spinal Cord, and Ganglions* (1845); *Lumleian Lectures on the Pathology and Treatment of Delirium and Coma* (1850); and *Clinical Lectures* (3 vols. 1854-59, and 1 vol. 1861).

TODDY-CAT. See Palm-Cat.

TOD'HUNTER, Isaac (1820-84). An English mathematician. He was educated at University College, London, and at Saint John's College, Cambridge. He was elected Fellow of Saint John's in 1845, and the rest of his life was devoted to mathematical writing and teaching, and to the study of philosophy and of languages. He was a fellow of the Royal Society (1862). Todhunter's text-books were the most popular ones ever published in England. They include, besides a number of elementary text-books: *Differential and Integral Calculus* (1852); *Analytical Statics* (1853); *Analytical Geometry of Three Dimensions* (1858); *History of the Progress of the Calculus of Variations During the Nineteenth Century* (1861); *History of Probability* (1865); *History of the Mathematical Theories of Attraction* (1873); *Researches on the Calculus of Variations* (1871); *Treatise of Laplace's, Lamé's, and Bessel's Functions* (1875); *History of the Theory of Elasticity* (posthumous, 1886). Consult: *Proceedings of the London Mathematical Society* (1884, p. 284, with list of writings); *Proceedings of the Royal Society* (1884, xxvii.).

TODHUNTER, John (1839—). A British poet, born in Dublin, Ireland. He graduated in medicine at Trinity College, Dublin, in 1866, and continued his medical studies in Vienna and Paris. After practicing his profession for a time in Dublin, he became professor of English literature in Alexandra College, Dublin (1870-74). He traveled in the East and settled in London. His lyrical poems comprise: *Laurella and Other Poems* (1876); *Forest Songs* (1881); *The Banshee and Other Poems* (1888); and *Three Irish Bardic Tales* (1896). His dramas include: *Alcestis* (1879); *Rienzi* (1881); *Helena in Troas* (1885); *A Sicilian Idyll* (1890); *The Poison Flower* (1891); *The Black Cat* (performed in 1893). His prose comprises: *The Theory of the Beautiful* (1872); *A Study of Shelley* (1880); and *A Life of Patrick Sarsfield* (1895).

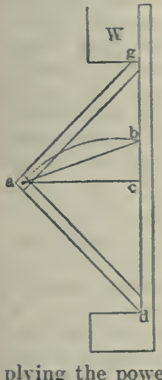
TODI, tō'dē. A town in the Province of Perugia, Italy, situated on an abrupt hill near the Tiber, 23 miles south of Perugia (Map: Italy, G 5). Its Etruscan origin is shown in its dilapidated walls and numerous tombs. Its fine remains of the Roman period include a temple or basilica, a theatre, and an amphitheatre. The Romanesque cathedral has a huge tower and frescoes by Lo Spagna. The Renaissance Church of Santa Maria della Consolazione, a massive structure surmounted by three domes, is simple but wonderfully impressive. The splendid Gothic Palazzo Comunale contains a small picture gallery. Todi, the Umbrian Tuder, was the scene of the decisive victory of Narses over the Goths in 552. Population (commune), in 1901, 16,561.

TOD'MORDEN, *locally* tạ'môr-den. A market-town in Lancashire, England, on the border of Yorkshire, 6 miles north-northeast of Rochdale (Map: England, D 3). Cotton manufactures form the staple industry; coal abounds in the neighborhood, and there are foundries and machine works. It owns gas and water-works, maintains a public library, and supports technical instruction. Population, in 1901, 25,420.

TODY (from Lat. *todus*, sort of small bird). Any of several species of small West Indian birds forming the family Todidæ, and related to the kingfishers, bee-eaters, and motmots (qq.v.). They are less than three inches long with a short tail and long bill. The plumage is very gorgeous, grass-green, carmine-red, and white. They breed in holes in banks and lay white eggs. The best known species is the common green tody (*Todus viridis*) of Jamaica, which is a familiar and useful little bird, often called 'robin redbreast' by the English residents. The name 'tody' is incorrectly applied to rollers, barbets, and other brilliantly colored tropical birds, even in the East Indies. See Plate of Wrens, Warblers, etc.

TOGA (Lat., mantle). The principal outer garment of the Roman citizen, worn over a shirt (*tunica*). For ordinary citizens the toga was pure white in color (*toga virilis, toga pura*); boys, and most of the magistrates, wore togas with an attached border of crimson (*toga prætexta*). On certain occasions of especial festivity magistrates appeared in a toga entirely of crimson embroidered with gold (toga picta), worn over a tunica of similar character (*tunica palmata*). Candidates for public office presented themselves in togas freshly laundered and artificially whitened (*candida*, shining). On the other hand, persons in mourning for any reason wore carelessly arranged and soiled togas (*sordida*), or even those of an artificially darkened color (*pulla*). The material of the toga was wool, closely woven, and fulled, with a combed nap, making it (at least in late Republican and early Imperial days) cumbrous, expensive, and (except in winter) too heavy a garment. The shape of the toga, like its size, the elaboration of its folds, and the way it was worn, differed at different periods. It was less voluminous in earlier days. By the beginning of the Empire it must have been fully twice as long as the wearer was tall, and of an elliptical shape. It was folded lengthwise and hung over the left shoulder (with the fold toward the neck) so that the end rested a few inches upon the floor in front. The rest of the garment was passed around the back, under the right arm, and thrown backward over the left shoulder, so that the end hung down behind, but cleared the ground. The folds were most carefully and systematically arranged (in later days, more or less, pins or clasps were used), and the end that depended in front was pulled up to clear the floor, and the slack (*nodus, umbo*) allowed to hang down over the mass of folds (*sinus*) that crossed the front of the body toward the left shoulder. The right arm was thus left free, and the left for the most part covered. The toga was not usually worn at home, the tunica being regarded as sufficient: and for out-of-door wear it gave place under the Empire, except on formal occasions, to lighter and more convenient garments, chiefly of foreign origin. See COSTUME.

TOGGLE JOINT (probably connected with ME. *toggen, tuggen*, to tug, variant of *tukken*, AS. *tucian*, to pull, and akin to Eng. *tow*). A mechanical appliance acting on the principle of the inclined plane. Let *ad* and *ag* represent the arms of the toggle joint, with the joint at *a*. Then, if the arms are brought to a perpendicular, the end *d* being stationary, the point *a* will move through the arc *ab* to *b*, and at each point in the arc in the direction of a tangent at that point. As the point *a* approaches *b* the tangent will become more and more horizontal, and at last perpendicular to the arms *ad* and *ag*. When they form one and the same straight line the weight *w* will have been raised to twice the height *bc*. The form in the figure here presented is given to show more clearly the action of the knee and elbow joints in man, but that which is more frequently used, particularly in hay and cotton presses (to which the appliance is peculiarly adapted), makes the ends *d* and *g* of the arms approach each other, applying the power at *a* making *ac* the perpendicular. It will be seen that on the application of power the motion of the point *a* will at first be quite rapid (when the hay or cotton is loose), becoming slower and slower as the points *d* and *g* approach each other, so that when both arms become very nearly perpendicular the weight or resistance will move very slowly; but the power will be extremely great, and adapted to the resistance offered by the greatly compressed bale. See INCLINED PLANE.



TOGOLAND, tō′gō-länt. A German protectorate in West Africa, bounded by Dahomey on the east, the Gulf of Guinea on the south, and the Gold Coast Colony on the west and north (Map: Africa, E 4). The northern boundary has not yet been definitely settled. Area, estimated at 33,000 square miles. The low sandy coast rises toward the interior, which is mostly undulating and traversed by the Aposso Mountains, entering from northern Dahomey. The chief rivers are the Mono, the Dako, the Sio, and the Haho. There are many coast lagoons. The climate is moist and unhealthful. Togoland possesses abundant natural resources, which are gradually being developed. Extensive cocoanut plantations have been established along the coast, and good crops of corn and rice are raised. Tobacco and coffee are also cultivated. The chief products for export are palm oil and kernels, rubber, ivory, and copra. The imports and exports amounted in 1901 to $1,124,050 and $878,351 respectively. The chief ports are Lome, which is also the seat of administration, and Little Popo. A narrow-gauge railway line is being constructed between the two places. Togoland comes nearer to being self-supporting than any other German colony. The population is estimated at 2,500,000, chiefly Sudanese. Togoland was declared a German protectorate in 1884.

TOINETTE, twä′nĕt′. In Molière's *Malade imaginaire*, the bright young servant of the title character. She constantly irritates her master, but makes his interests her own, and brings about the marriage of Angélique and Cléante.

TOKAIDO, tô-kī′dô. An ancient division of Hondo, the principal island of Japan, occupying the eastern part of the island. It developed later than the western and southern parts of the island, but since the triumph of Yoritomo (q.v.) at the end of the twelfth century it has been dominant, ruling Japan from Kamakura and Yedo (Tokio). It is now the most populous and richest part of Japan.

TOKAIDO. A name applied to the great highway which connects Tokio with Kioto. It is 323 miles long. Starting from Nihombashi (Jap., Bridge of Japan), in Tokio, it skirts the Bay of Tokio and the Pacific, climbs the Hakone Mountains across the peninsula of Idzu, again follows the coast line through many large towns to Kuwana, 247½ miles from Nihombashi, where it turns inland to Lake Biwa and Kioto. It is the most famous though not the most ancient highway in Japan. Here in the days of the Tokugawa régime the daimios from the centre and west of Japan traveled with their trains of armed men to and from their enforced residence in Yedo. The sides of the road were planted with lines of great cedars, there were inns at distances of every six or seven miles, and the journey in palanquin and on slow-walking horses took ten days. Since the abolition of the feudal system the Tokaido has lost its romance, and by the completion of the railway between the cities its importance has diminished.

TO′KAY (*Ger. pron.* tô′kī). **TOKAJ**, tô′koi. A town in the County of Zemplin, Hungary, at the confluence of the Bodrog and Theiss, 41 miles north of Debreczin, on the Szerencs-Debreczin Railway (Map: Hungary, G 2). In the vicinity are sapphire and carnelian deposits and saltworks. Tokaj is celebrated for its wines. The population of the commune, in 1900, was 26,711; of the town, about 5500, mostly Magyars.

TOKAT, tô-kät′ (Arm. *Evtoghia*). The capital of a sanjak in the Vilayet of Sivas, Turkey in Asia, 125 miles northeast of Kaisarieh (Map: Turkey in Asia, G 2). It is in a hilly region abounding in fine scenery, and is well laid out. The chief features of interest are the Byzantine castle and the old Roman tombs. The town is the commercial centre for a section producing fruit, hemp, corn, and tobacco, and has manufactures of cotton cloth, dyestuffs, copper wares, and leather. Population, in 1901, 29,890, the majority being Mohammedans. During the Middle Ages Tokat, the ancient *Dazimon*, was an important trading centre. It was the scene of an Armenian massacre in 1895.

TOKEN MONEY. See MONEY.

TOKIO, tō′kē, or **TOKYO** (formerly YEDO) (Jap., Eastern Capital). The capital of Japan, situated on the southeast side of the island of Hondo, on the Bay of Tokio, in latitude 35° 41′ N., longitude 139° 46′ E. (Map: Japan, F 6). The city covers a wide area, and is exceedingly irregular in outline, being, indeed, a number of towns grown together rather than a single city laid out according to design. It is divided into two unequal parts by the river Sumida. The eastern portions along the river and fronting the bay are level and low, the western rise into considerable hills with a dense population in the valleys which separate them. The chief feature is the palace inclosure within the grounds of the ancient castle. These grounds under the old régime were very extensive and were surrounded by an outer wall and moat more than two and a half miles in length. This wall has been leveled in part and the moat filled up. Within was a second moat and wall, and even a third in parts. The old residence of the Shogun within the third wall was burned in 1872 and has been replaced by the palace of the Emperor, in a mixed Japanese-European style of architecture. It stands in the ancient and beautiful park called Fukiage. The palace was first occupied by the Emperor in 1889. Much of the area inclosed by the outer wall and moat was occupied in the past by the mansions of the feudal barons, but these are now destroyed and in their place are the various buildings devoted to the use of the Government, in European style and devoid of especial interest. To the east of the castle is the distinctively commercial portion of the city, with banks, warehouses, shops, hotels, restaurants, newspaper offices, and dwellings. A long main street, variously named in different parts, and without any general designation, passes through this part of the city from northeast to southwest. It is broad, with rows of trees, a tramway, electric lights, and rows of low buildings of stone and brick in a semi-European style. From it lanes and streets diverge in all directions, for the greater part lined with small wooden buildings, inexpensive and without pretension. Mingled with them are storehouses made of mud or clay, and incongruous modern buildings. Of late years some of the streets have been straightened and widened, wooden bridges have been replaced by iron ones, and many improvements have been introduced. Nevertheless the old styles of shops and dwellings are in so vast a majority that this part of Tokio is still essentially as in the centuries past.

In the northern part of the city is the arsenal, with the beautiful garden attached which formerly belonged to the mansion of the Barons of Mito. Not far away is the ancient building used as a library which was once the great Confucian College. Farther to the north on the site of the town mansion of the Baron of Kaga is the Imperial University. (See TOKIO, UNIVERSITY OF.) Farther to the east is the great park, Ueno, with the mortuary shrines of eight of the shoguns of the Tokugawa family, and the Imperial Museum filled with objects of great interest. Still farther to the east is the great temple of the goddess of mercy, Kwannon Sama, with a park, many shrines, a pagoda, rows of shops, and innumerable places of amusement. Across the river Sumida, the eastern portion of the city embraces the two districts called Honjo and Fukiage, a quiet region known to visitors chiefly for its displays of flowers, the cherry blossoms at Mukojima, the wistaria at Kameido, and the iris at Horikiri, and for the great wrestling matches at the temple E-ko-in. On the west bank of the Sumida was the Foreign Concession, but since the abolition of extraterritoriality foreigners are permitted to live in all parts of the city. In the same district, on the shore of the bay, is the Imperial park known as Enryo-kwan. In the southern part of the city is the park called Shiba, with the magnificent mortuary shrine of the second Shogun, and the almost equally fine shrines of six others. Beyond the park, still following the line of the bay, is the Temple of Sankakuji, famous for the little cemetery containing the tombs of the forty-seven Ronins. To the west of the palace are many large residences surrounded by gardens and high walls. In the suburbs there are many delightful resorts, especially Meguro, Oji, Futago, and Ikegami. The city is protected against fire by a well-organized fire department equipped with steam fire engines. It has also an excellent police system. The affairs of the city are administered by a mayor, a municipal council, and a municipal assembly. Tokio proper has few industrial interests, although there are numerous factories in the neighborhood. It is unfavorably situated for commerce, as the Sumida River is unnavigable for vessels of large tonnage. Trade is carried on by way of Yokohama. Population, in 1898, 1,440,121.

Originally an obscure hamlet called Yedo (gate of the inlet) stood on the seashore in the district of the city now called Asakusa, while most of the busiest parts of the present city were covered with the waters of the bay and of lagoons. Near Yedo a rude castle was built in the fifteenth century, but the place continued without importance until, toward the end of the sixteenth century, Tokugawa Ieyasu took possession of it, and in 1603 made it the seat of his government of the Empire. He retained the ancient name Yedo, but made it speedily the most important city in Japan and the capital in a sense never known before. Ieyasu commanded artisans and merchants to move to his new city from Kioto and Osaka. He occupied the ancient castle, and in the days of his grandson the new castle was constructed. But the most characteristic and original feature of Yedo was caused by the requirement that the feudal barons should spend a portion of every second year in the city and that in their absence members of their families be left as hostages. In consequence the feudal barons built town mansions, surrounded them with beautiful gardens, and for the first time in the history of Japan came, in time of peace, into contact with each other. The result was rivalry in display and a luxury and extravagance before known only in Kioto in connection with the Imperial Court. From this time Yedo took on the appearance so often described by travelers. Its population was immense, and the success of the policy of Ieyasu is proved by the fact that it was never entered by a hostile army, nor so much as attacked or besieged. The records of the city contain accounts of many terrible catastrophes. Its slight wooden buildings furnished excellent fuel for fire, and repeatedly it was destroyed in conflagrations, until in recent times the building of rows of brick and stone houses has furnished efficient barriers. It has also suffered greatly from earthquakes and from epidemics, while terrible storms have destroyed thousands of dwellings. After the weakening of the House of Tokugawa, in 1863, the requirement of residence for the barons was relaxed, and the population fell off greatly. But after the fall of the shogunate on September 13, 1868, it was made the eastern capital, and its name was changed accordingly to Tokio. It was opened to the residence of foreigners in 1869. Though nominally only the eastern capital, yet, as the residence of the Emperor, the meeting place of the Diet, and the seat of the Government in all departments, it is in reality the only capital of the Empire, Kioto retaining an empty title merely.

TOKIO, UNIVERSITY OF. A Japanese university founded in 1868 by the union of two older schools, as one of the results of the great political and social revolution of that year. It has grown with the growth of modern Japan. At first officered largely by foreigners, these have been gradually superseded by Japanese, for the most part trained in Europe and the United States. The university is a Government institution. Its administration is vested in a president and a board of councilors, two from each college, named by the Minister of Education, for a term of five years. The colleges comprise law, medicine, engineering, philosophy, history, mathematics, and science. Two degrees are given, one for work in course, the other for special distinction. The university includes an observatory and a library. There were 2908 students in 1900-01.

TÖKÖLYI, tē′kēl-yĭ, or **TÖKÖLI,** IMRE (Emerich), Count (1656-1705). An Hungarian patriot. He belonged to a Lutheran family and was born at the Castle of Késmárk, in the County of Zips. His father, Count Stephen, was implicated in the conspiracy of Zrinyi, Rákóczy, and Frangipani against Leopold I. of Austria; and after his death, and the execution of Zrinyi and others, young Tökölyi sought an asylum in Poland, where he had large possessions. After vain endeavors to recover from the Emperor his patrimonial estates, he obtained the support of Apafi, Prince of Transylvania, and in 1678 he took the lead in the insurrection in Hungary. He advanced victoriously, capturing a number of towns, and even penetrating into the heart of Moravia. The Turkish Sultan, Mohammed IV., espoused his cause, and in 1682 declared him Prince of Hungary under Turkish suzerainty. Tökölyi joined Kara Mustapha in the great onslaught on Austria in 1683, but after the disaster to the Turks at Vienna many of his followers fell off from him, and in 1685 he was imprisoned by the Turks. He was soon released, however, and resumed operations, but without success. In 1689 he was made Prince of Transylvania by the Sultan, and invaded that country with a Turkish army, but was forced back into Wallachia. He took part in the subsequent campaigns against Austria, and after the Peace of Karlowitz he was made by the Sultan Prince of Widdin and resided as his pensioner at Constantinople, where he died.

TOKUGAWA, tō′kōō-gä′wȧ. The name of the great family which ruled Japan for more than two centuries and a half (1600-1868). Its founder was Ieyasu, one of the five generals from the east of Japan who restored peace after centuries of feudal strife and anarchy. He claimed descent from an early Emperor through the Minamoto family, and took their hereditary title 'shogun' (general). He made Yedo, then an obscure village, the capital of Japan, reformed the laws, and established the system which was characteristic of Japan and made it unique in the eyes of foreigners. Ieyasu retired in 1604 to Shidzuoka, but continued to rule through his son until his death in 1616. His descendants were shoguns to the number of fourteen. The greatest of them was Iemitsu, his grandson, who ruled from 1623 to 1649. Most of the Tokugawa shoguns were weaklings and debauchees. The fifteenth shogun resigned his powers to the Emperor in 1868 and retired to Shidzuoka. Since that time the family has exerted no political power.

TOKUSHIMA, tō′kōō-shē′mȧ. The capital of the Prefecture of Tokushima, in Japan, near the coast in the northeastern part of the island of Shikoku (Map: Japan, D 6). It is the largest city on the island, and is beautifully situated. Population, in 1898, 61,501.

TO′LAND, JOHN (1670-1722). A deistical writer. He was born near the village of Redcastle, in the County of Londonderry, Ireland. He was brought up as a Roman Catholic, but in his sixteenth year was a Protestant. He entered the University of Glasgow in 1687, but removed to that of Edinburgh, where he took the degree of master of arts in 1690. Thence he passed to Leyden, where he entered upon theological studies. On his return to England he resided for some time at Oxford, where he was already looked upon as a free-thinker. *Christianity Not Mysterious*, which he published in London in 1696, and in which he fully avowed his principles, created a sensation in the theological world. In the following year Toland returned to Ireland, but his book was burned publicly by order of the Irish Parliament. Finding it necessary to flee from Ireland, Toland returned to London, where he published a defense against this judgment of the Irish Parliament; but he soon afterwards turned his pen from theological to political and literary subjects. A pamphlet entitled *Anglia Libera* (1701), on the succession of the House of Brunswick, led to his being received with favor by the Princess Sophia at the Court of Hanover, and to his being sent on a kind of political mission to some of the German courts. In 1705 he outstripped the boldness of his former opinions, openly avowing himself a pantheist. In this course he was emboldened by the patronage of Harley, in whose service he had engaged as a political pamphleteer, and by whom he was sent abroad to Holland and Germany in 1707. He returned to England in 1710; and having forfeited the favor of his patron, or at least having separated from him (1714), he engaged as a partisan pamphleteer on the side of Harley's adversaries. His after-life was that of a literary adventurer, and was checkered by every variety of literary conflict and pecuniary struggle.

TOLBOOTH. A massive structure, dating from various periods, on Castle Hill, Edinburgh, removed in 1817. It served as a Parliament House, a court, and a prison. It is known as the Heart of Midlothian, and many relics connected with it were preserved in Sir Walter Scott's collection at Abbotsford.

TOLDY, tōl′dĭ, FERENCZ (1805-75). An Hungarian writer on the history of literature. His real name was Schedel. He was born in Budapest, and educated there as a physician. In 1830 he founded with Paul Bugát, at Budapest, the *Orvosi Tár,* the first Hungarian medical journal, and in 1833 he became professor extraordinary of dietetics at the university. In 1835 he was elected secretary of the Academy, a post which he retained until 1861, and in 1836 he founded the great Kisfaludy literary society, of which he became president in 1841. After 1849 he devoted himself entirely to the history of Hungarian literature, and in 1860 was appointed professor of that subject in the university. His historical and critical works in German and Hungarian include: *Die ungarische historische Dichtung vor Zrinyi* (1848); *Kulturzustände der Ungarn vor der Annahme des Christentums* (1850); *A magyar nemzeti irodalom története* ("History of the Hungarian National Literature," Budapest, 1851); *A magyar költészet története* ("History of Hungarian Poetry," 1855 and 1867); *Marci chronica de gestis Hungarorum* (1867); and *A magyar költészet kézikönyve* ("Handbook of Hungarian Poetry," 2d ed. 1876).

TOLEDO, tō-lā′ᴅō. The capital of the Province of Toledo, Spain, 42 miles south-southwest of Madrid, on the Tagus (Map: Spain, D 3). The hundred-towered city, situated on a bold promontory, bordered on three sides by a bend of the Tagus and surrounded by a lofty wall, preserves almost unchanged its mediæval appearance. The Tagus is spanned by the bridge of San Martín, a well-constructed specimen of the military architecture of the Middle Ages, and the thirteenth-century Bridge of Alcántara; the walls are pierced by a number of gates, of which the most beautiful is the Arabic Puerta del Sol. The houses of the city cluster in the form of a semicircle around the Alcazar. The streets are winding, narrow, and steep. Among the many interesting churches are the Gothic Cathedral dating from 1227, with its forty chapels and library of ancient manuscripts; the cloister of San Juan de los Reyes, a gift of the Catholic sovereigns; Santa Maria de la Blanca, a Jewish synagogue of the twelfth century, rebuilt and consecrated as a church in 1507; and El Tránsito, another synagogue dating from 1366, and given by the Catholic sovereigns to the Knights of Calatrava. Many former convents are devoted to the service of the State as prisons and hospitals. The city hall with two towers and classic façade dates from the fifteenth century. There are a beautiful theatre, and a provincial library containing 70,000 volumes, housed in the archbishop's palace. Toledo is the seat of an archbishop who bears the title of primate of all Spain—one of the few survivals of the period when the city was the centre of Spanish national life. It is largely untouched by modern industrial life and exists as a survival of the golden age of Spanish chivalry. The climate is rather unhealthful and the surrounding region largely barren and cheerless. The city has manufactures of spirits, beer, chocolate, varnish, church ornaments, cloth, silk goods, pottery, brick, and fans. But the most famous establishments of Toledo are those devoted to the manufacture of arms, for even before the time of Roman domination Toledo blades were famous. The present Government factory dates from 1777; within recent years establishments for the manufacture of cartridges have been added. There are also several private establishments for the manufacture of arms and ammunition. Population, in 1900, 23,375.

Nothing certain is known of the origin of Toledo. Under the name of *Toletum* it is mentioned by Livy in connection with the date B.C. 192. After the period of Roman sway it fell first into the power of the Alani, and a little later came under the control of the Visigoths, of whose kingdom it became the capital. From A.D. 400 to 701 it was the meeting place of eighteen Church councils which exercised a great political as well as religious influence on Spain. Under the Arabs it was a city of great importance. After the dissolution of the Caliphate of Cordova it was the seat of a short-lived Mohammedan kingdom. Alfonso the Valiant of Leon and Castile conquered this State in 1085 and gave the name of New Castile to the region. The town became an important place of residence for the Castilian monarchs. In the War of the Communes (1520-21) Toledo espoused the popular cause. In 1808 it took part in the national uprising against the French, and in 1810 and 1813 suffered much from the vandalism of their armies. Consult Camero, *Historia de la ciudad de Toledo* (Toledo, 1863).

TOLEDO. A town of Cebú, Philippines, situated on the central part of the west coast, 39 miles from Cebú (Map: Philippine Islands, H 9). Population, 10,900.

TOLE′DO. The third city of Ohio and the county-seat of Lucas County, situated at the mouth of the Maumee River where it enters Lake Erie by way of Maumee Bay; 130 miles north of Columbus (Map: Ohio, C 2). The Maumee through the city averages half a mile in width, and is navigable for lake vessels of the largest size. There is an excellent harbor with 25 miles of docks, eight miles of which are devoted to coal and ore. A straight channel, 400 feet wide and 21 feet deep, leads to the lake. Six passenger steamship lines connect the city with Mackinac, Detroit, Montreal, and other river and lake cities. Nineteen railroads enter the city, including five divisions of the Lake Shore and two divisions of the Wabash. It is the terminus of the Ohio Central and is tapped by the Michigan Central. It is the terminus of the Pennsylvania, Toledo, Saint Louis and Kansas City, Cincinnati, Hamilton and Dayton, Hocking Valley, Wheeling and Lake Erie, Pere Marquette, Detroit, Toledo and Milwaukee, Ann Arbor, and Grand Trunk railroads. These lines are intersected and connected by the Toledo Railway and Terminal Company's belt line, which maintains an immense union passenger and freight depot and a lake transfer house. There are 110 miles of street railroads reaching every portion of the city. The river is spanned by five railroad and two passenger bridges.

Just ouside the city limits are the flourishing suburbs of Rossford, with the celebrated Ford plate glass works, and West Toledo. A large portion of the city rests on made ground, as the greater part of its site was formerly a swamp, the first settlements having been made on two hills that rose from this swamp. The streets are paved with brick, asphalt, and stone, and throughout the residential portions are well planted with shade trees. The city has 848 acres of parks, including Walbridge Park, with fine zoölogical gardens and the city greenhouse; Ottawa Park, with a public golf course; Riverside, Bay View, Navarre, City, and Collins parks; and planted triangles in all sections. The outlying parks are connected by a fine boulevard about 25 miles in length, as yet completed only in part. Public playgrounds for children are situated in populous quarters of the city. There is a municipally owned cemetery which is self-supporting.

Among the more prominent buildings are the county court-house in the centre of the city with a beautiful park containing a fine statue of President McKinley; the Public Library; the Soldiers' Memorial Building, erected by the city at a cost of $100,000 for the soldiers and sailors of Lucas County; the Toledo Club; the Spitzer office building; and Saint Patrick's and Saint Paul's churches. There are 42 public school buildings, including two high schools and a manual training school and university. Toledo Medical College has a high standing and is afforded special clinical facilities by the Toledo and Saint Vincent's hospitals, as well as by a number of private hospitals. There are numerous private educational institutions, including Saint John's College. The Public Library (46.000 volumes) maintains a reference library and reading rooms. It has five sub-stations.

Toledo is the meeting point of the iron ore from the Lake Superior region and the coal of Ohio and Virginia. It is the central point of the northwestern Ohio oil fields, and is surrounded by a fine agricultural country especially adapted to fruit-gardening. The building of lake and ocean vessels is extensively carried on, and among the more important manufactures are plate glass, cut glass, bicycles, automobiles, agricultural implements, malt liquors, clothing, malleable iron, foundry products, tobacco, etc. In the census year 1900 the various industries were capitalized at $25.592,000 and had an output valued at $37,372.000. There is a very large grain trade, and the clover-seed market is second only to that of Chicago. Vessels to the number of 2313, having an aggregate tonnage of 1,854,262, touched at the port in 1902. In shipment of coal Toledo leads every lake port but Cleveland.

The government, under the new charter, is vested in a mayor, a council of 16 members, a board of public service, city solicitor, treasurer, and auditor, all elected by the people; a board of public safety appointed by the mayor if the council indorses his appointments, if not, by the Governor of the State; and a number of minor boards, health, library, sinking fund, etc., appointed by the mayor. Toledo spends annually more than $2,800,000, exclusive of amounts for public schools; but a considerable portion of this goes for interest on the bonded debt. The waterworks are municipally owned and operated, and have a capacity of 45,000,000 gallons, with an average daily consumption of 10,000,000 gallons. The supply is drawn from the Maumee River. Plans are prepared for a $750,000 filtering plant. The sewerage system comprises 140.3 miles of mains.

The site of Toledo was a favorite resort of the Miami Indians in the eighteenth century. The place was first settled in 1832 and was chartered as a city in 1837, its population then being less than 1000. With the surrounding territory it was claimed for several years by both Ohio and Michigan, the dispute culminating in 1835 in the so-called 'Toledo War' (q.v.)—a war of words only. The population in 1840 was 1222; in 1850, 3829; in 1860, 13,768; in 1870, 31,584; in 1880, 50.137; in 1890, 81,434; and in 1900, 131,822. The total in 1900 included 27,822 persons of foreign birth and 1710 of negro descent.

TOLEDO WAR. A boundary controversy which arose in 1835 between the State of Ohio and the Territory of Michigan. Congress in the Ordinance of 1787 had reserved the right to form new States out of that part of the territory northwest of the Ohio River "lying north of an east and west line drawn through the southerly bend or extreme of Lake Michigan." Ohio was admitted as a State in 1803, the above line being described in the act as its northern boundary, though the State Constitution claimed more territory. When in 1805 Michigan Territory was organized, and, later, Indiana and Illinois became States, the most confused ideas existed on the boundary question. A survey was made by order of Congress in 1817 which established the present line. The old line had included in Michigan the city of Toledo, and this was the main point in dispute. In 1835 Ohio laid claim to all within the new line, known as the Harris line, and proceeded to organize townships therein. Michigan declared the intention of resisting such invasion, and the militia of both sides were called upon to maintain the alleged rights of their respective governments. An opinion of the United States Attorney-General, B. F. Butler, favored Michigan; President Jackson sent out a 'peace commission' with no result, and serious conflict seemed imminent. In September. 1835, the Michigan troops occupied Toledo to prevent the formal organization of Wood County by Ohio officers. The latter, however. accomplished their purpose secretly and withdrew. The trouble was finally settled by the admission of Michigan into the Union on condition that she accept the Harris line. while as a make-weight that State was given the upper Wisconsin Peninsula, which afterwards proved from its mineral wealth to be far more valuable than the disputed territory.

TOLENTINO, tō'lĕn-tē'nō. A town in the Province of Macerata, Italy, on the Chienti, 30 miles south-southwest of Ancona (Map: Italy, H 4). The cathedral has a good portal by Rosso. The churches of San Catervo and San Francesco possess noteworthy frescoes and reliefs. There are manufactures of machinery, silks, woolens, wine, and olive oil, and stone quarries. Tolentino was the scene of Murat's defeat by the Austrians on May 2-3, 1815. Population (commune), in 1901, 12,872.

TOLERATION (Lat. *toleratio*, from *tolerare*, to endure, tolerate; connected with Gk. τλῆναι, *tlēnai*, to bear, endure, Skt. *tul*, to lift up, weigh). The recognition of the right of private judgment; specifically, such recognition, on the part of the Government, in matters of faith and worship. By governmental toleration is granted not only the liberty of holding and putting into practice varied religious opinions, but of teaching and defending them publicly. But thereby no permission is given to violate the rights of others, or to infringe laws designed for the security of the governing power or for the protection of decency, morality, or good order. See Liberty, Religious.

TOLIMA, tô-lē′mȧ. A southern department of Colombia, South America, bounded by the departments of Antioquia and Cundinamarca on the north, Cundinamarca and Cauca on the east, and Cauca on the south and west (Map: Colombia, B 3). Area, about 18,500 square miles. The western and eastern parts belong to the region of the Central and Eastern Cordilleras respectively, while the central belongs to the valley of the Upper Magdalena. Agriculture is carried on chiefly in the central part, where sugar, cacao, rice, and tobacco form the chief products. The stock-raising industry is also important. The mineral deposits of the department are extensive, but are almost utterly neglected. The climate along the river is tropical, but it is cold in the upper mountain regions. There are no good means of communication. The population was estimated at 230,000 in 1892. Capital, Ibagué (q.v.).

TOLIMA. A quiescent volcano in Colombia rising from the Central Cordillera of the Andes, 75 miles west of Bogotá. It is the highest peak in the country, having an altitude of 18,325 feet.

TOLL (AS. *toll, tol*, OHG. *zol*, Ger. *Zoll*, toll, tax; probably from Lat. *telonium*, from Gk. τελώνιον, custom-house). In law, a charge or duty paid for some service, or the license to use something, generally in the nature of a public franchise. The right to exact toll is almost entirely created by statute, and generally is only granted to persons who maintain some public convenience, as a ferry, bridge, or turnpike. See Franchise, Ferry; Highway.

TOLLENS, tôl′lĕns, Hendrik Caroluszoon (1780-1856). A Dutch poet, born in Rotterdam. He was the son of a merchant, and himself was engaged in commerce till 1846. His early work followed French models and ideas. His first original works were poems (1802), followed by *Lucretia* (1805) and other historical tragedies, and works of much strength. His subsequent productions were mainly lyric and more distinctively national and simple. These poems, gathered under various titles (1808-53), show powers undiminished to the last. He won wide popularity through the national song *Wien Neêrlandsch bloed.* His best work is *Tafereel van de overwintering op Nowa Zembla* (Picture of the Wintering on Nova Zembla, 1819).

TOLOSA, tô-lō′sȧ. The former capital of the Province of Guipúzcoa, Spain, 16 miles southwest of San Sebastián, in the valley of the Oria, and on the Irum-Burgos line of the Northern Railway (Map: Spain, D 1). It contains the Church of Santa Maria, the Palacio Idiaquez, and two handsome *pascos.* During the nineteenth century it was an important Carlist centre. Its principal manufactures are paper, woolens, steel, brassware, and malt liquors. Population, in 1900, 8100.

TOLS′TOY, *Russ. pron.* tôl-stoi′, Alexei Konstantinovitch, Count (1817-75). A Russian author. He was born in Saint Petersburg, and studied at Moscow. After seeing diplomatic service and traveling extensively, he took part in the Crimean War, and subsequently held a high position at the Court. He wrote lyric and epic poetry and one novel, *Prince Serbryanyi* (trans. by J. Curtin, 1893), after the manner of Sir Walter Scott. His chief literary achievement, however, was his dramatic trilogy, *The Death of Ivan the Terrible* (1866; Eng. trans. by F. Harrison, London, 1869), *Czar Fedor Ivanovitch* (1868), and *Czar Boris* (1870). All three parts were published together at Saint Petersburg in 1876.

TOLSTOY, Dmitri, Count (1823-89). A Russian statesman. After serving in the Ministry of the Navy, he became procurator of the Holy Synod in 1865 and Minister of Public Instruction in 1866. In both positions his reformatory measures aroused violent opposition, and especially through his undue preference for the classical languages in the intermediate schools, and his petty tutelage over the universities, he incurred such widespread enmity that he was obliged to resign in 1880. Appointed president of the Academy of Sciences in 1882, he held the post of Minister of the Interior in 1883-85. He was the author of a history of the finances of Russia to the reign of Catharine II. (1847), and of *Le catholicisme romain en Russie* (1863-64).

TOLSTOY, Lyoff (Leo) Nikolayevitch, Count (1828—). A famous Russian author. He was born on his father's estate at Yasnaya Polyana, in the Government of Tula, August 28, 1828. In 1843 he studied Oriental languages at the University of Kazan, a year afterwards he began to study law, and he received his diploma in 1848 'knowing literally nothing,' as he asserted later. He lived on his estate until 1851, when his brother, an artillery officer, induced him to visit the Caucasus. Charmed by the life there, he joined an artillery regiment, and in 1853 was attached to the Army of the Danube during the Crimean campaign. During this period he published his *Childhood, Incursion, Boyhood, The Morning of a Proprietor,* and *The Cossacks.* He took part in the defense of Sebastopol, and embodied his experiences in *Sebastopol in December, 1854, Sebastopol in May, 1855,* and *Sebastopol in August, 1855.* These sketches immediately placed Tolstoy among the great pen-masters of the day. They painted the horrors of war, with its show heroes and real heroes, in the spirit of that cruel, cold-blooded realism which is the chief trait of Tolstoy's unyielding logic. It was naked truth and nothing else. At the end of the war Tolstoy resigned and went to the capital. A visit abroad in 1857 sowed the seeds of his disappointment in modern civilization, and *From the Memoirs of Prince Nekhlyudoff (Luzern)* was an indignant protest against the poverty and ignorance in modern society. He settled on his estate at Yasnaya Polyana and devoted himself to school work among the peasants. A second visit abroad to study the German methods of education served only to intensify his disappointment, and his own methods, as embodied in practice and in his pedagogical publication, *Yasnaya Polyana*, were an attack on all existing standards, and called forth a heated discussion in pedagogical circles. About this time work on a long novel, *The Decembrists* (of which only three chapters appeared), led Tolstoy to the study of the reign of Alexander I. and his interest gradually was centred on the great Napoleonic campaign. Thus he came to write his *War and Peace* (1864-69)—a colossal prose epic, embracing the whole of Russia at the beginning of the nineteenth century, from the Emperor down through all stages of society.

Again the elemental forces of the common people are lovingly dwelt upon in contrast with the artificiality of the upper classes. With the artistic exposition is intertwined a new philosophy of history, which in the last analysis is but old fatalism in a new guise. After this, pedagogical pursuits absorbed Tolstoy's energies, until in 1875-76 *Anna Karenina* appeared in *The Russian Messenger.* This great work deals with the unlawful relations of the social lion, Vronski, and Anna, wife of Karenin, the bureaucratic machine. The great questions of human life which centre around marriage are treated here with unapproachable mastery, force, and directness. The novel has a second plot—the life of the rationalist proprietor, Konstantin Levin, and his wife, Kitty. Amid perfect home surroundings, he is discontented, and even thinks of suicide, until he is 'regenerated' through contact with the common people, and finds new strength in manual labor. According to later statements of the author this work contained much autobiographical material.

After this, philosophical and social questions took complete hold of Tolstoy, and for more than a decade he gave to the world a series of religious, social, and philosophical treatises, like *Commentary on the Gospel; Letter on the Census* (1883); *Confession; My Religion; What Shall We Then Do?* a few short stories written for the people, *The Death of Ivan Ilyitch* (1885), and the dramas *The Power of Darkness* and *Fruits of Culture.* Works of literary art were also produced at this period. *The Kreutzer Sonata* (1888), denouncing marriage, raised a storm of indignation on both sides of the Atlantic. *What Is Art?* (1898), a great philippic against art as commonly understood, although leaving the question unanswered for many, was a brilliant contribution to the literature of the subject. It contains ideas of great depth and breadth, interspersed with paradoxes, and is interesting as a proof of the thoroughness with which Tolstoy goes into his work. It is the result of a minute study of every writer of any consequence on the subject. In 1899 a new work of fiction, *Resurrection*, appeared. The central figure, Nekhlyudoff, while acting as a juror, recognizes in the culprit the woman whom he had betrayed in his youth. Torn by remorse, he finally comes to the conclusion that he is the real cause of the woman's guilt and downfall, and wishes to expiate his former wrong-doing by accompanying her to Siberia and sharing with her all hardships of the exile. All the bitterness that had been collecting in the heart of the author seems to have found free utterance, and the work is a powerful arraignment of all existing institutions. In 1900 a drama, *The Corpse*, appeared. In March, 1901, the Holy Synod issued the excommunication with which he had been threatened for nearly thirty years.

Tolstoy has the same power of psychological analysis that characterized Dostoyevski (q.v.), but excels him in range and variety. Dostoyevski does not get beyond the magic circle of the middle classes, while Tolstoy is equally at home in all walks of life. He draws, with the same firm hand and correctness, the rulers of men's fates, courtiers, generals, petty officers, common soldiers, great noblemen, peasants, prisoners in the dungeons and on the great road to Siberia, men, women, children—everywhere he strikes the very bottom of human character. There is none of Dostoyevski's nerve-harassing for the sake of satisfying the author's own 'cruel talent'—the great reformer is actuated by nothing but the desire to get at truth, and his conscience will not rest until he arrives at it. Hence Tolstoy's works, although they depict the rise and evolution of controlling passions with a master hand, and contain scenes that are entrancing in beauty, still possess none of those elements of piquancy that attract the many to read works of the realistic school. He came to know his peasants through his pedagogical work among them, and became a great believer in the salutary influence of labor. The philanthropic work during the famines of 1873 and 1891 gave him an impulse for the "Simplification of Life" which filled the foreign periodicals with sensational pictures and descriptions of Tolstoy in a cheap shirt-blouse, girded with a rope, with his hands on a plow, tilling his estate at Yasnaya Polyana. Gradually he came to defy all unnecessary comforts of life, did cobbling and all manual labor for himself, preaching *Karma* and the doctrines of Lao-Tse. The principle of simplification was carried into his religious beliefs: all teaching not coming from Christ Himself was ruthlessly discarded, and a new gospel reconstructed from the old. The doctrine of evangelic humility was carried to the extreme of his famous doctrine of non-resistance—especially remarkable side by side with individualism of an extreme kind. All human institutions—kingly power, State, Church, judiciary, jury, army, even marriage—were in turn anathematized as standing in the way of the natural development of the powers of an individual. Always carrying his logic to its inexorable limits, Tolstoy had to denounce his own literary achievements along with all products of civilization, as begotten of idle fancy and human craving for the plaudits of the world. This double individuality of Tolstoy the artist and Tolstoy the man is perhaps the most striking case in the annals of literature.

In 1862 Tolstoy married Sophie Andreyevna Behrs of Moscow, by whom he had eight children. One son, Lyoff Lyovitch, who inherits his father's literary inclinations, has attracted considerable attention by his sketches in periodical publications.

Tolstoy's collected works were published at Moscow in 14 volumes in 1889-95 (8th edition). An English translation by N. H. Dole of the complete works in 12 volumes with an introduction by the translator was published (New York, 1900). Most of Tolstoy's works are also obtainable in French translations. There is a vast literature on Tolstoy and his works. The best books in Western languages are: De Vogüé, *Le roman russe* (Paris, 1866); Löwenfeld, *Gespräche mit Tolstoy* (Berlin, 1891); id., *L. N. Tolstoy, sein Leben, seine Werke, seine Weltanschauungen* (ib., 1892); Eugen Zabel, *Litterarische Streifzüge durch Russland;* P. A. Sergeyenko, *How Tolstoy Lives and Works*, translated by I. F. Hapgood (New York, 1899). Consult also: Howells, *My Literary Passions* (New York, 1895); Ward, "The Gospel of Count Tolstoy," in *Prophets of the Nineteenth Century* (ib., 1900).

TOL′TEC, or **TOLTECA**, tôl-tā′kȧ (People of Tollan, the modern Tula). An early cultured people of Mexico, the subject of considerable historical controversy. According to the general Mexican tradition they were the most ancient civilized race of Mexico, preceding the arrival of the ruder Aztec, who derived their own best culture by absorption from the Toltec. Their capital was at the now ruined city of Tollan or Tula, whence their dominion extended over all the central pleateau, eastward to the Gulf and southward to the Maya border. After some centuries of flourishing existence their empire fell to pieces through internal dissensions and the invasion of barbarous northern tribes about the close of the tenth century, the survivors from war and famine being either incorporated by the conquering Aztec or driven southward to become the culture pioneers among the southern tribes as far as Guatemala. The entire subject of Toltec history is so interwoven with myth and disfigured by exaggeration and uncertainty of dates that it is difficult to arrive at any conclusion, but enough remains to indicate that the Toltec had an important historic existence, either as a distinct race finally absorbed by conquering invaders from the north, or, which is more probable, as the advance guard of the Nahuatlan stock (q.v.), preceding the arrival of the Aztec by several centuries. Consult Valentini, *The Olmecas and the Tultecas* (Worcester, 1883).

TOLUCA, tô-lo͞o′kȧ. The capital of the State of Mexico, Mexico, thirty-four miles southwest of the city of that name, on the Mexican National Railroad (Map: Mexico, J 8). It is a clean, well-built city, with an altitude of 8653 feet and a cool and healthful climate. Its Institute and State buildings are interesting. The manufactories consist of breweries, cotton mills, and oil and flour mills. It is well known for its drawn work. In the vicinity is the extinct volcano Nevado de Toluca, a snow-capped peak 15,155 feet high. Tradition assigns the city a Toltec origin; it was an important Aztec pueblo called Tollân at the time of the Conquest. Population, in 1895, 23,150.

TOM, Mount. A mountain peak on the west bank of the Connecticut River, in Hampshire County, Mass., about five miles south of Northampton (Map: Massachusetts, B 3). It is 1214 feet high and affords a splendid view of the Connecticut Valley. Its summit is reached by a mountain railway.

TOMAHAWK (Algonquian *tomehagan*, Mohegan *tumnahegan*, Delaware *tamoihecan*, tomahawk; probably connected with Cree *otomahuk*, knock him down, *otâmahwaw*, he is knocked down). In general, the hatchet or axe made and used by the American natives. The aboriginal implement was usually of stone, either flaked and chipped, or battered and ground or polished. The former type was usually of flint or chert, with a constriction for holding the haft; the latter was commonly of green stone, granite, or other tough material, grooved to receive the haft. This haft was usually of wood. In rougher specimens it was merely a withe doubled or bent around the implement and firmly attached with sinew or rawhide, sometimes with the aid of a wedge, but in the more elaborate forms used in ceremonies and on the warpath it was carefully wrought of tough wood and attached to the head by means of sinew or rawhide lashings. Itself a symbol of war, the tomahawk usually bore some emblem of peace, and the highest type combined the weapon and the pipe, the distinctive American symbol of amity. This type culminated in the calumet (q.v.). The native type served as a model for a trade implement manufactured of metal and imported for barter with the natives, especially during the seventeenth century, which in its turn became the model for artists, and to some extent for the tribesmen themselves. The tomahawk grades into the celt (q.v.), and to some extent the implements were interchangeable; but while native copper was a not uncommon material for the latter implements, copper tomahawks are extremely rare. See Indians; Archæology, American.

TOMASZOW, tôm′ȧ-shôv. An important manufacturing town in the Government of Piotrkow, Russian Poland, 41 miles northeast of Piotrkow. It has extensive textile mills, with an annual output valued at over $3,000,000. Population, in 1897, 21,041, including many Germans and Jews. It dates from the early part of the nineteenth century.

TOMATO (Sp., Port. *tomate*, from Mexican *tomatl*, tomato), *Lycopersicum esculentum.* A semi-vine-like annual herb of the natural order Solanaceæ, native to South America in the region of the Andes. It was formerly called love apple and was considered poisonous. It is now widely cultivated in all temperate regions and considered one of the most wholesome and important garden vegetables. Near the large cities it is extensively forced. The numerous varieties vary much in form from the red currant forms to the small yellow pear-shaped varieties and the larger red sorts. The red sorts with smooth round fruits somewhat flattened at the ends and varying from 2 to 4 inches in diameter are most in cultivation. The tomato is propagated from seed and in greenhouses often by cuttings. In the temperate regions these are usually started in the greenhouse, hotbed, or cold frame, and the plants transferred to the field when the weather is warm and all danger from frost is past. The plants thrive best in a sandy soil, well fertilized. They are set in the field about five feet apart each way and in garden culture are often trained to stakes to keep the fruit off the ground. In the United States tomatoes are more largely grown for canning than any other vegetable. Over 5,500,000 cases of 24 cans each, requiring 300,000 acres of land for their production, are packed annually. Maryland, New Jersey, Indiana, and California are the leading States in production, the first two giving nearly one-half the entire pack. The bacterial blight (*Bacillus solanacearum*) attacks also the egg-plant and potato. The leaves become yellow, and the stems wilt and later become brown or black, the plant being destroyed. Spraying for the disease itself appears to have little effect, but preventing insect attack is thought to act as a check. The leaf blight (*Cladosporium fulvum*), often a more serious pest, appears as brownish spots on the under side of the leaves and yellow on the upper. As the disease progresses the leaves curl up and finally drop from the stem. A leaf-spot disease (*Septoria lycopersici*), sometimes troublesome, causes numerous spots to appear on the leaves and young stems, ultimately destroying them. Tomato rot is caused by various fungi, e.g. *Phytophthora infestans, Macrosporium tomato,* attacks the green fruits of the tomato usually at the blossom end and first shows as a small black spot, which increases rapidly until half the fruit is a soft, black, sunken mass. *Fusarium lycopersici* attacks the ripe fruit, covering it with a thick, white mold, which later becomes reddish. This disease is less common than the others. Repeated sprayings with Bordeaux mixture or other fungicide have been recommended as checks. Diseased fruits should be removed and burned. Consult Bailey, *The Forcing Book* (New York, 1898); *United States Department of Agriculture Farmers' Bulletin No. 76* (Washington, 1898). See Plate of VEGETABLES.

TOMATO INSECTS. Many of the insects that attack the tomato also live upon other members of the family Solanaceæ. Among the most common are blister-beetles, plant-lice, flea-beetles, and cutworms, descriptions of which will be found under their respective titles. Others are discussed under POTATO INSECTS; TOBACCO PESTS; STALK BORER. The boll-worm (q.v.) is sometimes seriously troublesome. See illustration under COTTON-WORM.

TOMB (OF. *tombe, tumbe,* Fr. *tombe,* from Lat. *tumba,* from Gk. τύμβος, *tymbos,* sepulchral mound, grave, tomb; connected with OIr. *tomm,* little hill, Skt. *tunga,* vaulted). A chamber or structure for the burial of the dead. In all ages the belief in immortality and the desire to honor the dead have led to the bestowal of the highest efforts of art upon their burial places. The ancient belief in the intermediate, shadowy existence in the tomb of the *ka* or 'double' of the deceased led also to the decoration of the tomb interior with pictured or carved 'doubles' of the appurtenances of mundane life for the delectation of this imprisoned shade, as in the tombs of Egypt and Etruria.

Tombs may be either excavated or structural. Those cut in the rock are called *hypogæa.* Of these the most noted are those which honeycomb the west bank of the Nile in Egypt, some having roomy chambers with open porches in front; others, more numerous, penetrating deep into the cliffs (that of Seti I. extending 800 feet) with a complex of descending passages, chambers, and pits. Other rock-cut sepulchres are in the 'Valley of the Kings,' near Jerusalem; at Petra in Syria, where are Roman hypogæa with elaborately carved façades; the tomb of Darius at Naksh-i-Rustam in Persia; and many Etruscan tombs with less elaborate façades at Cære, Vulci, Corneto, etc. In Lycia, besides hypogæa with carved fronts, there are many tombs above ground hewn each from a single block into the semblance of a timber-framed structure. The splendid Sidon sarcophagi in the Constantinople Museum, shaped like small shrines or temples, almost deserve to be called tombs on account of their size and elaborate architecture. Intermediate between the rock-cut and structural tombs are such subterranean or buried structures as the hive-shaped Pelasgic tombs of Mycenæ, e.g. the so-called 'Treasury of Atreus.'

Structural tombs in the open air affect usually the type of a tumulus, of a shrine, of a tower, or of a canopy over a solid *podium* or pedestal. The Pyramids of Egypt are the grandest examples of the first type. (See PYRAMIDS.) The Romans sometimes built circular tombs surmounted by a cone or tumulus of earth or masonry; e.g. tombs of Cæcilia Metella, of Augustus, and of Hadrian; the last named on the Vatican side of the Tiber, over 200 feet in diameter, but like the others destitute of its mound, is now known as the Castle Sant' Angelo. The Greeks attempted little in the way of sepulchral architecture except in Asia Minor, where the magnificent tomb of Mausolus (whence 'Mausoleum,' q.v.) in Caria was accounted one of the Seven Wonders. The Romans, who delighted in raising impressive tombs, perfected the canopy or tower type, as in elegant examples at Saint-Remy and Vienne in France, Igel, near Treves, Mylassa in Asia Minor, and many other places. They lined their great highways beyond their city gates with tombs of various types and often of great beauty, and in the fourth century developed, in such examples as the tomb of Saint Helena, the circular tomb with a dome, which was in the Middle Ages adopted by the Moslems and perfected, first on a small scale but with great richness of detail, in the hundreds of domed and minareted tombs at Cairo known as tombs of the Khalifs, and later in such majestic structures as the tombs of Khurrem at Constantinople, of Humayun at Delhi, and of Mahmud at Bijapûr, and in the incomparable Taj Mahal (q.v.) at Agra. Syria abounds in tombs of all types, mostly dating from the early Christian centuries, though not a few belong to the Roman dominion, e.g. the 'Tomb of Absalom' at Jerusalem, the tombs at Palmyra, etc.

In early Christian times and the Middle Ages the practice of interment within the church edifice became common, springing from that of erecting the altar over the tomb or sarcophagus of a martyr (altar-tomb). Throughout the Middle Ages the decoration of indoor tombs assumed a great variety of shapes, the most common type being that of a sarcophagus bearing on the cover a recumbent figure of the deceased, under a richly wrought canopy borne by twisted shafts or clustered columns and pointed arches and embellished with sculpture and often with mosaic. These tombs were sometimes free-standing, sometimes set against a wall, or even set high up upon the wall, especially in Italy. Both kinds are to be seen imitated in the celebrated open-air tombs of the Scaligers at Verona. The bronze shrine of Saint Sebaldus at Nuremberg is a late Gothic example of the canopy tomb. The Renaissance adopted these types, but altered their details and filled the churches of Italy, France, England, Germany, and Spain with splendid monuments, some of great refinement and beauty, others marvelously rich and even ostentatious, to the memory of the great dead. The fifteenth-century wall-tombs of Italy are especially beautiful, and such churches as Santa Croce at Florence, Santi Giovanni e Paolo at Venice, Santa Maria del Popolo at Rome, and Westminster Abbey became great repositories of sepulchral art. Sculpture played an increasing part in these works, and in the seventeenth and eighteenth centuries was lavishly employed in allegorical groups, often theatrical and vulgar.

In modern cemeteries, besides the ordinary graves with their gravestones or obelisks, are to be seen tombs shaped like classic shrines, and occasionally more elaborate structures fronted or surmounted by elaborate groups of allegorical sculpture. Among important mausolea may be mentioned the impressive dome of the Invalides at Paris, serving as the tomb of the great Napoleon, and the less successful Grant mausoleum in New York. Neither of these compares in splendor, however, with the Oriental tombs mentioned above. Modern sepulchral art is inferior to mediæval, Renaissance, or Oriental art. The modern preference is to erect imposing monuments to the dead in the frequented squares of populous cities, rather than over their quiet graves in remote cemeteries. Consult: Brindley and Weatherly, *Ancient Sepulchral Monuments* (London, 1887); Tosi and Becchio, *Altars, Tabernacles, and Tombs* (Lagny, 1843); Trendall, *Monuments, Cenotaphs, Tombs, and Tablets* (London, 1858); Boussard, *Architecture funéraire* (Paris, 1875); and for Greek and Roman tombs, Stackelberg, *Die Gräber der Hellenen* (Berlin, 1837); Rossi, *Roma, sotteranea cristiana* (Rome, 1887-88). See BURIAL; CAMPO SANTO; CEMETERY; CENOTAPH; NECROPOLIS; PYRAMID; SEPULCHRAL MOUND.

TOMBAC (Fr. *tombac*, Sp. *tumbaga*, Port. *tambaca, tambaque*, from Malay *tāmbaga, tambaga*, copper, from Skt. *tāmrika, tāmra*, copper). An alloy of copper and zinc. *White tombac* contains about 75 parts of copper and 25 parts of arsenic. It is used in making imitation jewelry.

TOMBIG′BEE. One of the chief rivers of Alabama (Map: Alabama, A 3). It rises in the northeastern corner of Mississippi and flows in a south-southeast direction with numerous abrupt windings. After a course of 450 miles it joins the Alabama River to form the network of channels composing the Mobile and Tensas, which empty through several arms into Mobile Bay. The largest tributary is the Black Warrior, which drains the north central part of Alabama. The Tombigbee is navigable to Aberdeen, Miss., 410 miles from Mobile Bay.

TOM BROWN'S SCHOOL DAYS. A noted story of life at the famous Rugby School under the rule of Thomas Arnold, by Thomas Hughes (1856). The vein was continued in *Tom Brown at Oxford*, by the same author (1861).

TOMBS, THE. A noted city prison in New York, erected in 1838, and so named from its massive and gloomy appearance. The low Egyptian structure of granite has been replaced by a modern edifice of greater height. It is connected with the new Criminal Courts by a covered passage known as the Bridge of Sighs.

TOMBS, Sir HENRY (1824-74). An English soldier, born at sea and educated at the India Company's Military College at Addiscomb. In 1841 he entered the service of the East India Company as second lieutenant and soon distinguished himself. In the Sepoy Mutiny he won the Victoria Cross by his gallant conduct at the siege of Delhi in 1857. Afterwards he took part in the capture of Lucknow, the relief of Shahjahanpur, and in an expedition to Shakabad. In 1863 he was made brigadier-general and in 1867 major-general. During his later years he was in command of several important expeditions in India, but in 1872 resigned his command and returned to England, where he died. Consult: Mallerson, *History of the Indian Mutiny* (London, 1878-80); Stubbs, *History of the Bengal Artillery* (London, 1877); and Roberts, *Forty-one Years in India* (London, 1898).

TOMCOD (probably from North American Indian *tacaud*, plenty-fish, or perhaps from *tom* + *cod*). One of the small codfish of the genus Microgadus, as *Microgadus tomcodus* of the Atlantic Coast, or *Microgadus proximus* of the Pacific. They are very abundant and of considerable importance as food. See Plate of CODFISH AND ALLIES.

TOM CRINGLE'S LOG. A sea yarn by Michael Scott, which first appeared in *Blackwood's Magazine.* The hero, as an officer of the British Navy, in the early part of the nineteenth century, passes through many adventures by sea and land, principally in the West Indies. As a picture of West Indian life in the old days and for descriptions of tropical scenery it has no equal in the English language.

TOME, tō-mā′. A modern seaport of the Province of Concepción, Chile, 12 miles north of the city of that name. It has made notable commercial progress and is now the principal grain port of the surrounding provinces. Municipal population, in 1885, 5530.

TOME INSTITUTE. See JACOB TOME INSTITUTE.

TOMELLOSO, tō′mĕl-yō′sō. A town in the Province of Ciudad Real (La Mancha), Spain, in the district of Alcázar de San Juan. The town dates from the sixteenth century and is well built. The chief industry is the cultivation of the vine and of cereals, and there are manufactures of spirits, leather goods, and cloths. Population, in 1900, 13,917.

TOM JONES. A noted novel by Henry Fielding (1749). The hero is a foundling, eventually discovered to be the illegitimate nephew of Squire Allworthy, who brings him up. He has a generous and manly character, spoiled by various forms of dissipation.

TOM′LINE, Sir GEORGE PRETYMAN (1750-1827). An English divine, Pretyman by name, who assumed the cognomen of Tomline on falling heir to an estate in 1803. He was born at Bury Saint Edmonds and was educated in that town and at Pembroke Hall, Cambridge, where he formed the acquaintance of the younger Pitt—as his tutor in 1773—which was the making of his own career. In 1783 he became private secretary to Pitt, when that statesman was made First Lord of the Treasury. In that position his mathematical ability enabled him to be of considerable service to his patron in the elaboration of the latter's financial schemes. Tomline was made Dean of Saint Paul's and Bishop of Lincoln in 1787, and was awarded the see of Winchester in 1820. In the following year appeared his memoir of Pitt. This work, although accurate as far as it went, was disappointing in that it took no notice of Pitt's career after 1793 and made scant use of the unique opportunities which the writer had enjoyed for acquaintance with the inner history of the time.

TOM′LINSON, Charles (1808-97). An English scientist, born in London. He studied science under George Birkbeck, the founder of the London Mechanics' Institute. For a while he had a school with his brother Lewis, at Salisbury. Becoming known for original investigation, he was called to London, where he was appointed lecturer on experimental science at King's College School. In 1872 he was elected to the Royal Society, and in 1874 he took a leading part in founding the Physical Society. As a scientist Tomlinson made valuable contributions to the knowledge of the surface tension of liquids. His last years were devoted to literature, and in 1878-80 he held the Dante lectureship at University College, London. Besides several works on mechanics and the useful arts, he published: *The Sonnet, Its Origin, Structure, and Place in Poetry* (1874); a translation of Dante's *Inferno* (1877); *The Literary History of the Divine Comedy* (1879); *Dante, Beatrice, and the Divine Comedy* (1894); and a volume of original *Sonnets* (1881).

TOMMASEO, tô′mȧ-zā′ō, Niccolò (1802-74). An Italian author and lexicographer, born at Sebenico, in Dalmatia. He went to Padua to study law, but turned to literature. In Florence he collaborated on Viessieux's *Antologia*. The Government suppressed the *Antologia* in 1832, and Tommaseo, having to leave Florence, sought refuge in Paris, where he endeavored to make the French better acquainted with his countrymen, through various writings, especially *Dell' Italia* (1835). In 1838 he took up his abode in Corsica, and there made a collection of popular songs, *Canti popolari corsi, toscani, greci e illirici* (1841). He returned to Venice, where he was permitted to stay from 1839 to 1848. In January, 1848, he was arrested because of his liberal opinions, but a popular insurrection freed him. After the fall of Venice in 1849 he went to Corfù, going thence in 1854 to Turin, where he began the publishing of his great *Dizionario della lingua italiana*. He passed his last days in Florence.

The multitudinous works of Tommaseo are all mentioned in the excellent account of him given in vol. v. of d'Ancona and Bacci's *Manuale della letteratura italiana* (Florence, 1895). They embrace religious writings, moral and pedagogical treatises, political essays, philological, literary, and critical works, poems, and ballads; and they all reveal the qualities of the ardent patriot and citizen, of the fervent and tolerant Catholic, and of the clear-thinking and indefatigable scholar.

TOMMASI, tôm-mä′zē, Donato (1848—). An Italian chemist and electrician, born in Naples and educated at Paris and at the University of Brussels. His specialty is electrochemistry, a branch of science in which he made valuable investigations. His discoveries include various methods for separating and extracting metals by electricity (1892), and an accumulator which has been much used on railways. His publications include: *Traité théorique et pratique d'électrochimie* (1889); *Traité des piles électriques et des accumulateurs* (1890); and *Manuel pratique de galvanoplastie* (1890).

TOMMY ATKINS. The popular name for a private soldier in the British army. It had its origin in the Government usage of the fictitious name of Thomas Atkins to designate the place of the soldier's signature in such documents and army forms as were to be signed by him.

TOMOCHICHI, tō′mô-chē′chē (one who makes a bird fly upward) (c.1642-1739). A noted chief of the Yamacraw, a detached band of the Creek Confederacy, in the early period of Georgia colonization. He was a native of the Lower Creek town of Apalachukla, on the Alabama side of the Chattahoochee, nearly opposite the present Columbus, Ga. For some reason he had incurred the displeasure of the confederacy and in consequence withdrew with his immediate followers and established himself in a new settlement on the Savannah River at Yamacraw Bluff, now included within the western limits of Savannah, Ga. Here he met and concluded a treaty of friendship with Governor Oglethorpe, and through his influence a treaty was made in 1733, at Savannah to the Altamaha. In the next year, with a considerable retinue, he accompanied Oglethorpe to England. A monument to his memory was erected in the public square of Savannah.

TOMP′KINS, Daniel D. (1774-1825). An American political leader, Vice-President of the United States from 1817 to 1825. He was born in Fox Meadows (Scarsdale), Westchester County, N. Y., graduated at Columbia in 1795, and in 1797 was admitted to the bar. In 1804 he was elected to Congress, but before taking his seat was appointed by Governor Morgan Lewis to the vacancy on the State Supreme bench caused by the promotion of Judge Kent to the Chief Justiceship. In 1807 he became the candidate of the Clintonian Republicans for Governor to succeed Morgan Lewis, who had been renominated by the Livingston party with strong Federalist support. He was elected over Governor Lewis by 4085 majority, and was reëlected four times, serving altogether ten years. During his third term an attempt to secure a charter from New York State for the Bank of America was accompanied by a wholesale bribing of the State Legislature. After the Lower House had sanctioned the charter, on March 27, 1812, Governor Tompkins prorogued both Houses—a power granted by the Constitution, but never before nor since exercised. The charter was granted at the next session of the Legislature, but Governor Tompkins's action had increased his popularity. During the War of 1812 Governor Tompkins recruited and equipped 40,000 militia in New York State. For these purposes he provided funds raised partly on his personal security. It was on his recommendation made in his last message to the Legislature in January, 1817, that the New York Legislature passed a law decreeing that all slaves should be free on and after July 4, 1827. Throughout both of Monroe's terms in the Presidency (1817-25) Tompkins was Vice-President of the United States.

TOMP'SON, BENJAMIN (1642-1714). An early American poet, born at Braintree, Mass. He was educated at Harvard College and became a school teacher in Cambridge. He is known by his poem on King Philip's War, *New England's Crisis* (1675).

TOM'S. A former London coffee-house in Covent Garden, a fashionable resort, and the headquarters of a club founded in 1764, which among its 700 members included many noted names of the day. Tom's was taken down in 1865.

TOMSK, tômsk. A government of Western Siberia, bounded by Tobolsk and Yeniseisk on the northwest and the northeast, respectively, Yeniseisk and the Chinese Empire (Mongolia and Sungaria) on the east, the Territory of Semipalatinsk on the south, and Tobolsk on the west (Map: Asia, H 3). Area, about 336,000 square miles. The southern and southeastern parts belong to the region of the Altai Mountains, and contain many snowclad peaks, some of them 11,000 feet high. The Kuznetzky Alatau, along the eastern frontier, is densely wooded and rises to about 6000 feet. The remainder of the region is mostly low and consists of vast densely wooded marshes and open steppes. The region is watered mainly by the Obi (q.v.) and its tributaries, including the Irtysh (q.v.). Lakes are numerous and some of them are salty. The climate is severe and unhealthful in the lowlands. In spite of the abundance of the mineral deposits of the Altai Mountains, the mining industry is poorly developed. Agriculture is the principal occupation and the output of cereals is far above the local demand. Stock-raising is also an extensive industry. Manufactures are undeveloped, but the trade with Mongolia is on the increase and there is considerable navigation on the Ob. The trade with European Russia also shows an increase since the construction of the Trans-Siberian Railway. Population, in 1897, 1,929,092, of whom the natives (Tatars, Samoyeds, Ostiaks, etc.) numbered only about 67,500, the remainder being Russians. The immigration to Tomsk has latterly been very heavy. The number of immigrants for the decade 1888-98 was over 227,000.

TOMSK. The capital of the Siberian Government of Tomsk and the intellectual centre of Siberia, situated on the Tom, a tributary of the Ob, and connected by a short line of 54 miles with the Trans-Siberian Railway (Map: Asia, H 3). It is one of the finest cities of Siberia, with electric lighting and street railways, but without an adequate water supply and unsatisfactory in its sanitary arrangements. The university, established in 1888, has two faculties of medicine and law, 540 students, and a library of 200,000 volumes. The commerce is very extensive, Tomsk being one of the chief distributing centres of Siberia. The town was founded in 1604. Population, in 1900, 63,335.

TOMS RIVER. The county-seat of Ocean County, N. J., 35 miles southeast of Trenton; on Toms River and on the Pennsylvania Railroad and the Central Railroad of New Jersey (Map: New Jersey, D 4). It is known as a summer resort. Farming, especially the cultivation of cranberries, fishing and oyster planting, lumbering, and yacht building are the leading industries. Population, in 1900, about 1850. Early in the Revolutionary War important salt works were established here, and a small blockhouse was built to protect them. On March 24, 1782, this blockhouse, then occupied by Captain Joshua Huddy and 25 men, was attacked by a much larger force of Loyalists under Captain Evan Thomas and Lieutenant Owen Roberts, and was captured after a stubborn conflict. Immediately afterwards the village itself was totally destroyed. Consult a pamphlet by Striker, *The Capture of the Old Blockhouse at Toms River, New Jersey* (Trenton, 1883).

TOM THUMB. See STRATTON, CHARLES HEYWOOD.

TOM-TOM. See TAM-TAM.

TON. See WEIGHTS AND MEASURES.

TONALITY (from *tonal,* from *tone,* OF. *ton,* from Lat. *tonus,* from Gk. *τόνος,* tone, sound, tension, strength, cord, from *τείνειν, teinein,* Lat. *tendere,* Skt. *tan,* to stretch). In music, the grouping of certain *chords* around a central *tonic chord.* The principle rests upon the relationship which various chords bear to one another. Briefly stated, a tone is related in the first degree to all tones forming consonant intervals with it; in the second degree to all tones forming *dissonant* intervals with it. Thus we can establish the relationship of D to C by means of the chord of the dominant seventh d-f♯-a-c, which is the dominant of G major, which, in turn, is the dominant of C major.

The relationship of single tones becomes intelligible only through the agency of chords. It is sufficient to recognize only two degrees. Since, when considering the relationship of chords, each chord is considered a *tonic* chord, it will perhaps be best to speak of *triads.* A sharp distinction must be made between *similar* and *dissimilar* triads. If a major triad is followed by another major, or a minor triad by another minor, the two major triads are similar; as are also the two minor triads. But if a major triad is followed by a minor, or vice versa, the two triads are dissimilar. It must also be borne in mind that when speaking of *major* triads all intervals are reckoned *upward;* when speaking of *minor* triads all intervals are reckoned *downward.* A triad is related in the first degree to all *similar* triads whose fundamental tone is related in the first degree to the fundamental tone of the original triad. Thus the triad of C major is related in the first degree to the similar *major triads* of G, F, E, A♭, E♭, A. It is also related in the first degree to the dissimilar *minor triads* whose fundamental lies a fifth below any of the tones of this C major triad. These are F, A, C, a fifth below C, E, G, respectively. To these must also be added the triad built upon the mediant, which in a *major* key is always a *minor* triad. Hence, every triad is related to ten other triads in the first degree. In the case of a minor triad similar relations exist. The triad of A minor is related to the *similar minor triads* of D, E, F, C♯, F♯, C. Also to all *dissimilar major* triads whose fundamental tone is one of the component tones of the A minor triad, viz. A, C, E. To these is also added the triad of the mediant, which in a *minor* key is always a *major* triad.

All triads other than the ten just mentioned are related to the original triad in the second degree. Here the degree of affinity may be more or less remote. See CHORD; CONSONANCE; DISSONANCE; KEY. For a full exposition of the subject, consult: H. Riemann, *Musikalische Syntaxis* (Leipzig, 1877); *Skizze einer neuen Methode der Harmonielehre* (ib., 1880); *Systematische Modulationslehre* (ib., 1887).

TON'AWAN'DA. A city in Erie County, N. Y., about 10 miles north of Buffalo; on the Niagara River and the Erie Canal, and on the New York Central and Hudson River and the Erie railroads (Map: New York, B 3). It is connected with North Tonawanda by two bridges. The prominent features of the city include the armory, the high school, the public library, and a park. Tonawanda is an important lumber market, and is also interested in manufacturing, the chief products being steel, lumber, and paper boards. The government, under the charter of 1903, is vested in a mayor, chosen biennially, and a unicameral council. The water-works are owned and operated by the municipality. Population, in 1890, 7145; in 1900, 7421.

TONE. In music, the name given to the larger intervals in the diatonic scale, so called in contradistinction to the *semitones* (q.v.), or smaller intervals. Theoretically, some of the intervals called tones are larger than others, and none of them are equal to two semitones; thus, in the scale of C, the intervals CD, FG, and AB are all equal; but DE and GA, which are also called tones, are smaller; and the semitones, EF and BC, are larger than half even of the larger tones. In instruments, however, which are tuned according to the equal temperament (q.v.), all the tones are made equal, and each equivalent to two semitones.

TONE, THEOBALD WOLFE (1763-98). An Irish revolutionist. He was born in Dublin, where he was educated, graduating at Trinity College. He was called to the Irish bar in 1789. He was one of the founders of the first club of United Irishmen at Belfast, and similar organizations in other parts of Ireland and agent of the Roman Catholic committee, 1792; was implicated in Jackson's treasonable designs with the French Government in 1794, but was allowed to go to the United States in 1795. In the following year, however, he went to France for assistance, and returned suddenly to Ireland, recalled by rumors of a revolt. In the expedition to Bantry Bay he was adjutant-general to the commander Hoche, but the fleet was driven off the coast and scattered. In 1798 he again set sail for Ireland with a small French expedition, and was captured by an English fleet off Lough Swilly. Having been sentenced to be hanged, he cut his throat with a penknife, dying a few days later. Consult: *The Life of Theobald Wolfe Tone, etc., with his Political Writings*, edited by his son, William Theobald Wolfe Tone (2 vols., Washington, 1826).

TONE COLOR. In music, the quality of the tone of musical instruments or of the human voice. See CLANG TINT, EXPLANATION OF; TIMBRE.

TO'NER, JOSEPH MEREDITH (1825—). An American physician, born in Pittsburg, Pa., and educated at Mount Saint Mary's College, the Vermont Medical College, and the Jefferson Medical College. He graduated at Jefferson Medical College in 1853 and two years afterwards settled in Washington, D. C., where he founded the Providence Hospital and became identified with several other similar institutions. In 1868 a resolution which he had offered was adopted by the American Medical Association, providing for the collecting of American medical literature. In 1871 he gave the fund which established the well-known Toner lectures. He was president of the American Medical Association in 1873, of the American Health Association in 1874, and was vice-president of the International Medical Congress of 1887. He was an indefatigable collector of books and pamphlets on medical subjects, and in 1882 presented his valuable library to the Government. His publications include: *Maternal Instinct* (1864); *Compulsory Vaccination* (1865); *Annals of Medical Progress and Medical Education in the United States* (1874); *Medical Men of the Revolution* (1876).

TON'GA ISLANDS, or FRIENDLY ISLANDS. A group of Polynesian islands in the Pacific Ocean, about 350 miles southeast of Samoa, extending from 18° 5′ to 22° 29′ south latitude and from 173° 52′ to 176° 10′ west longitude, the Fiji Islands being on the east (Map: Australasia, L 4). The Tonga Islands form a native kingdom, but are controlled by Great Britain. They number about 150, but only 32 are of any importance. The area is about 390 square miles. The Tonga Islands form two nearly parallel rows of islands extending from north to south. The eastern row contains the Vavau, Haapai, Namuka, Kotu, and Tonga groups. These eastern islands are of coral limestone formation, and lie low and are comparatively level. In the last-named group is the largest and most fertile island of all—Tongatabu. It is in the south, and contains about 140 square miles. It has about half the population of all the Tonga Islands. The western row of islands are volcanic, high and steep. Of these, Lette and Tofoa are active, and Kao (about 2850 feet high) is extinct. The climate of the Tonga Islands is moderate and favorable, considering the latitude. The annual rainfall is heavy—over 75 inches. Serious earthquakes are not infrequent, and small islands rise suddenly at times and as suddenly disappear. A tornado wrought havoc in Vavau in 1900. The flora is very rich, especially in palms. The native fauna is comparatively insignificant; there only needs to be mentioned the large bat (*Pteropus tonganus*). All the main Tonga Islands are covered with luxuriant vegetation. The soil is rich. The land is leased, not sold; and as its tenure is not assured, the improvements are both meagre and poor. Copra and fungus are exported, and tapa and mats are made. The imports, mostly from Australia and New Zealand, amounted to $440,000 in 1901, and include draperies and foods. The tonnage entered and cleared in 1901 was 119,100. There is regular steam communication with the neighboring British possessions. There are many good harbors. The annual revenue is about $100,000, the expenditure somewhat less. There is no debt. The capital is Nukualofa, on Tongatabu Island. The population was given in 1900 as 18,959, nearly all natives. They are among the most civilized of the Polynesians. They are agriculturists and adept seafarers. While clever and eager to learn and imitate, they appear to lack the qualities necessary to independent and enduring success. Most of them are Wesleyans.

The Tonga Islands were discovered in 1643. In 1773 and in 1777 they were visited by Cook, who explored them, and gave them the name of Friendly Islands on account of the friendly attitude of the natives. Before the breaking out of the civil wars early in the nineteenth century, the islands were under the rule of two reigning families. During this political upheaval the local hereditary chiefs declared their independence, but were united under the wise rule of George I., who in 1875 introduced a sort of constitutional government, allowing the chiefs a share in the administration. Treaties were concluded with Great Britain, Germany, and also, in 1888, with the United States. The privilege of building a naval station was abandoned by Germany in 1899 in favor of Great Britain, which country declared its protectorate over the group in that year. The present ruler, King George II., is assisted by a legislative assembly, meeting every three years, and composed partly of hereditary nobles and partly of members elected on a property qualification. There are a cabinet, a privy council, and judiciary.

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TON′GALAND, or **AMATONGALAND.** A district of Zululand, and accordingly of Natal, in Southeast Africa, bounded on the north by Lourenço Marquez, on the east by the Indian Ocean, on the south by Zululand, and on the west by the Vryheid district and Swaziland (Map: Cape Colony, P 4). It thus forms the northern neck of Zululand. Area, 1280 square miles. The Lebombo Mountains border it on the west. The Pongola River traverses the country from south to north, just west of the centre, the Kosi River, flowing in a general eastern direction, is in the south, and Lake Kosi—a lagoon—forms an inlet from the ocean on the east. The country is generally level and low. The climate is very unhealthful. The inhabitants are Zulu-Kafirs—the Amatonga. No figures for the population are given. The possession of Tongaland was strongly desired by the Boers, since it would have furnished them an outlet to the sea and a haven. Great Britain was eager to frustrate their plans, however, and declared Tongaland under British protection in 1895. It was annexed to Zululand (q.v.) December 27, 1897. This action embraced also the small possessions of the Sambana and Umtegiza chiefs, which formed the narrow portion of Tongaland west of the Pongola River. Zululand, including Tongaland, was annexed to Natal December 30, 1897.

TONG-HAK, tông-häk′ (Sinico-Korean, Oriental culture). The watchword of a revolutionary party in Korea founded in 1859 by a native Korean scholar named Choi, who fused together the elements of the three systems of Confucius, Buddha, and Lao-tse. In 1865 he was branded as a 'foreigner Korean,' and beheaded, and his followers were persecuted, but still increased. In 1893 a delegation of 50 of them went to Seoul and petitioned for the rehabilitation of Choi. They were driven away, but in the succeeding spring occurred the Tong-Hak uprising that led indirectly to the Chino-Japanese war of 1894, the independence of Korea, and the present Russian aggressiveness in Manchuria. See Korea.

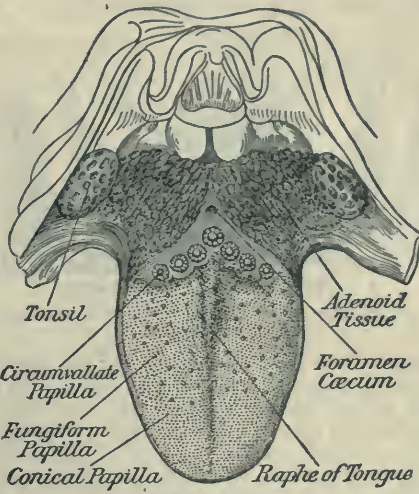
TONGKING′, or **TONQUIN,** tŏn′kēn′, *Fr. pron.* tôɴ′käɴ′. A French protectorate in French Indo-China (q.v.), situated just south of the Tropic of Cancer, in Southeastern Asia, bordered by China on the north, the Gulf of Tongking on the east, Annam, Laos, and Siam on the south and southwest, and Laos on the west (Map: French Indo-China, E 2). Area, estimated at 46,400 square miles. Tongking has a heavily forested plateau in the north. The eastern part is tilled, and contains slate and limestone. The protectorate is traversed in a southeasterly direction by the navigable Red River (q.v.) or Song-Koi, its delta district covering some 5000 square miles. This district, together with the neighboring islands, affords coal (kebao) and fishing. Other minerals of the protectorate are iron, copper, and gold. The climate is hot and humid. Storms are frequent in summer. The temperature ranges from 61.7° to 84° F. The soil is of great fertility. The flora in the southwest resembles that of India; that of the northeast is akin to that of Southern China. Nuts and tropical fruits abound.

France is making strong endeavors to colonize the protectorate. The cattle industry is prominent. Opium, cacao, sugar, tea, cotton, corn, coffee, and tobacco promise to be extensively cultivated. Rice, the staple crop, equals the best in the world. Furniture, glass, silk, cotton, indigo, paper, oil, and sugar are manufactured. The commerce has rapidly increased. The imports consist largely of machinery, metals, and textiles. The main exports are rice and animal products. The transit and the coast trade are extensive. The leading commercial points are Haiphong (the chief port, possessing a fine harbor) Kwang-yen, and Nam Dinh. A railroad extends from the last point to Hanoi, and thence northeast to Lungchow. The Red River Valley railroad to Yunnan and the coast line to Hué are in course of construction. There are ocean cables to Hué and Hong Kong. The largest city is Hanoi, the seat of the resident superior of Tongking, as well as of the Governor-General of French Indo-China. (For government, see French Indo-China.) There are fourteen provinces. The budget in 1902 balanced at $851,200. See Hanoi.

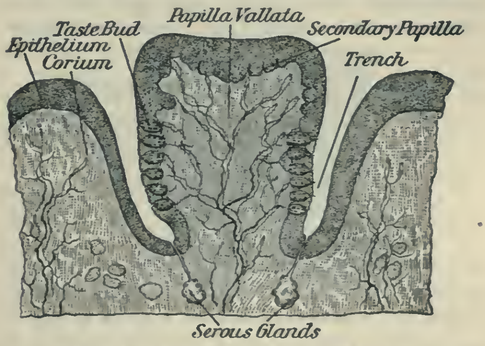
The population of Tongking is estimated at 7,000,000. The race is Annamese. Besides these, who dwell largely in the delta region, and who are taller and darker than their kindred in Cochin-China and Annam, the interior contains a number of more or less primitive peoples, such as the Thos (q.v.) of the Claire River basin, the Muongs (q.v.) of the Black River valley, and others who belong to the Thai (q.v.). The Chinese number upward of 35,000. Several hundred thousand of the inhabitants profess Catholicism. Tongking was an independent State before it came under the control of Annam in 1802. In 1873 the first military expedition of the French was sent into the territory, but by agreement the next year they retired. In 1882 the French Government, having conceived the design of securing the delta of the Red River for French commerce, sent an expedition against the predatory Black Flags, a Chinese soldiery, representing a remnant of the Taiping rebels. The French sailed up the Red River and occupied the citadel of Hanoi. Annam lent her support to the Black Flags, whereupon in August, 1883, the French fleet under Courbet bombarded Hué and compelled Annam to accept a French protectorate and to allow France to prosecute her designs with regard to Tongking. The French pushed their operations with success, but soon had to face a war with China, to whose suzerainty Annam was still nominally subject. This conflict, which lasted a year (1884-85), left France in virtual possession of Tongking. In 1887 Tongking was made a part of French Indo-China. Consult: Imbert, *Le Tonkin industriel et commercial* (Paris, 1885); Millot, *Le Tonkin* (ib., 1888); Petit, *Le Tonkin* (ib., 1892); Mat Gioi, *Le Tonkin actuel 1870-90* (ib., 1891); Pinabel, *Sur quelques peuples sauvages dépendants du Tonkin* (ib., 1884); Holquard, *Une campagne au Tonkin* (ib., 1892).

TONGKING, GULF OF. An arm of the China Sea extending northward between French Indo-China on the west and the Chinese island of Hainan together with a peninsula of the Province of Kwang-tung on the east (Map: China, C 8). It is 150 miles wide and 300 miles long, and receives the Red River. Its depth is everywhere less than 300 feet.

TONGUE (AS. *tunge*, Goth. *tuggō*, OHG. *zunga*, Ger. *Zunge*, tongue; connected with OLat. *dingua*, Lat. *lingua*, tongue). A symmetrical muscular organ, extending from the hyoid bone forward and downward, to the lips in front, and occupying the buccal cavity. The superior surface, borders, and anterior third of the inferior surface are free; while the remaining parts are attached to adjacent parts by the investing mucous membrane and subjacent structures. At certain points this membrane, on leaving the tongue, forms distinct folds, containing fibrous or muscular tissue, which act to a certain extent as ligaments of the tongue. The most considerable of these folds is termed the *frænum* (or bridle) of the tongue, and connects its anterior free extremity with the lower jaw. It acts as a strong ligament, and limits the backward movement of the tip of the tongue. In rare cases this ligament extends abnormally to the tip, so as to interfere with speech and mastication, and the child is said to be *tongue-tied;* recourse must be then had to division of the frænum, popularly known as *cutting the tongue.* Other folds of mucous membrane (the *glosso-epiglottid folds*) pass from the base of the tongue to the epiglottis; while from the sides of the base, passing to the soft palate, are seen two folds on either side, known as the *pillars of the fauces.* (See PALATE). The *superior surface* of the tongue is divided into two symmetrical lateral parts by a median longitudinal furrow beginning at the tip, and extending back about two-thirds of the tongue's length. The various kinds of papillæ which are seen on their surface are described in the article TASTE, ORGAN AND SENSE OF. At the back of the surface, just behind the circumvallate papillæ, are large mucous glands, extending into long and capacious canals, and helping to secrete the fluid that moistens the tongue. On the *inferior surface*, the longitudinal furrow, which extends from the tip to the frænum, is deeper than on the upper surface; on each side of it veins are seen running forward; and immediately beneath the tip is a cluster of mucous glands, known as the glands of Nuck (their discoverer in 1690). The *posterior extremity*, or *base*, is flattened and extended laterally before it is inserted into the *hyoid bone* (known also as the *lingual* or *tongue bone*), which, with certain ligaments, must be regarded as the basis or framework of the tongue. The muscles of the tongue are usually divided into

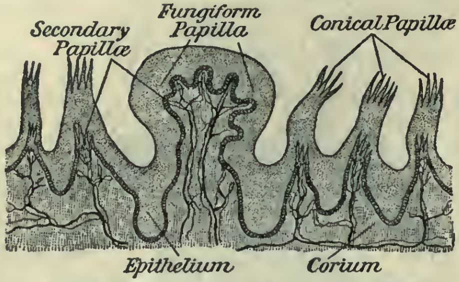


HUMAN TONGUE.

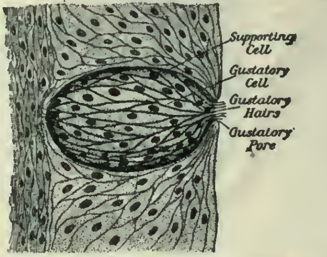


SECTION THROUGH A PAPILLA VALLATA.

two groups—viz. the *extrinsic* muscles, which attach the tongue to certain fixed points external to it, and move it on them, and the *intrinsic* muscles, which pass from one part of the tongue to another, constitute its chief bulk, and move it on itself. These intrinsic muscular fibres run vertically, transversely, and longitudinally, and are so interlaced as mutually to support one another, and to act with the greatest advantage. By the action of the various muscles, the upper surface of the tongue may be made concave or convex, or may be pressed against the roof of the mouth; the tip may be protruded straight out or laterally, upward and downward, and to any recess (as for instance, a hollow tooth) within the mouth where food might lodge; and the whole organ may be drawn back. The nerve supply to the tongue is motor and sensory. The motor nerve is the hypoglossal. The sensory nerves are the lingual (or gustatory) branch of the fifth, which confers sensibility on the mucous membrane of the anterior two-thirds of the tongue; the lingual branch of the glosso-pharyngeal, which confers ordinary sensibility and the sense of taste on the posterior third of the tongue; the chorda tympani, which is the special nerve of taste for the anterior two-thirds of the tongue.



SECTION SHOWING STRUCTURE AND ARRANGEMENT OF PAPILLÆ.



VERTICAL SECTION THROUGH A TASTE BUD.

The functions of the tongue are gustation, prehension (in man and monkeys this function is supplied by the hand), mastication, insalivation, deglutition, and speech; to which may be added spitting and whistling, and in the case of the Gasteropoda, trituration of the food.

The tongue is subject to several diseases, among which may be mentioned: *Glossitis*, or inflammation of the tongue, tuberculosis, and syphilis, new growths, usually malignant in nature; certain affections which the mucous membrane of the tongue shares with the skin, such as herpes, lichen, and leucopathia. It is also subject to excoriations, ulcers, and fissures. *Macro-glossia* is a term applied to certain chronically enlarged conditions of the tongue. It is a condition often found in cretins and is probably due in this case to alymphangioma.

Hypertrophy and also *cancer* may attack the tongue.

TON′IC (from Gk. τονικός, *tonikos*, relating to tone, from τόνος, *tonos*, tone, sound, tension, strength, cord). A medicine which acts upon the nutrition of the various tissues so as to restore lost tone, not by increasing their contractility, but by increasing their power. They are to a certain degree stimulant, but their effect is more permanent, and without producing excitation or elation. They do not rouse forces existing, but by increasing nutrition increase power. Most tonics act primarily through the nervous system, their effects upon the muscular system being secondary. They are of special value during convalescence, but are useless, if not harmful, during inflammatory reaction. Among the tonics in the *materia medica* are the *simple bitters*, including quassia, simaruba, gentian, nectandra, barberry, columbo, boneset, goldthread, centaury, dogwood, and salicin; the *peculiar bitters*, including wild cherry, cinchona, quinine, and picric acid; the *aromatic bitters*, including chamomile, snakeroot, cascarilla, and angustura; the *true aromatics*, including cinnamon, clove, nutmeg, allspice, cardamom, ginger, black pepper, red pepper, cajeput, and eucalyptus; and the *mineral tonics*, including iron, sulphuric acid, muriatic acid, nitric acid, nitromuriatic acid, lactic acid, and phosphorus. Most of these drugs are considered under their own titles. Digestive power is increased principally by the bitters, the aromatics, and the acids. Nutrition is improved especially by iron. Besides drugs, baths and massage are valuable adjutants in acquiring strength and vigor. Shower baths, cold sponge baths, sea bathing, and out-of-door exercise are very decided tonics.

TONIC, or KEYNOTE. In music, the note which forms the basis of any scale or key, and on which a piece of music written in that key naturally closes. The tendency of modern harmony is to conceive the tonic not as a single tone, but as a triad built upon that tone. See KEY; TONALITY.

TONICA, tô-nē′kȧ, or **TUNICA**. A peculiar tribe, constituting a distinct linguistic stock, who lived, when first known to the French, about 1700, on the Lower Yazoo River in Mississippi, near its junction with the Mississippi, where a mission was established among them. Probably at an earlier period they had lived at the Tunica Old Fields in the county bearing their name in the northwestern corner of the same State. They made a close alliance with the French, but were hostile to most of their Indian neighbors, particularly the Chickasaw, and in 1706 nearly exterminated the Huma in a massacre near New Orleans. Subsequently they removed to a location on the east bank of the Mississippi, about opposite Pointe Coupée, below Red River, where they still lived in 1802, having then 120 men. In 1817 they were settled about 90 miles up Red River, where the remnant, of about 25 persons, was found near Marksville, Louisiana, in 1886 by Gatschet, who obtained the first vocabulary of their language.

TONIC SOL-FA. Various attempts have been made at different times to introduce a musical notation in which the staff with its lines and spaces is dispensed with. Jean Jacques Rousseau suggested, but afterwards discarded, a notation where the notes of the scale were indicated by the Arabic numerals. A system similar to Rousseau's in its leading features, called the tonic sol-fa, has, through the influence of its principal promoter, the Rev. John Curwen (who obtained his main principles from the writings and practice of Miss Glover of Norwich), been brought into use to a considerable extent in singing schools in England. It proceeds on the principle of giving the chief prominence to the fact that there is in reality but one scale in music, which is raised or lowered according to the pitch of the key. This method is a revival of the old solmization system invented by Guido d'Arezzo. It admits, however, the interval of the seventh, strictly excluded by Guido. For the complicated music of modern masters the tonic sol-fa is as inadequate as the solmization system of Guido had been found. It also favors the system of unequal temperament, and this is directly opposed to the fundamental principle of equal temperament, without which the achievements of modern music would have been impossible. It is, however, of undoubted value as an educational system, since it can be taught more quickly and with better immediate results than the usual notation.

TONK. A native Rajputana State in Central India. Area, 1114 sq. miles. Population, in 1901, 143,330. Capital, Tonk.

TONK. The capital of the native Rajputana State of Tonk, Central India, near the river Banas, 55 miles south of Jaipur (Map: India, C 3). It is defended by a mud fort and a wall. Population, in 1891, 46,069; in 1901, 38,641, the great decrease being largely attributable to the famines of 1896-97 and 1899-1900.

TONKA, tŏn′kȧ. The Chinese name of Puket (q.v.).

TONKAWA, tŏng-kä′wȧ (from Hueco Indian *tonkaweya*, many staying together). A peculiar tribe, apparently constituting a distinct linguistic stock, originally occupying the country about the Lower Colorado and Guadalupe rivers in southeastern Texas. They call themselves *Titskan-watich*, 'indigenous men.' They were chiefly noted for their cannibalism. They roved from place to place, built circular, thatched houses, lived entirely by hunting and wild fruits, and were at war with almost all their neighbors, by whom they were hated and despised as 'man-eaters.' They appear to have had the clan system and to have paid special reverence to the wolf, whom, it is said, they claimed as their ancestor or teacher. According to their tradition they came from the south, somewhere farther down the coast, having been cut off from the rest of their people by an invasion of the sea. In 1760 some of them were attached to the San Antonio missions. In 1849 they were reported to number 600 or 700, who had been driven to the Upper Brazos on account of their depredations among the American settlements near the coast. In the fall of 1855, with several other small Texas tribes, a part of them, to the number of 170, were gathered upon a reservation on the Brazos, a few miles below Fort Belknap, but they were removed in 1859 to a new reservation on the Washita, near the present Anadarko, Oklahoma. Here they remained until the outbreak of the Civil War, when, on the pretext that they were about to enter the Confederate service through the persuasions of their agent, who held a Confederate commission, the other tribes took the opportunity to wipe out old scores. With guns procured from Fort Gibson a force of about 200 Shawnee, Delaware, Caddo, and other Indians attacked the agency and the neighboring Tonkawa village near Anadarko on the night of October 25, 1862, and killed one or two of the agency employees and 137 out of a total of about 320 Tonkawa men, women, and children. The Tonkawa made a stout resistance and inflicted severe loss upon the enemy. The fugitive survivors were gathered up by the Confederate authorities, and for several years after the war led a vagrant existence in northern Texas, most of the men enlisting as scouts against the Comanche, Kiowa, and other wild tribes, who took every occasion to retaliate, and forced the Tonkawa to keep close to Fort Griffin on the Brazos for protection. In 1875 they were reported to number but 119, in a miserable condition and dependent entirely on the pay of the able-bodied men serving as scouts. In 1882 they were put in charge of a special agent who reported them as numbering then only 98, indolent, poor, honest, and tolerably healthy, living in brush shelters and dependent upon the whites. Two years afterwards they were removed to a reservation in northern Oklahoma. In 1903 they were reduced to about 50, and derived their principal income from the leasing of their surplus lands.

TONKÜNSTLER-SOCIETÄT. One of the oldest musical societies of Vienna. It was founded in 1771 by F. L. Gassmann. Its object is the production of large choral works, particularly oratorios. The original chorus consisted of 400 members, which at times was increased to 700. One concert was given in Lent and another in Advent. The proceeds were devoted to the establishment of a pension fund for old members and widows of members. In 1797 Wranitzky, the friend of Haydn, reorganized the society. Haydn himself became a member and presented to the society the rights of the "Seasons" and "Creation," which generous gift placed the society upon a sound financial basis and was largely responsible for its subsequent prosperity. In 1865 the society was once more reorganized and renamed in honor of its generous patron "Haydn-Societat." Consult Hanslick, *Geschichte des Konzertwesens in Wien* (Vienna, 1869).

TONLE SAP, or Tale Sap. A lake of northwestern Cambodia, connected with the Mekong by an arm of that river known also as Tonk Sap (Map: French Indo-China, E 4). The lake acts as a great reservoir. During the summer monsoon the waters of the Mekong back up through the arm Tonle Sap, bringing the length of the lake to about 120 miles; during the dry season the lake is drained, by the same arm, to about 70 miles in length. During high water navigation is maintained from Saïgon to Battumbang in Siam. Approaching shores divide the lake into sections, the Caman Dai in the northwest and the Caman Tieu in the southeast.

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TONNAGE (formerly also *tunnage*, from *tun, ton*, from OF. *tonne*, pipe, tun, ML. *tunna*, OHG. *tunna*, Ger. *Tonne*, tun, both the Romance and the Germanic words apparently borrowed from Ir., Gael. *tunna*, tun. The tonnage of a ship is its carrying capacity or weight expressed in tons. There are in ordinary use four ways of expressing it, *gross* tonnage, *net* tonnage, *dead-weight* tonnage (or dead weight carrying capacity), and *displacement* (q.v.) tonnage. The *gross* tonnage of a ship is ascertained by dividing by 100 the whole interior capacity (expressed in cubic feet) of the hull of a ship and her inclosed deckhouses; this method presumes that an average cargo of light-weight freight will require not far from 100 cubic feet for each ton of actual weight. *Net* tonnage is derived from the *gross* tonnage by deducting the capacity of all spaces not used, or capable of being used, for cargo or passengers. The *dead-weight* tonnage is the actual weight of cargo a vessel can carry without immersing her too deeply for safety. *Displacement* tonnage is the weight of ship and cargo or contents when immersed to some fixed depth. In freighting ships 40 cubic feet of merchandise is considered a ton; but if that bulk exceeds 2240 pounds (or, in the United States, frequently 2000 pounds) the charge is made by weight. See articles on Displacement; Load-line Marks of Vessels; Measurement of Ships; and Shipbuilding.

TONNAGE and **POUNDAGE.** Certain duties on wine and other merchandise, which began to be levied in England in the reign of Edward III. They were at first granted to the Crown by the vote of Parliament for a limited number of years, and renewed on their expiration. Originally fluctuating in amount, tonnage and poundage came to be fixed at 3s. on every tun of wine, and 5 per cent. on all goods imported. In the reign of Henry V. they were first conferred on the King for life; and the same course being followed with his successors, the sovereign began gradually to consider them as his proper right and inheritance, and the vote of Parliament as but a formality expressive of the popular recognition of his prerogative. It was usual to levy these duties during the period intervening between a sovereign's accession and his first Parliament, and this was done by Charles I. as by his predecessors. The Commons, however, in Charles's first Parliament accorded these imposts not for life, but for a year only; and the House of Lords objecting to this departure from previous usages, and rejecting the bill, an attempt was made to levy tonnage and poundage by the royal authority alone, a proceeding which aroused the opposition of the Commons. Charles was, in 1629, induced to pass an act renouncing the power of levying these or any other imposts without Parliamentary sanction. On the restoration, Charles II. obtained a grant of tonnage and poundage for life; but by three several statutes of Anne and George I. these imposts were made perpetual and mortgaged for the public debt. The duties were abolished in 1787.

TONOM′ETER (from Gk. *τόνος*, *tonos*, tone, sound, tension, strength, cord, *μέτρον*, *metron*, measure). An instrument for measuring tension, as of the eyeball or of the blood pressure as transmitted by the ventricles of the heart. Hamer's tonometer consists of a tube of metal, with a peg or small rod projecting and so arranged that a coiled watchspring matches its tension against the tension of the body to which the peg is pressed. Roy's tonometer consists of a tube containing oil in which a cylinder plays, carrying a registering index.

TONQUIN, tŏn-kēn′. A division of French Indo-China. See Tongking.

TÖNSBERG, tĕns′bâr-y′. One of the oldest towns of Norway, in the Amt of Jarlsberg and Laurvik, on a fjord of the same name, 45 miles south of Christiania (Map: Norway, D 7). The seal and whale fisheries employ a large proportion of its male population, with a fleet of some 120 vessels. Population, in 1900, 8620.

TONSIL. One of a pair of small ovoid bodies situated between the pillars of the soft palate, one on each side of the throat, corresponding in position with the angles of the lower jaw. The tonsil has about twelve spaces within its substance from which smaller follicular depressions extend into its structure, and is classed with the ductless glands. It is frequently inflamed after infection by entrance of germs into the crypts and follicles described. Severe suppurative disease about the tonsil causing swelling and displacement of it is termed Quinsy (q.v.). See Palate.

TONSILLITIS. See Pharyngitis, Quinsy.

TON′SON, Jacob (c.1656-1736). A famous London publisher. He opened his shop at the Judge's Head in Chancery Lane, near Fleet Street, in 1678. Toward the close of the century he moved to Gray's Inn Gate, taking into company with him his nephew, Jacob Tonson, and in 1710 to the Shakespeare's Head in the Strand. For Dryden Tonson published several plays, the translation of Vergil (1697), and *The Fables* (1699). He was also helped by Dryden to start the famous *Miscellanies*, of which the first appeared in 1684. With this prestige he became the popular publisher among the next generation of authors. He bought out the rights in Milton's *Paradise Lost*, and from his press issued Rowe's edition of Shakespeare (1709). About 1700 he joined in forming the famous Kit-Cat Club, of which he was made secretary. About 1703 he bought a house at Barn Elms on the Thames, and built a room for the club.

TONSURE (Lat. *tonsura*, a shearing, from *tondere*, to shear, connected with Gk. *τένδειν*, *tendein*, to gnaw, *τέμνειν*, *temnein*, to cut). A religious observance of the Roman Catholic and Oriental churches, which consists in shaving or cutting the hair as a sign of the dedication of the person to the special service of God and commonly to the public ministry of religion. It would appear that the usage first arose in reference to the monastic rather than the clerical life. Paulinus of Nola, in the end of the fourth or beginning of the fifth century, alludes to it as then in use among the Western monks; and it speedily passed from them to the clergy. The form of the tonsure was different in different churches. That of the Roman Church, called 'the tonsure of Peter,' consisted in shaving the crown as well as the back of the head, so that there remained a circular ring or 'crown' of hair. In the 'Scottish (or Irish) tonsure,' the entire front of the head was shaved, leaving the front bare as far back as the line from ear to ear. This tonsure was called 'the tonsure of James,' and sometimes of Simon Magus. The Greeks and other Orientals shaved the entire head. Originally the tonsure was merely the symbol of admission to the clerical state (see CLERK), but about the seventh century it came to be used as a distinct and independent ceremonial.

TONTINE. A tontine exists whenever several persons are united in a group on such terms that on the death of any member of the group certain specified advantages previously enjoyed by him are distributed among the surviving members. The principle has been employed in many kinds of transactions, of which the most important are Government loans and life insurance. The application of the tontine principle to Government loans began in the later Middle Ages. The idea was introduced into France about the middle of the seventeenth century by an Italian named Lorenzo Tonti, but it had already long been known in Italy and Germany. It was one of numerous devices adopted by various States to induce the public to subscribe to Government loans. The first French loan on this principle was made in 1689, and the last one in 1759. Existing tontines were wound up in 1770 and life annuities substituted for their privileges. The English Government made less use of tontines than the French. The earliest one was organized in 1692, and the third and last in 1789. There were a few Irish tontines in the eighteenth century. The idea was unattractive to the English people, and none of the loans was fully subscribed, although offered on very favorable terms.

A subscriber to a tontine loan was the buyer of a life annuity, which increased in amount with the death of any member of the class to which the subscriber belonged. On the death of the last survivor the obligation of the Government terminated. In most cases the subscribers were divided into classes according to age, the right of survivorship prevailing only among the members of the same age class. Sometimes the amount of the annuity at the beginning varied for the different classes. Thus in the first English loan the annuity increased from class to class, being slightly over 4 per cent. for those under twenty years of age, and more than 5½ per cent. for those over sixty. Occasionally there were other limitations. For example, the first English loan, which did not classify subscribers according to age, provided that when the number of survivors was reduced to seven the right of survivorship should cease. On the third loan it was stipulated that no single annuity should exceed £1000. Nearly always the subscriber to a loan had the privilege of naming any other person as the recipient of the life annuity, with the natural result that a large proportion of the annuitants were young. The feature of a tontine loan which was relied on to attract subscribers was the great return secured by those investors who lived longest.

It is obvious that a tontine loan is a very unwise fiscal measure. In the case of ordinary life annuities it is fairly safe for the Government to assume that premature deaths will largely offset exceptionally long lives, but in the case of a tontine there is no such balancing of extra short and extra long lives. It is not the average duration of life of the group which determines the amount of interest which the Government will have to pay, but a much more uncertain thing, the duration of the longest life.

The application of the tontine principle to life insurance has taken two forms. Under the old or full tontine plan, which was in use before the days of surrender values, an insured person who allowed his policy to lapse recovered nothing from the company. The gain which the company had made on his policy was put to the credit of the other insured of the same class. At the end of the tontine period all such profits were distributed among the members of the group whose policies were still in force. After the introduction of surrender values, partly under legal compulsion and partly by the voluntary action of the insurance companies, the so-called semi-tontine plan was adopted. Under this plan there is a similar division of surplus among those members of the group whose policies are in force at the end of the tontine period, but the surplus to be divided is comparatively small. It arises chiefly from two sources, from an expense rate so low that some part of the loading of the premium is saved, and from an interest rate on investments higher than that assumed in calculating reserve values. A person taking out a semi-tontine policy enters into an agreement with the company that the profit thus arising on his policy shall be put into a pool along with the corresponding profit on other policies of the same class, and that at the end of the tontine period, which is usually ten, fifteen, or twenty years, the pool shall be divided among those members of the class whose policies are still in force.

The question of the desirability of applying the tontine principle to life insurance has been the occasion of much discussion. That the full tontine plan was a bad one cannot be questioned, but the evils arose more from the absence of surrender values than from the tontine method of distributing the surplus. For the semi-tontine plan the purely financial argument would seem, on the whole, favorable. In all forms of life insurance the indemnities paid on the policies of those dying early are partly at the expense of those whose policies run a longer time. The distribution of the surplus on the tontine principle is at least a partial reparation. It ought always to be clearly understood, however, that the larger return to those whose policies are kept in force to the end of the tontine period necessarily means a smaller return to those who die or whose policies terminate before that time. The weightiest objection to tontine insurance is a moral one. It is introducing additional uncertainty into the transaction of life insurance, where the speculative element is already large and ought to be kept at a minimum.

Private tontines were by no means uncommon down to the end of the eighteenth century. They were frequently resorted to for the purpose of raising money for purposes requiring large investments of capital. Large buildings in many cities of the United States were erected by means of capital raised in that way. At the present time they are almost unknown, partly because the abundance of capital has made it unnecessary to resort to them, partly because the large element of uncertainty involved in them is inconsistent with the spirit of modern business.

TONTY, or **TONTI**, tôn'tē', Henri de (c.1650-c.1704). A companion of La Salle (q.v.) in the exploration of the Mississippi Valley. He was a native of Gaeta, in Italy, and at an early age entered the military service of France. In July, 1678, he went with La Salle to Quebec and with him went to the Niagara River, where a vessel was built under Tonty's direction (January, 1679). In the autumn of the same year Tonty sailed up along the eastern shore of Lake Michigan and met his chief at the Saint Joseph River. In March, 1680, he was left by La Salle in command of Fort Crèvecœur, in the Illinois country. Forced to flee by a mutiny among his soldiers, he made his way to Green Bay, where he passed the winter of 1680-81, and in May met La Salle at Michillimackinac. In 1682 he was with La Salle in the memorable voyage down the Mississippi and in May of that year he was dispatched to Mackinac for supplies. In December Fort Saint Louis was erected at Starved Rock, on the Illinois, and Tonty was left in charge. In 1685 he took part in an expedition of the Illinois Indians against the Senecas and in 1687 he was with Denonville in the expedition against the English colonies. In February of the preceding year he had descended the Mississippi in search of La Salle. He continued to live among the Illinois Indians till 1702, when he joined Iberville in Louisiana. Spurious memoirs were published under his name at Paris in 1697 under the title, *Dernière découverte de la Salle dans l'Amérique septentrionale*. His real memoirs were published by Margry in *Origines françaises des pays d'outremer* (Paris, 1877-79).

TOOKE, John Horne (1736-1812). An English etymologist and political adventurer. He was born in London, and was the son of John Horne, a poulterer. He was educated at Westminster and Eton, and at Saint John's College, Cambridge. He entered the Church strongly against his own wish, and in 1760 became curate at New Brentford. In 1763 he traveled in France for a year as the tutor of the son of John Elwes, and two years later, while acting as the tutor of another boy, he met John Wilkes (q.v.). When Wilkes stood as a candidate for the County of Middlesex, Tooke zealously aided him, but the pair afterwards quarreled. Tooke still, however, continued to meddle in political affairs, and ventured to encounter Junius, with whom some have even sought to identify him. In 1773 he resigned his living at New Brentford, and commenced the study of law. About this time he rendered some important private service to Tooke of Purley in Surrey, who intended to make him his heir. In consequence he adopted the surname of Tooke, by which he is now known. In 1775 he was fined and imprisoned in the King's Bench for publishing an advertisement in which he accused the King's troops of barbarously murdering the Americans at Lexington. While in prison he penned his celebrated *Letter to Mr. Dunning* (dated April 21, 1778), in which are to be found the germs of his *Diversions of Purley*. On his release Tooke made an attempt to gain admission to the bar, but was refused on the ground of his clerical orders. Soon afterwards he returned to political writing, and in a *Letter on Parliamentary Reform* advocated universal suffrage. In the struggle between Pitt and Fox he wrote pamphlets on the side of the former, but soon got to hate Pitt, as he had learned to hate most other public men. In 1786 appeared the first volume of his famous *Epea Pteroenta, or the Diversions of Purley* (vol. ii., 1805), a work on the analysis and etymology of English words. Tooke's passion for politics soon drew him from literature into public life, and in 1801 he, the great enemy of rotten boroughs, entered Parliament for the most notorious rotten borough in England—Old Sarum; but he made no figure there. The best edition of the *Diversions of Purley* is that of Taylor (London, 1840). Consult Stephens, *Memoirs of John Horne Tooke* (London, 1813).

TOOKE, Thomas (1774-1858). A British economist, was born in Saint Petersburg. In 1804 he became partner in a prominent Russian house in London; later he became director of the Royal Exchange Assurance Corporation; president of the Calhamie Dock Company; member of the managing board of the London and Birmingham Railway. He was a member of the first great Factory Commission, and president of the commission appointed to inquire into the evils of child labor in factories. From his practical experience in the Russian trade Tooke developed a strong antipathy to governmental interference in foreign commerce. He was author of the *Merchants' Petition in favour of Free Trade*, presented to Parliament in 1820. He was chiefly interested, however, in questions relating to money and banking. In these subjects he is regarded as one of the best authorities of the times. He was the leading opponent of the 'quantity theory' of money, and was a harsh critic of Paul's Banking Act of 1844. He was author of several works on currency problems, of which the most important are his *On the Currency in connection with the Corn Trade, and on the Corn Laws* (1820); *Considerations on the State of the Currency* (1826); *An Inquiry into the Currency Principles and the Connection of the Currency with Price* (1844); *A History of Prices—1793-1856* (1838-1857), six vols., the last two written in collaboration with W. Newmarch.

TOOKE, William (1744-1820). An English historian, born at Islington, London, and educated there at an academy. Taking holy orders in 1771, he became chaplain to the English church at Kronstadt, in Russia, and three years later chaplain to the English merchants at Saint Petersburg. Coming into possession of a fortune, he resigned in 1792, and returned to London, where he devoted the rest of his life to literature. His most valuable work was in Russian history, based upon research in the Imperial Library at Saint Petersburg. It embraces mainly *The Life of Catharine II.*, partly a translation from the French (1798); *A View of the Russian Empire During the Reign of Catharine II., and to the Close of the Present Century* (1799); and *A History of Russia from the Foundation of the Monarchy by Rurik to the Acces-*

sion of Catharine II. (1800). He published numerous miscellaneous books, as *The Loves of Othniel and Achsah*, a Chaldee romance (1769); *Varieties of Literature* (1795); and *Lucian of Samosata*, from the Greek, with the comments of Wieland and others (1820). His son, William Tooke (1777-1863), took a prominent part in founding University College, London, and also the Society for the Diffusion of Useful Knowledge. He was also a member of the Royal Society and president of the Society of Arts. He edited the poems of Churchill, compiled *The Monarchy of France* (1855), and published a volume of verse.

TOOLE, John Lawrence (1832—). An English comedian, born in London. He made his début in London at the Haymarket Theatre in 1852. Upon the opening of the new Adelphi Theatre by Benjamin Webster in 1859, Toole became the leading comedian, and there, in 1862, he appeared in his great part of Caleb Plummer, in Boucicault's dramatization of *The Cricket on the Hearth.* In 1868 he played the Artful Dodger at the Queen's Theatre, with Henry Irving as Bill Sykes. He visited America in 1875, and in 1890 made a successful trip to Australia. He opened Toole's Theatre (the Folly Theatre reconstructed) in November, 1880, and managed it as a home of comedy for a number of years. Consult: Toole's *Reminiscences*, chronicled by Joseph Hatton (London, 1888); Matthews and Hutton, *Actors and Actresses of Great Britain and the United States* (New York, 1886); Scott, *The Drama of Yesterday and To-day* (London, 1899).

TOOMBS, Robert (1810-85). An American statesman, born at Washington, Ga. He studied at the State University at Athens and graduated (1828) at Union College, Schenectady, N. Y. He studied law at the University of Virginia, and began practice in Wilkes County, Ga. After service against the Creeks in 1836 and several years in the Georgia Legislature as a States' Rights Whig, he was elected to Congress in 1844 and held his seat for four terms, until 1853, when he was elected to the United States Senate, and in 1859 reëlected. He opposed the Mexican war and the annexation of territory by force, aided in the adoption of the Compromise of 1850, opposed the Nashville Convention, and helped secure the famous 'Georgia Platform.' As an impassioned political speaker he had few equals. The movement of secession had his full approval; and it was chiefly his influence, in opposition to the more conservative views of his life-long friend, Alexander H. Stephens, that led his State to pass its ordinance of secession, to which there was a strong opposition, especially among the 'old line Whigs.' On the election of Davis, Toombs was offered the office of Secretary of State, and with reluctance accepted it for a short time, on his resignation receiving a commission as brigadier-general. He served in the second battle of Bull Run and at Sharpsburg, and later was made brigadier-general of the Georgia militia. After the war he lived for some time abroad; then from 1867 he carried on a successful law practice at his old home, being especially serviceable to Georgia by winning his contention that railroads should pay taxes like other property. He was noted for his brilliant wit, his legal sagacity, and his benevolence. He was a bitter opponent of the 'Reconstruction' measures, and never took the oath of allegiance. He is mainly remembered as one of the most typical and vigorous of the so-called Southern 'fire-eaters.' Consult Trent, *Southern Statesmen of the Old Régime* (New York, 1897).

TOON (Hind. *tūn*, *tun*, from Skt. *tunna*, toon); or Toona (*Cedrela Toona*). A tree of the natural order Cedrelaceæ, one of the largest timber trees of India, occurring also in Australia, where it attains a height of 150 to 180 feet and a diameter of 5 to 7 feet. Hooker mentions one which he measured in India which was 30 feet in girth at 5 feet above the ground. The flowers are used in India for dyeing. The tree, sometimes called bastard cedar, occurs at 4000 feet on the Himalaya Mountains, and is found in the farthest south of the East Indies. The bark contains considerable tannin and is used to produce a kind of purplish leather. The wood is soft, durable, easily worked, and extensively used in house-building and for furniture. Veneers cut from the roots or from the trunks where large branches occur are said to be very beautiful. The timber is exported from India in considerable quantities, being known in the English market as Moulmein cedar.

TOOTHACHE TREE. See Aralia; Xanthoxylum.

TOOTH-BILLED PIGEON. An extraordinary member of the pigeon tribe (*Didunculus strigirostris*) native to Samoa, and alone representing a separate family (Didunculidæ). This species, known to the Samoans as *manu-mea*, or 'redbird,' is about one foot long, and glossy greenish black, with a chestnut tinge on the upper parts and brown on the wing-quills and abdomen. Its most striking characteristic is a great orange-colored, hawk-like, toothed bill, suitable for gathering the bananas and other large fruits upon which it lives. It was originally wholly terrestrial in its habits, spending its time on the wooded mountain sides, where it roosted on rocks and stumps and nested on the ground, rarely gathering into parties. It was hunted for food. This circumstance, the fact that it laid but a single egg, and the introduction by white settlers of cats, rats, and guns, led not only to its speedier destruction, but to an interesting change in habits, since it soon resorted much more to tall trees than previously and placed its nest on high branches. See Plate of Pigeons.

TOPAZ (Lat. *topazion*, *topazus*, from Gk. τοπάζιον, τόπαζος, topaz; possibly connected with Skt. *tapas*, heat, but, according to Pliny, derived from the name of an island *Topazus*, conjectured to be in the Red or in the Arabian Sea, from Gk. τοπάζέιν, *topazein*, to conjecture). A mineral aluminum fluosilicate, crystallized in the orthorhombic system. It has a vitreous lustre, and may be colorless, yellow, green, blue, or red. Topaz occurs in gneiss or granite associated with beryl, mica, tourmaline, etc., and occasionally with apatite, cassiterite, and fluorite, and also in certain talcose rocks, in mica slate, in rhyolite, and in alluvial deposits and drift. The crystallized varieties, owing to their hardness, are valued as gem-stones, and the best varieties come from Ceylon and other parts of India, the Urals, Minas Geraes, Brazil, and in the

United States from various localities in Maine, Colorado, and Utah. The name *topaz* was appliey by Pliny and others to yellow crystals, probably chrysolite. Among the ancients it was regarded as symbolical of friendship; when worn as an amulet it was said to drive away sadness and nightmares, strengthening the intellect and bestowing courage; mounted in gold and hung around the neck, it dispelled enchantment; and when worn on the left hand it preserved its wearer from sensuality. It was considered favorable for hemorrhages, also imparting strength and good digestion. When powdered and taken in wine it was believed capable of curing asthma and insomnia. The true Oriental topaz is the yellow sapphire, and the Saxon, Scotch, Spanish, smoky, and false topaz are yellow varieties of quartz.

TOPE (Hind. *tōp*, from Pali, Prak. *thūpa*, from Skt. *stūpa*, mound, accumulation). The vernacular name of Buddhistic monuments intended for the preservation of relics. In Ceylon and elsewhere they are also called *dagops;* and another of their designations is *chaitya. Tope* is the name of those monuments in regard to their shape; *dagop*, in regard to their purpose; and *chaitya* the general term. Technically, the *stupa* is a form of tope which does not contain a relic, but is merely a memorial. The oldest topes are in the shape of cupolas, generally spherical, but sometimes elliptical, resting on a cylindrical or quadrangular or polygonal base, which rises either in a straight or inclined line, or in terraces. The top of the cupola, surrounded by a balcony of pillars of a peculiar kind, is crowned by a structure generally quadrangular, but sometimes in the shape of a reversed pyramid of a few steps; and over this structure is a roof in the shape of an extended parasol. The cupola was sometimes ornamented with more than one parasol; in some of the topes of Sanchi there are three, and even five parasols side by side, the middle one exceeding the others in height. The different arrangement of these parasols, especially when their number increased, led to a different shape of the topes, such as occurs, for instance, in China and Tibet. This arrangement consists in placing them one over the other; and not only three or five, but even seven, nine, or more are so placed, and the topes, instead of having the character of cupolas, now assumed that of pyramids resting on a cupola base, the parasols gradually giving way to a real pyramidal form. In some monuments of this class, however, the cupola was placed above, when the base consists of round or quadrangular towers rising in a spiral form, or in several stories. The Chinese, on the contrary, rejected the cupola altogether, and merely retained the succession of parasols extended one over the other, converting them into a many-storied tower; and the same is the case with the topes of the Mongols, the *ssuvurghans*, which are pyramids erected on a low quadrangular base. The top of the pyramidal topes always carries some metal ornament, frequently gilt, resembling a parasol, or a needle, or a trident, or a rising flame. The height of these buildings varies from a few feet to 300 and even more. If erected in cave-temples the tope generally stands at the end of a long hall especially cut out for it, but sometimes also in the sanctuary of the cave-temple itself; if erected overground it stands always in the vicinity of a temple or convent.

In the interior of the tope is the cell or chamber (*dhâtugarbha*) where the box containing the relics and the 'seven precious things' was placed. These seven precious things are differently enumerated; according to one account they are gold, silver, lapis lazuli, crystal, red pearl, diamond, and coral; others mention ruby and emerald; and others again omit gold and silver. In several cells which have been opened the box contained, besides the relics, precious stones of various kinds, golden ornaments, and coins; and the box itself generally consisted of an outer casement of stone, clay, or bronze, which inclosed a silver cylinder, and within this a golden cylinder, which was the real receptacle of the relics. Both cylinders had generally a convex lid, representing the shape of the cupola, and the box exhibited inscriptions commemorating the name of the saint to whom the ashes or other relics contained in it had belonged. It seems that there are also topes which had the relics placed, not within, but under them. The cupola of the topes was intended to represent the water-bubble, the Buddhistic symbol of the hollowness and perishability of the world, while the parasol of the topes was intended to imply the royal dignity possessed by a Buddhistic saint. When the topes became pyramids or towers consisting of terraces and stories, the number of the latter had likewise a symbolical import. Thus, only the topes of the most accomplished Buddhas had thirteen terraces, to show that these Buddhas had passed beyond the twelve causes of existence; three terraces imply the three worlds —the world of desire, that of form, and that of absence of form; five, the five steps of Mount Meru; and so on.

The most important is the Bhilsa group in Central India, of which the most famous is the Sanchi Stupa, and near it are two minor groups, at Sonari and Satdhara. In Bengal is that of Sarnath, one hundred and twenty-eight feet high. The great tope at Amravati is the most interesting for the wealth and beauty of its sculptures. Others are at Gandhara, Telelabad, and Menikalya. The sculptured rails are described under INDIAN ART. See Koeppen, *Die Religion des Buddha* (Berlin, 1857); Fergusson, *History of Indian and Eastern Architecture* (London, 1876).

TOPE. A small European shark (*Galeorhinus galeus*). It is represented on the Western American coast by the so-called 'oil' or 'soup-fin' shark (*Galeorhinus zyopterus*), about six feet long and gray with black-edged dorsals. The name is also given to the related small dog-shark (*Mustelus canis*) of the North Atlantic. See Plate of LAMPREYS AND DOGFISH.

TOPE'KA. The capital of Kansas, and the county seat of Shawnee County, 66 miles west of Kansas City; on the Kansas River, and on the Missouri Pacific, the Union Pacific, the Atchison, Topeka and Santa Fe, and the Chicago, Rock Island and Pacific railroads (Map: Kansas, G 2). It is situated on rolling prairie land, at an elevation of over 800 feet, and covers an area of about 7 square miles. Beautiful shade trees and handsome residences add to the city's attractiveness. The most notable structure is the State Capitol, in the heart of the city.

Other noteworthy edifices are the Public Library (containing 24,000 volumes), the United States Government Building, the county court-house, and the city hall and auditorium. The Melan Arch Bridge, which cost $150,000, possesses considerable architectural merit. Topeka is the seat of Washburn College (Congregational), opened in 1865; of the College of the Sisters of Bethany (Protestant Episcopal), opened in 1861; and of the Kansas Medical College. The State Insane Asylum and the State Reform School are also here. The prominent local charitable institutions include the Santa Fe Railway Hospital, the Jane C. Stormont Hospital and Training School for Nurses, Christ Hospital, Bedwell's Private Insane Asylum, Detention Hospital, and Ingleside, a home for aged women.

The industrial interests are centred chiefly in the extensive shops of the Santa Fe Railroad, and in the manufacture of flour. Of the smaller establishments, the most important are foundries and machine shops, lumber mills, and manufactories of boilers, trusses, woolen goods, etc. In the census year 1900 the total capital invested in all industries was $3,891,530; the value of their output amounted to $9,977,605. Considerable wholesale and jobbing business is carried on in Topeka. The government is vested in a mayor, chosen biennially, and a unicameral council. Subordinate officials, with the exception of the board of education, which is elected by popular vote, are appointed by the mayor, subject to confirmation of the council. The electric light plant and the water-works are owned by the municipality. The city spends annually for maintenance and operation about $323,000, the chief items being: schools, $102,000; interest on debt, $52,000; streets, $33,000; fire department, $28,000; and police department, $25,000. Population, in 1890, 31,007; in 1900, 33,608.

Topeka, laid out in 1854, was one of the 'Free State' towns founded by Eastern anti-slavery men immediately after the passage of the 'Kansas-Nebraska Bill.' In 1856 an anti-slavery convention adopted here the 'Topeka Constitution,' in pursuance of which the 'Topeka Government' was established, to be soon broken up by the United States troops. During this year Topeka became notorious for the raids made by its citizens on pro-slavery settlements. In 1857 Topeka was chartered as a city, becoming a city of the first class in 1881. It was made the capital of the State in 1861. Consult Giles, *Thirty Years in Topeka, a Historical Sketch* (Topeka, 1886).

TOPELIUS, tô-pā'lê-ụs, Zachris (1818-98). A Swedish-Finnish poet and novelist, born at Kuddnäs, near Ny Karleby, and educated at the University of Helsingfors. In 1863 he became professor of the history of Finland and the North at the university. He resigned his professorship in 1878. As a lyric poet he was second only to Runeberg, and his children's stories have been translated into many languages. His publications include: *Ljungblommor* ("Flowers of the Heath," 3 parts, 1845-50); *Efter femtio ar* (play: "After Fifty Years," 1851); *Fältskärns Berattelser* ("Tales of an Army Surgeon," 1853-67); *Läsning för Burn* ("Children's Stories," 7 parts, 1865-91); and *En resa i Finland* ("A Journey in Finland," 2 ed. 1885).

TOPETE, y Carballo, tô-pā'tâ ė kär-bä'lyô, Juan Bantista (1821-85). A Spanish admiral and politician, born at San Andrés de Tuztla, Mexico. He entered the navy at the age of seventeen and became midshipman in 1843 and lieutenant two years later. From 1846 to 1849 he served in Cuban waters and subsequently was on duty in the Mediterranean. He was promoted to the captaincy of a frigate in 1857 and during the war with Morocco in 1859 was chief of staff to the fleet. About this time he formed political affiliations with the Union Liberal Party under O'Donnell and in 1862 was elected to the Cortes from Cadiz. He was on the Pacific station during the conflict with Peru and Chile in 1865-66 and was severely wounded in the bombardment of Callao in May of the latter year. Made brigadier on his return and placed in command of the port of Cadiz he took an active part in the political conspiracies of the times and by his *pronunciamento* of September 17, 1868, gave the signal for the outbreak of the Revolution which drove Isabella II. from the throne. He sent a ship to bring back the generals who had been deported to the Canaries (see Spain) and after he had been joined by Prim and Sagasta won over the city of Cadiz to the Revolution. In the provisional government Topete assumed the portfolio of Marine. He favored the election of the Duke of Montpensier to the throne and laid down his post when the choice fell upon Amadeus of Savoy. In 1872, however, he resumed office under Serrano and during the latter's absence from the capital presided over the Ministerial Council. In the Revolution of 1873 he was imprisoned for a short time but regained influence under the presidency of Serrano who placed him once more at the head of the navy. With Serrano he fought against the Carlists in the north. On the accession of Alfonso XII. Topete retired from active participation in politics. In 1879 he was made a life Senator and in 1881 became vice-admiral. He died at Madrid, October 29, 1885.

TÖPFFER, tēpf'ēr, Rodolphe (1799-1846). A Swiss novelist and draughtsman, born in Geneva, son of the landscape and genre painter Adam Töpffer (1766-1847), under whose instruction he devoted himself to art. His eyesight failing, he took up teaching, in 1825, established a boarding school, and in 1832 became professor of æsthetics at the Academy of Geneva. His novel *Le presbytère* (1839) attracted universal attention. The *Nouvelles genevoises* (1838), *Nouvelles et mélanges* (1840), *La bibliothèque de mon oncle* (1843), and *Rose et Gertrude* (1845) are hardly less delightful than the humorous sketches of travel *Voyages en zigzag* (1848) and *Nouveaux voyages en zigzag* (1853), illustrated by himself. A little archaic in style, his work is simple, artistic, sound, and witty, with a childlike fancy and sentiment. Among his best productions are the seven little novels in pictures: *Mr. Jabot, Mr. Crepin, Mr. Pencil, Le docteur Festus, Histoire d'Albert, Les amours de Mr. Vieux Bois,* and *Mr. Cryptogame,* published together in *Collection des histoires en estampes* (Geneva, 1846-47). For his biography consult Relave (Paris, 1886); Blondel and Mirabaud (ib., 1887); and Glöckner (Zerbst, 1891).

TOPHET, tō'fĕt (Heb. *tōpheth*). A place in the Valley of Hinnom, south of Jerusalem, associated with the worship of Molech (II. Kings xxiii. 10; Is. xxx. 33; Jer. vii. 31-32; xix. 6, 12-14). The origin and meaning of the name are uncertain. See HINNOM, VALLEY OF; MOLECH.

TOPINARD, tō̇'pē̇'när', PAUL (1830—). A French anthropologist, born at Isle-Adam (Seine-et-Oise). He spent ten years in the United States, returned to study medicine in Paris, and established himself there in 1869, but after 1871 gave up his practice in order to study anthropology under Broca. He became curator for the Société d'Anthropologie in 1872, assistant director of the anthropological laboratory in the Ecole des Hautes Etudes, professor in the school of anthropology (1876), and secretary-general of the Société d'Anthropologie after Broca's death in 1880. He also succeeded Broca as editor of the *Revue Anthropologique*, was commissioner for the section of anthropology at the exhibition of 1889, and in that year was admitted to the Legion of Honor. His publications include *Etude sur la taille consideree suivant l'âge, le sexe, l'individu, les milieux et les races* (1865); *Etude sur les races indigènes d'Australie* (1872); *L'Anthropologie* (1876); *Des anomalies de nombre de la colonne vertébrale chez l'homme* (1877); and *Eléments d'anthropologie générale* (1885).

TOP'LADY, AUGUSTUS MONTAGUE (1740-78). A clergyman of the Church of England. He was born at Farnham, Surrey, and was educated at Westminster School and Trinity College, Dublin (B.A. 1760). He was ordained priest in 1764 and became rector of Broad Hembury in 1768. In 1775 failing health necessitated his removal to London, where he died of consumption, August 14, 1778. He was the great champion of Calvinism in the Church of England, and wrote much against the Methodists, with vigor of language and argument, but often with undue asperity of style. He is best known as the author of the popular hymn "Rock of Ages, Cleft for Me" (1775). He edited for several years the *Gospel Magazine*. His controversial works, mostly in reply to Wesley, are numerous. The best was *The Historic Proof of the Doctrinal Calvinism of the Church of England* (1774). His works were published with memoir (6 vols., 1794; 2d ed., 1825); there is another memoir by W. Winters (London, 1872). Of his poetry the best edition is by D. Sedgwick (London, 1860).

TÖPLER, tẽp'lẽr, AUGUST (1836—). A German physicist. He was born in Brühl, on the Rhine, and was educated in Berlin, and after various minor appointments became professor at the Polytechnic School in Riga in 1864, and in 1868 professor of physics in Gratz, where he built the Physical Institute. In 1876 he was called to the professorship of physics in the Polytechnic Institute in Dresden. He devised numerous forms of apparatus, especially in connection with optical and electrical phenomena. The electrical machine that bears his name is perhaps the best known of his inventions. Besides numerous papers he wrote *Optische Studien nach der Methode der Schlierenbeobachtung* (1865).

TÖPLITZ, tẽp'lĭts. A town of Austria. See TEPLITZ.

TOP-MINNOW. One of the minnows of the extensive genus Gambusia. They are small viviparous fishes inhabiting still waters in the Southern States, Mexico, and Cuba, and keeping near the surface of the water. See MINNOW; and Plate of KILLIFISHES AND TOP-MINNOWS.

TOP-SHELL. A mollusk of the scutibranchiate family Trochidæ, so called because the shell, when reversed, often presents a striking similarity in shape to a boy's top. When ground and polished they are extremely beautiful, and are largely used as ornaments. The operculum is horny, circular, multispiral, and has a central nucleus; and these operculæ were formerly highly valued in the East to serve the purpose of an artificial eye. These mollusks dwell in great numbers and variety along all weedy coasts, and feed upon marine herbage.

TOP-SHELL (*Trochus Niloticus*).

TOPSY. A typical young slave in *Uncle Tom's Cabin*. She is ignorant and morally undeveloped, but shrewd and cunning.

TORAH, or **THORAH**, tō̄'rå (Heb. *hattōrāh*, law, direction, Babylon. *tertu*, oracle, divine revelation). The Hebrew term technically applied to the Pentateuch. Besides the term Torah, there is also used *Tōrath Mōshe*, i.e. Law of Moses, on the basis of the tradition which ascribes the whole Pentateuch (the historical as well as the legal portions) to Moses. Traces of the original sense of Torah as 'oracle' are to be found in various passages of the Old Testament. Consult Haupt, "Babylonian Influence in the Levitic Ritual," in the *Journal of Biblical Literature*, vol. xix. (1900); Zimmern, *Beiträge zur Kenntnis der babylonischen Religion* (Leipzig, 1896-1900).

TORBANEHILL MINERAL. See TORBANITE.

TORBANITE, TORBANEHILL MINERAL, or BOGHEAD COAL. A dark brown variety of cannel coal found at Torbanehill, near Bathgate, Scotland. It contains over 60 per cent. of volatile matter and is extensively used for the extraction of burning and lubricating oils, paraffin, and illuminating gas.

TOR'BERT, ALFRED THOMAS ARCHIMEDES (1833-80). An American soldier, born at Georgetown, Del. He graduated at West Point in 1855. In 1861 he took part in the Peninsular campaign and in August, 1862, became commander of a brigade of the Sixth Corps, which he led during the campaigns of Northern Virginia and Maryland, participating in the second battle of Bull Run and in the battles of South Mountain and Antietam. He was commissioned brigadier-general of volunteers in 1862, and by his gallantry at Gettysburg earned the brevet of major in the Regular Army. In April, 1864, he was transferred to the cavalry, and was placed in command of the First Division of the Army of the Potomac. He commanded at the actions of Hanovertown, Matadequin Creek, Winchester, Kearnysville, Milford, Luray, Waynesborough, Mount Crawford, Ponis Run, Liberty Mills, and Gordonsville. He was brevetted major-general of volunteers in 1864, and in the Regular Army in 1865. He was mustered out of the volunteer service in 1866, and resigned his commission in the Regular Army. In 1869 he was appointed United States Minister to the Central American States; in 1871 was transferred as consul-general to Havana, Cuba; and in 1873 was transferred as consul-general to Paris, France. This last office he held until 1878. He was drowned in a wreck off Cape Canaveral, Fla.

TORCELLO, tôr-chĕl′lô. A small town and island in the lagoon of Venice, Italy, six miles northeast of Venice. The seventh-century Byzantine cathedral, Santa Maria, has a gorgeous twelfth-century mosaic representing biblical scenes. The Santa Fosca Church is also architecturally interesting. There are two small museums of antiquities. The population of the island is about 130.

TORCH DANCE. Specifically, a ceremony held at certain European courts, especially that of Prussia, upon the marriage of any member of the ruling house. It is participated in by Ministers of State and Privy Councilors, as well as by the members of the royal family. Its most striking feature is a march or procession about a hall of the palace by the bride and bridegroom accompanied by their relatives and led by the Ministers and Councilors, in pairs, all of whom carry lighted wax candles. The torch dance is probably a survival from early fire-worship ceremonials, which under various forms appeared sporadically in Europe during the Middle Ages.

TOR′DA. A town of Hungary. See THORENBURG.

TORDESILLAS, tôr′dâ-sēl′yâs, CONVENTION OF. See DEMARCATION, LINE OF.

TO′RELL, OTTO MARTIN (1828-1900). A Swedish naturalist, born at Warberg. He studied medicine and the natural sciences at Lund and then traveled through Scandinavia, Switzerland, and Iceland engaged in scientific investigation. In 1858 he accompanied Nordenskjöld to Spitzbergen, thence making his way to Greenland, and in 1861 he went again with Nordenskjöld to Spitzbergen. Five years afterwards he was appointed professor of zoölogy and geology at Lund. In 1871 he was called to Stockholm as chief of the Geological Survey. His map of Sweden ranks with the best that have been made. Besides many papers on the Ice Age and upon animal life in the North, he wrote an account of the Swedish expeditions to Spitzbergen of 1861, 1864, and 1868.

TORELLI, tô-rĕl′lê, ACHILLE (1844—). An Italian dramatist, born at Naples. He wrote his first comedy, *Dopo morte*, at the age of sixteen—a piece still played under the title *Chi muore, giace*. In 1867 his *I mariti* scored a tremendous triumph, which, however, was not repeated. In 1878 he was made director of the San Carlo Theatre at Naples. His other plays include: *Prima di nascere* (1862); *Il precettore del rè* (1863); *Il colore del tempo* (1875); and *Scrollina* (1880).

TORELLI, GIUSEPPE (c.1660-1708). An Italian violinist and composer, born in Verona, originator of the *Concerto grosso*. This form of music remained in favor until the time of Handel and prepared the way for the modern symphony. With Corelli, Torelli was the principal musician of his time. He became connected with the Church of San Petronio at Bologna (1685), joined the Accademia Filarmonica of that city, and in 1703 was made concert master to the Margrave of Brandenburg.

TORELLI-TORRIANI, tôr′rê-ä′nê, MARIA. An Italian novelist, born at Novara, better known under her pseudonym Marchesi Colombi. She prepared for a pedagogical career, but, failing to secure a position, resorted to her pen, and after marrying, in 1869, Eugenio Torelli-Viollier, editor of the *Corriere della Sera* in Milan, produced a series of tales which made her widely popular. Her first book, *La gente per bene* (1877), created a sensation, and was followed by the novel *Tempesta e bonaccia* (1878), which, however, did not attain to the merit of the tale *Risaja* (1877), a touching description of peasant misery. Her other publications include: *Piccole cause* (1879); *Senz' amore* (1883); *Il tramonto d'un ideale* (1883); *Giornate piovose* (1884); *Prima morire* (1887); *Troppo-tardi* (1890); *Cara speranza* (1895); *Le gioie degli altri* (1900); and the collection of poems *Lungo la vita* (1891).

TORFÆUS, tôr-fē′ŭs, THORMODUS, or THORMODR TORFASON (1636-1719). An Icelandic antiquary. He was born at Engö, Iceland; was educated at the University of Copenhagen; and in 1662 returned to Iceland by command of Frederick III. to collect saga manuscripts. In 1667 he was appointed royal antiquary, and in 1682 royal historiographer for Norway. He translated several Icelandic works into the Danish language, and was the author of *Historia Vinlandiæ Antiquæ* (1705); *Grœnlandia Antiqua* (1706); and *Historia Rerum Norvegicarum* (4 vols., 1711).

TORGAU, tôr′gou. A fortified town of the Province of Saxony, Prussia, on the left bank of the Elbe, 31 miles east-northeast of Leipzig (Map: Prussia, E 3). The Castle of Hartenfels (1481-1544), one of the largest Renaissance edifices in Germany, was once the residence of the electors of Saxony. It is now used as barracks. There is a museum of Saxon antiquities. Gloves, glass, druggists' sundries, cigars, and biscuits are manufactured. Frederick the Great here defeated the Austrians in 1760. Population, in 1900, 11,807.

TORII, tō′rē′ (Jap., bird-rest, or, less probably, gateway). An archway formed by two upright posts and one horizontal beam, placed before the Shinto shrines in Japan. It is supposed that the Torii was originally a perch for sacred fowl who were to herald the approach of day.

TORLO′NIA. A princely Roman family. Its founder, GIOVANNI TORLONIA (1754-1829), was a poor *cicerone* of Rome, who grew enormously rich in manipulating *assignats* during the French Revolution, and as banker for many kings and princes. He was made a grandee of Spain, and Duke of Bracciano by the Pope. His three sons married into the highest families, the eldest succeeding to the dukedom, the youngest, ALESSANDRO, becoming Prince of Civitella-Cesi and Duke of Ceri, and acquiring immense wealth, of which he made charitable use. He acquired fame by successfully draining Lake Celano (Fucino) at an expenditure of over $800,000, thereby restoring to cultivation 36,000 acres of land.

TORMENTIL (Fr. *tormentille*, from ML. *tormentilla*, *tormentella*, tormentil, from Lat. *tormentum*, torment, from *torquere*, to rack, twist, torment; so called because the plant was supposed to be a remedy for toothache). A popular name for Potentilla Tormentilla, formerly called Tormentilla officinalis, common on European moors and heaths. Its large woody roots have been used as an astringent and for staining leather. It has ternate leaves and axillary terminal yellow flowers. The leaves are ternate, the leaflets lanceolate and inciso-serrate, the stems ascending and forking, the flower-stalks axillary and terminal, and the flowers yellow.

TORNADO. See WIND.

TORNEÅ, tôr′nĕ-ȯ. A town in the Government of Ulcåborg, Finland, Russia, situated on the Torneå, near the northern end of the Gulf of Bothnia (Map: Russia, B 1). Population, in 1897, 1400. About 33 miles north is the Mountain of Avasakra (1573 feet), which is visited by many tourists at the summer solstice, when the sun remains there above the horizon for almost two days.

TORNEÅ. A river, forming the boundary between Russia and Sweden. It rises in the Tornea Lake near the Norwegian boundary, and flows southeast through Sweden, then south on the Russian boundary, entering the Gulf of Bothnia at its northern extremity, after a course of 250 miles (Map: Sweden, K 3). Near its mouth is the town of Torneå (q.v.). Its chief tributary, the Muonio, forms the northern part of the boundary.

TORO, tō′rȯ. An ancient town of Spain, in the modern Province of Zamora, in Leon, on the right bank of the Duero, 38 miles southwest of Valladolid, on the Medina del Campo-Zamora Railroad (Map: Spain, C 2). It contains numerous religious houses and palaces, most of which have been allowed to fall into a state of decay, and the Cathedral Church of Santa Maria la Mayor, dating from the reign of Alfonso VII. There are brandy distilleries, vineyards, tanneries, and woolen manufactories. Population, in 1900, 8187. Toro has been of little importance in Spanish history since its resistance to Charles V., when it took a leading position in the rebellion of the *comunidades*.

TÖRÖK-SZENT-MIKLÓS, tẽ′rẽk sĕnt mê′klōsh. A commune of the County of Jász-Nagy-Kun-Szolnok, Hungary, 66 miles southeast of Budapest (Map: Hungary, G 3). The extensive plain in which it is situated is noted for its production of cereals and live stock, and in the commune itself there is some manufacture of brick and of agricultural implements. Population, in 1900, 21,881.

TORON′TO. The capital of the Province of Ontario, Canada, on the north shore of Lake Ontario, 333 miles southwest of Montreal (Map: Ontario, D 4). It is situated on the north side of a spacious inlet called the Bay of Toronto, has a water frontage of about eight miles from east to west, and extends inland from south to north about three miles. The harbor or bay, about five miles long and one mile in width, is protected by a sandy islet, which extends into the lake in a south and west direction to a distance of five miles. The port accommodates the largest vessels that navigate the lakes, has a dry dock 198 feet long, and is defended at the entrance by a fort. The Grand Trunk and the Canadian Pacific railroads pass through the city, and connect with all parts of Canada and of the United States.

The scenery of the vicinity is somewhat tame, and the situation of the town is low and flat. The most elevated quarter—the Queen's or University Park in the west—lies from 100 feet to 200 feet above the level of the lake. There are many handsome official buildings, including the new city hall and court house, the supreme courts of the province, the legislative buildings, the Government House, the custom-house, the post-office, the horticultural gardens, and benevolent institutions. There are several parks, including Riverdale; the Queen's Park, already referred to with its beautiful monument to the volunteers who fell at Ridgeway in 1866; and the exhibition grounds where the important annual fair of the Industrial Association is held each September. Toronto is distinguished for its churches. The principal are Saint James's Cathedral (Anglican), a noble edifice in early English, erected in 1852; Saint Michael's Cathedral (Roman Catholic); Saint James's and Saint Andrew's (Presbyterian); the Metropolitan Methodist Church, noted for its huge organ; Jarvis Street Baptist; Bond Street Congregational; and the Church of the Ascension (Anglican). Toronto is the head of the Canadian school system. Its higher institutions include the Toronto University, in Queen's Park; Victoria University, a Methodist institution also in Queen's Park; Trinity College; Baptist College; Knox College; and Upper Canada College, etc. The city maintains an excellent free library of over 100,000 volumes, which has branch libraries; has water-works, gas and electric lighting plants, and electric street railways. Cabinet-ware, iron rails, agricultural implements, stoves, pianos, bicycles, carpets, and shoes are manufactured, and there are shipbuilding yards, foundries, breweries, distilleries, and flour mills; the exports are manufactured lumber, flour, wheat, and other grain. Toronto ranks second among the commercial centres of Canada. The name Toronto, 'place of meeting,' is of Indian origin. The town was founded in 1794 by Governor Simcoe, and incorporated in 1834. It was burned by the Americans in 1813, and suffered severely as the headquarters of the rebellion in 1837, and also from fire in 1849. Population, in 1891, 181,220; in 1901, 207,971.

TORONTO, UNIVERSITY OF. An institution of higher education at Toronto, Can., established in 1827, as King's College. The opening of the college was delayed for fourteen years, and not till 1842 were the faculties of arts, medicine, law, and divinity established. In 1849 the institution assumed its present title, and in 1853 the faculties of medicine and law were abolished and the functions of the institution were divided between the two newly organized corporations of the University of Toronto and University College. By the Federation Act of 1887, the faculty of University College consists of professors in classical languages and literature, ancient history, Oriental languages, English, French, German, and moral philosophy. All other portions of the arts course were assigned to the faculty of the University of Toronto, the lectures of which are open to the students of University College and of all federating institutions. A faculty of medicine was established in 1887; in 1888 the Ontario Agricultural College was affiliated, and subsequently the Royal College of Dental Surgeons, the College of Pharmacy, the Toronto College of Music, the School of Practical Science, and the Ontario Veterinary College became parts of the University. Federated with the university are Victoria University, Knox College, Wycliffe College, Saint Michael's College, and Trinity University (1903). The attendance in 1903 was 1717, including 883 in arts, 494 in medicine, and 340 in applied science, and the whole number of instructors was 146. The library contained about 76,000 volumes and 22,500 pamphlets. The endowment in 1903 was $868,899, the income $231,160, and the total value of property under the control of the institution, $3,503,729. University extension work is carried on by means of lectures delivered throughout the Province of Ontario.

TORPEDO (Lat. *torpedo*, numbness, cramp-fish, torpedo, from *torpere*, to be numb, stupid). A naval torpedo is an explosive device designed to destroy or injure a ship by blowing a hole in her hull at or below the water line. It consists essentially of the explosive charge, the fuze (which ignites the charge), and the case containing these. Torpedoes are of two classes, fixed and moving. Fixed torpedoes are now commonly called *torpedo mines* or *submarine mines.*

Torpedo mines are (1) *self-acting*, and (2) *controlled*, according to the conditions of firing. *Self-acting mines* are *mechanically* or *electrically* fired. The mechanical arrangements are of numerous types, but the most common is a set of pins projecting from the head of the torpedo, any one of which if struck would be driven down upon a fulminate primer in communication with the charge. The *electrically fired* are (1) *simple buoyant* mines, anchored so as to be not less than 5 nor more than 20 feet below water, and (2) *combination ground* mines with a buoyant contact piece or float which is anchored so as to be about the same distance beneath the water as a contact torpedo. In both these types the explosion is caused by the completion of the electric circuit by the driving in of a pin by a ship which have contact floats.

Controlled mines are (1) *automatic* and (2) *observation.* The firing wires for all controlled mines lead to mine stations. For automatic mines this is done merely to secure safety. When the circuit is closed at the mine station the torpedo is not fired, but merely prepared to explode if one of the contact pieces on the shell is pressed down by a passing ship. The *combination controlled* torpedo, like the combination self-acting, is a ground mine with a contact float; it is made ready in the same way as an automatic controlled mine. *Observation* mines are fired by observers who keep the circuit closed at their stations when the ship is on line with torpedoes as seen from their points of view. Therefore, when a ship is directly over a torpedo, the circuits at both mine stations (usually placed so as to give nearly right angle intersection of lines of sight on each torpedo) are closed and the charge is exploded. *Observation mines* may be of the *simple* or *compound buoyant* type or of the *ground* type. The *simple buoyant* mine can only be exploded by the observers; the *compound* type has extra fittings, so that it may be considered as belonging also to the *automatic buoyant* type or *controlled* mine. *Observation ground* mines are *simple* if fitted for explosion by the observers only, and are *combination* if they also have contact floats.

Mines of all the types mentioned are in common use, their various characteristics fitting them to different local conditions. Self-acting mines have the advantages of (1) being comparatively cheap, (2) can be kept in store ready for immediate use, (3) do not require specially trained men or observation mining stations, and (4) *extempore* ones can be easily made. But self-acting mines are all (1) rather dangerous to put out or pick up, (2) the condition of the igniting apparatus cannot be tested after the mine is placed in position, (3) they are as dangerous to friend as to foe when once placed, and (4) the mechanical or electric contact pins may become so overgrown with barnacles as to prevent their operation. After being two months in the water the Spanish self-acting torpedoes (in 1898) were so overgrown with barnacles that none were in a condition in which they would have been exploded if struck by a ship; indeed, two United States ships actually struck them without causing explosion. The objections to this type are evidently so serious as to preclude their use in important channels. In such places, particularly if it is desired to keep open a passage for friendly vessels, observation mines are used. If the water is not too deep, ground mines are laid; but in deep water buoyant mines must be employed. Where the water is very deep and the currents are strong the mining of a channel is very difficult—in some cases it is impossible to lay them so that they can always be operated effectively.

Self-acting mines are usually placed singly and far enough apart to prevent the explosion of one mine from setting off the others by shock. Controlled mines, and particularly the observation variety, are commonly put out in groups, all the mines in each group being exploded simultaneously. When so arranged, each group should be far enough from the others to avoid being exploded by shock. The distance at which sympathetic explosion takes place varies with the character of the explosive and the weight of the charge. Guncotton is commonly use. Its extreme destructive horizontal range, according to General Abbott, U. S. A., is 14.7 feet for a 100-pound charge, 20.5 feet for a 200-pound charge, and 31.7 feet for a 500-pound charge; while the safety interval or distance between mines or groups should be at least eight times the extreme destructive horizontal range.

MOVING TORPEDOES are (1) *controlled* or (2) *uncontrolled.* The *controlled* type are (1) *spar*, (2) *towing*, or (3) *dirigible*—the last-named class being either (1) *extra-mobile* or *locomotive* or (2) *automobile.* The *uncontrolled* type includes (1) *automobile*, (2) *projectile*, (3) *rocket*, and (4) *drifting* torpedoes.

Authorities do not favor greatly *controlled* torpedoes. In the spar type of these weapons the charge was placed at the end of a spar rigged out from a boat or ship, and torpedoes of this sort were much used in the Civil War; the rapid-fire gun sounded their death-knell. The *Harvey towing* torpedo (and its modifications) was towed in a spar at the end of a hawser, its shape and steering vanes keeping it well out on the quarter of the ship using it. Its defects are apparent and it is obsolete. The *extra-mobile* or *locomotive* torpedo has an external source of power supplied through wires which are also used in carrying the steering force. Some few of these are still 'officially' in service, such as the *Brennan* and *Sims-Edison,* but they are not much in favor. The *Brennan* is propelled by two wires which are reeled up in the torpedo. By hauling on them they unreel and rotate twin screws. Steering is effected by varying the tension on the port or starboard wire. The *Sims-Edison* torpedo is propelled and steered by electricity from an external source which is supplied to the torpedo through a wire cable which is unreeled as the torpedo advances. The *automobile controllable* torpedoes, of which there were many varieties, carried their own source of power, which was usually compressed air or carbonic acid gas, and were all electrically steered, the current passing through a light cable which was unreeled as the torpedo moved ahead.

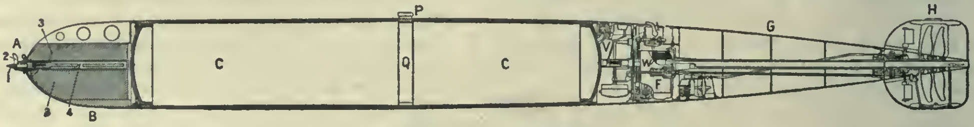


FIG. 1. WHITEHEAD TORPEDO.

The *projectile* type of *uncontrollable* torpedoes is fired from a submarine gun (q.v.). It has never proved satisfactory as a weapon, but it received its most successful development at the hands of Ericsson, who was able to give it a reliable range of about 150 yards. The short range of the submarine gun was its fatal defect and caused its condemnation. *Rocket* torpedoes have usually been fitted to move along the surface of the water, the propelling force being the reaction from the gas escaping from the rear end. As they are very erratic in their movements when the water is smooth and cannot be used at all when it is rough, they have never had much vogue. Submerged torpedoes propelled by rocket tubes have been even less successful; they lack the speed of the surface type and are nearly as erratic as regards their course. *Drifting* torpedoes are merely self-acting buoyant mines set adrift.

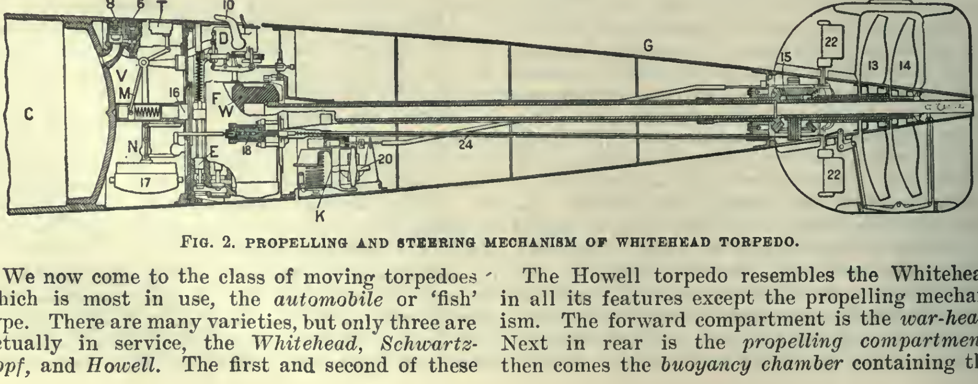


FIG. 2. PROPELLING AND STEERING MECHANISM OF WHITEHEAD TORPEDO.

We now come to the class of moving torpedoes which is most in use, the *automobile* or 'fish' type. There are many varieties, but only three are actually in service, the *Whitehead, Schwartzkopf,* and *Howell.* The first and second of these are identical in general design and similar as regards details, though the body of the Whitehead has a steel shell or outer case, while that of the Schwartzkopf is made of bronze. The details of a Whitehead torpedo are shown in the accompanying plans. In Fig. 1, A is the *war-nose;* B is the *war-head* (an exercise head without explosive charge or war-nose is used in ordinary torpedo target practice); C is the *air-flask* containing the compressed air—its shell is thicker than that of the rest of the torpedo; P is the *guide stud* for holding the torpedo in position in the tube; Q is a *strengthening band* to support the guide stud; V is the *balance chamber;* F is the *engine compartment;* G is the *tail;* H is the *tail-frame;* 1 is the firing-pin; 2 is one blade of the releasing screw. B, the *war-head,* contains the *explosive charge,* 3, of wet guncotton, while 4 is a small *priming charge* of dry guncotton in a hermetically sealed case inserted in the front end of the war-head before screwing in the war-nose. In Figs. 2, 6 and 8 are the *charging* and *stop valves* for charging the torpedo; T is the *depth regulator* which connects by the *bell-crank lever* M to the *regulator spring,* which is pressed by the hydraulic piston, 16; the hydraulic piston receives the water-pressure on its after side as the engine-room (F) is open to the sea; the hydraulic piston operates small levers pressing against a lever pivoted on the pendulum (17), and the motion is transmitted through the rod N to a crank and thence to the steering engine (18), which operates horizontal rudders (not shown) by means of the rod 24; D is the *operating valve group* which controls the supply of air to the *engine,* W; 10 is the *starting lever;* E is the *releasing mechanism;* K is the *Obry gear,* in which 20 is the *gyroscope* wheel; 13 and 14 are the *propellers;* 15 is the *bevel gear,* which permits the two propellers to be driven in opposite directions; and 22 are the rudders actuated by the Obry gear. This latter by means of its gyroscope wheel (which always keeps in one plane) operates the little rudders (22) and brings the torpedo back to its original direction if it is deflected from any cause.

The Howell torpedo resembles the Whitehead in all its features except the propelling mechanism. The forward compartment is the *war-head.* Next in rear is the *propelling compartment,* then comes the *buoyancy chamber* containing the *depth regulating mechanism*, and lastly, the after compartment which contains the steering mechanism for both horizontal and vertical rudders. The source of propelling power is a heavy fly-wheel so designed as to have most of its weight near the periphery. By means of a steam turbine connecting to a clutch projecting barely through the shell of the torpedo this wheel is spun up until its speed is 9000 revolutions per minute or 150 revolutions per second. This gives ample power for a long and fast run if it could all be utilized, but up to the present it has been found impracticable to get the power to the propellers fast enough. The propellers are not on one shaft as in the Whitehead, but on two, each connecting to shafts driven by gearing from the fly-wheel. In addition to the simplicity of the form of power, the fly-wheel acts as a gyroscope and strongly resists any force tending to force the torpedo out of the plane in which it was originally launched. The Howell is still in service in the United States Navy, but the development of the Obry gear in the Whitehead has so improved the directive force of the latter that its otherwise superior qualities have caused it to displace the Howell in all new ships.

It is not unlikely that attempts to employ torpedoes or mines were made in the early days of gunpowder, but the first occasion on record in which they were used was in 1585, when an Italian engineer by the name of Gianibelli (q.v.) partially destroyed a bridge across the Scheldt at Antwerp by means of small vessels each carrying a considerable quantity of gunpowder which was exploded by clockwork mechanism. Nothing more is heard of torpedoes until 1730, when the French scientist Desaguliers made some experiments with some of the rocket type which were fired under water and with which he is said to have destroyed several boats. The first torpedoes to be used in war against ships were designed by an American, Capt. David Bushnell, who also built the first submarine torpedo boat, though not the first submarine boat. After making numerous successful experiments Captain Bushnell made three attempts to destroy British men-of-war. In the first, Sergeant Lee used Bushnell's submarine boat (see TORPEDO BOAT, SUBMARINE, for description and illustration), and actually got under H.M.S. *Eagle*, but failed to attach and explode his torpedo, owing to inexperience in handling his novel craft and the bluntness of the screw he tried to use. The second attack was made on H.M.S. *Cerberus* by drifting torpedoes; this failed, but one of the torpedoes was picked up by the crew of a prize schooner astern of the *Cerberus* and, exploding on board, killed three men, destroyed a boat, and injured the schooner. The fourth attempt, also at New London, was the celebrated 'Battle of the Kegs,' and it failed because the British ships had hauled in to the wharves to avoid the ice; but it created much confusion and alarm among their crews. The next man to take up torpedoes seriously was Robert Fulton, who began his experiments on the Seine in 1797. His first attempts were chiefly failures, but in 1801, at Brest, he destroyed a small vessel with a submarine mine containing twenty pounds of gunpowder. This is believed to be the first vessel sunk by a torpedo, but he afterwards succeeded in several instances, and where the attack failed it was owing to the movement of the vessel from above the torpedo and not to defects in the torpedo. In one instance a British brig was destroyed by two torpedoes made by him containing 180-pound charges of gunpowder fired by clockwork. In 1812 and 1813 another American, Mr. Mix, made unsuccessful attempts to blow up British ships. In 1820 Captain Johnson, an Englishman, with a submarine boat attached a torpedo to the bottom of a vessel and exploded it. In 1829 Colonel Samuel Colt began his torpedo investigations, developed the electric firing of mines in 1842, using in one instance wires forty miles long with complete success.

In the Civil War in America the torpedo came quickly to the front as a serious weapon. The few ships of the Confederates offered little opportunity for the use of torpedoes by the Federals, but the great fleet of the latter and the necessity which often compelled the vessels to operate in narrow waters gave a multitude of chances which their enterprising antagonists were quick to seize. The unsuccessful attempts were hundreds in number, but during the course of the struggle 7 Federal armor-clads, 9 gunboats, 6 transports, and 1 cruiser were sunk or destroyed, and 2 armor-clads, 3 gunboats, 1 transport, and 1 large cruiser were seriously injured. Of the latter, 1 cruiser and 1 armor-clad were attacked by boats using spar torpedoes. The only important Federal success was the destruction of the armor-clad *Albemarle* by Cushing, who also used a spar torpedo.

While all this was going on Captain Lupuis of the Austrian Navy and Mr. Whitehead began the development of the movable torpedo. The idea of a small, self-propelled boat carrying an explosive charge and directed from a distance had occurred to Captain Lupuis in 1860, but it was not until 1864 upon his association with Mr. Whitehead that any craft of the sort were built. Mr. Whitehead, who was an English engineer acting as superintendent of engineering works at Fiume, took hold of the project with great interest. He soon gave up the plan of using directing wires, and bent his energies to the development of a completely automatic device. In 1868 the first official trial was held before a board of Austrian officers, and its report resulted in the adoption of the weapon in the Austrian service, although the speed attained was only about seven knots. From this time to the present the improvement has been continuous, the speed rising to 35 knots and the directive force becoming almost absolutely certain when the conditions are favorable. All naval powers now use the Whitehead or its equivalent, the Schwartzkopf, and many (including the United States) have purchased the right to manufacture them.

Shortly after Whitehead's successful experiments Captain Harvey, R.N., brought out his *towing torpedo*, which had a vogue wholly unwarranted by its performance, but it was pleasing from its simplicity. About 1870 Commander (now Rear-Admiral) Howell, U. S. N., conceived the idea of applying the principle of the gyroscope to automobile torpedoes for the purpose not only of steering them, but to afford motive power as well. His torpedo was gradually improved until in 1898 it attained a speed of about 28 knots with almost perfect directive force. The application of the Obry gyroscopic gear to the otherwise perfected Whitehead, however, drove the Howell out of the field, and it is now practically unused.

In 1873 while the success of the Whitehead remained uncertain in many minds, Mr. J. L. Lay brought out his first controllable torpedo, propelled by carbonic acid gas and directed by electricity through wires paid out from a reel in the torpedo as it advanced. The Lay was followed by a host of similar inventions, the Lay-Haight, Patrick, Nordenfelt, Brennan, Sims-Edison, and others; but, although some are still officially in service, none are regarded as of much use in modern warfare. Controllable torpedoes, steered by wireless induction currents, have been under experiment.

The first Whitehead to be fired with hostile intent was directed at the Peruvian monitor *Huascar* by the British cruiser *Shah*, which sought to capture or destroy the former to prevent her from further lawless attacks on British vessels. The shot failed because fired at too great a distance. In 1891 two Chilean Government torpedo vessels sank the insurgent armorclad *Blanco Encalada* with Whitehead torpedoes, and during the Japan-China War several vessels were destroyed by them. The recent improvements in the range, speed, and directive force of Whitehead torpedoes, as well as in torpedo boats and firing appliances, has caused a considerable change in naval opinion, which now is inclined to regard the Whitehead as a most dangerous weapon; still it is not, as many uninformed people seem to think, likely to take the leading part in future wars, because the danger from it may be greatly reduced by careful disposition of ships at night, proper scouting, and increasing vigilance. Moreover, since it is only useful against vessels and cannot support operations against coasts, fortifications, or men, it can never hope to displace the gun and the well-protected gun-carrying warship.

Bibliography. For further information, consult: Sleeman, *Torpedoes and Torpedo Warfare* (2d ed., Portsmouth, Eng., 1889); Armstrong, *Torpedoes and Torpedo Vessels* (2d ed., London, 1902); *Annual of the Office of Naval Intelligence* (U. S. Navy); Brassey, *Naval Annual* (Plymouth); Buchard, *Torpilles et torpilleurs* (Paris, 1889); *Proceedings of United States Naval Institute* (Annapolis, quarterly). See articles on Torpedo Boat; Torpedo Boat, Submarine; Torpedo Director; etc.

TORPEDO, or Electric Ray. A ray (q.v.) of the family Narcobatidæ, which inhabits warm seas, and often is of large size. These rays have a broad, flat body with a comparatively slender tail, and are of interest because of the electrical powers which they possess. (See Electric Fish.) There are about 15 species, of which the best known is *Torpedo marmoratus* of Southern Europe. A similar species, the 'crampfish,' or 'numbfish' (*Torpedo occidentalis*), occurs on the Atlantic coast of the United States, and is said to attain a weight of 200 pounds. The same, or a very similar species is found on the coast of California. See Plate of Electric Fish.

TORPEDO BOAT. A small war vessel fitted to use the torpedo as its primary weapon of attack. The principal requirements of a torpedo boat are high speed, efficient means of launching torpedoes, handiness, and fair seaworthiness. To attain these essentials the boats are long, slender, very lightly built, and low in the water. The torpedo tubes are pivoted on deck—on small boats on the fore-and-aft midship line; on larger boats, near the side. Modern torpedo boats belong to four classes: (a) *torpedo boat destroyers;* (b) *sea-going* boats; (c) *harbor* boats; and (d) *portable* boats carried by men-of-war. Torpedo boat destroyers are here classed with torpedo boats because of similarity in general design and because they will undoubtedly be used for torpedo attack in the same manner as the smaller craft—from which they differ little except in size and the possession of a battery sufficiently powerful to quickly sink and destroy boats of the lesser dimensions. They vary in size from 250 to 600 tons. The torpedo boat proper carries very few and very small guns. Sea-going boats are of 100 to 250 tons; harbor boats (capable of going to sea in moderate weather) of 30 to 100 tons; and portable boats of from 5 to 15 tons. The speeds are in somewhat similar ratio, destroyers having 26 to 35 knots; sea-going boats, about 25 knots; harbor boats, 20 to 25 knots; and portable boats, 13 to 17 knots.

Torpedo boats can only hope to be successful when attacking under cover of night or of thick fog, and several should attack a ship simultaneously and from different directions. The defense against them consists of picket boats, torpedo nets (q.v.), rapid-firing guns (q.v.), and searchlights (q.v.). Although it is difficult to sink a well-built modern battleship by torpedo attack, it is always possible, and the knowledge of this fact exercises a great moral effect. All maritime nations possess torpedo boats. (See Navies.) In 1903 the United States boats were, with one or two exceptions, quite new, and averaged much larger than those of the same class in foreign navies. The American destroyers are much more heavily armed than the foreign ones. Sixteen of them carry two 3-inch guns and five 6-pounders, and the other four have four to seven 6-pounders. Many of the foreign destroyers carry only five or six 1-pounders or 3-pounders; while, aside from a few of the latest British boats, none carries more than one 3-inch.

In its earliest form the torpedo boat contained merely a large quantity of powder and was itself destroyed by the explosion. Craft of this type were used by Gianibelli at Antwerp in 1585. (See Torpedo.) The first evolutionary step developed boats which carried torpedoes that were designed to be attached to the bottom of the enemy's ship. All of this type were submarine. (See Torpedo Boats, Submarine.) The first surface boats appeared during the American Civil War and the first partial success was achieved (October, 1863) in an attack by a Confederate boat on the Federal armorclad *New Ironsides*, in which the latter was slightly injured. Practically all of the torpedo boats of the war used 'spar' torpedoes, which were carried at the end of a long spar or boom rigged out beyond the bow; and nearly all were ordinary steam launches or pulling boats, though the boat which attacked the *New Ironsides* and one or two others were specially built craft with nearly submerged hulls. In 1873 the first fast (speed, 15 knots) specially designed torpedo boat was built by Thorneycroft of Chiswick, England, for the Norwegian Government and was fitted for using the Harvey towing torpedo, then in much favor. In the next year both Thorneycroft and Yarrow (of Poplar, near London) constructed boats for various foreign governments, and they built several in the ensuing year, but none for Great Britain. About the same time Herreshoff completed a very fast boat for the United States Navy. In 1877 Herreshoff brought out the first boat fitted to use Whitehead torpedoes, and although many subsequent boats were designed to carry spar torpedoes, the Whitehead rapidly made its way, so that by 1880 it had practically displaced all rivals except the Howell and Schwartzkopf, which were of somewhat similar type.

The advent of the 'destroyer' class of boat was brought about by the realization of the inadequacy of the existing means of defense against torpedo attack. The first boat was completed for the British Navy in 1893. Experience with these craft demonstrated their value both as scouts and picket boats against torpedo boat attack, and also showed that under many circumstances they were available and desirable as torpedo boats.

Bibliography. For further information, consult: Sleeman, *Torpedoes and Torpedo Warfare* (2d ed., Portsmouth, England, 1889); Armstrong, *Torpedoes and Torpedo Vessels* (2d ed., London, 1902); Johnson, *Defense of Charleston Harbor* (Charleston, 1890); Scharf, *History of the Confederate Navy* (New York, 1887); *Annual* of the Office of Naval Intelligence (United States Navy Department, Washington, current); Brassey, *Naval Annual* (Portsmouth, annual); Buchard, *Torpilles et torpilleurs* (Paris, 1889). See also articles on Torpedo; Torpedo Boat, Submarine; and Torpedo Net.

TORPEDO BOAT, Submarine. Modern submarine torpedo boats are of two kinds, the *submerged* and the *submergible.* The submerged, when in light cruising condition, moves with only a small percentage of the hull above water; the submergible cruises on the surface much like an ordinary torpedo boat, which it resembles externally. The difference in principle between the two types is slight, but in construction details it is very marked. Submerged boats are usually nearly cylindrical with pointed ends, the general shape being much like that of a Whitehead torpedo. Submergence is effected by admitting water to the ballast tanks or by means of inclined rudders or both. *Submergible* boats have two hulls, one inside the other. The outer hull resembles closely that of the ordinary torpedo boat, but has as few projections as possible rising from the general outline, in order to present a smooth surface when submerged. Inside this there is a second hull of nearly circular crosssection and as large as the shape of the outer boat permits. To effect submergence water is first admitted to the space between the hulls, and this brings the boat to the 'awash' condition. Further submergence is effected by permitting the ballast tanks to fill. The advantages of each type are apparent. The submerged boat is ready for nearly instant service, but cannot cruise with comfort to the crew. The submergible boat affords fair speed and comfort when cruising, but considerable time is required to effect its submergence. The section (Fig. 4) of the Holland submarine boat shows the general features of a submerged boat; similar boats have also been built for the British Navy. France, which is building more submarines than any other nation, is the only one using the submergible boats, and they form but a small part of those she has completed or under construction. For the number of boats completed and under construction in the various navies of the world in 1903, see Navies.

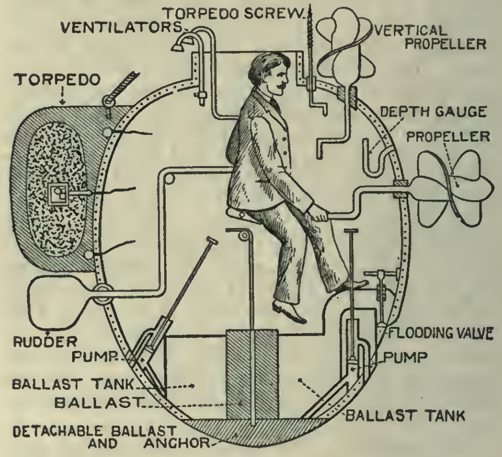
The difficulties in the way of submarine navigation are: (a) difficulty of securing safety; (b) of obtaining a fair speed; (c) of steering; (d) of securing habitability; (e) of insuring stability; to which is to be added, for submarine torpedo boats, the difficulty of directing and discharging the torpedo. In the present state of development submarine boats can be made fairly safe. The problem of reaching a speed in excess of 10 knots when wholly submerged is a difficult one. Storage batteries are too heavy (at least all types now known) for the purpose of furnishing sufficient power; steam is inadmissible for obvious reasons; and the only practicable machine seems to be an explosive motor developing a high pressure in the engine. So far no efficient means of keeping the exhaust gases from escaping into the boat has yet been devised; and even if such means were found it is possible that the escaping bubbles and the smell would enable the course of the boat to be ascertained and followed. As to steering and directing the course, there remain several imperfectly solved problems. It is impossible when under water to see more than a few feet ahead with the boat at rest, and the difficulty increases with the speed. Even when near the surface of the water the hull of a large ship is undiscernible beyond 100 feet. A sensitive compass with adequate directive force is possible only if the hull is made of copper, bronze, aluminum, or some other non-magnetizable metal. The most promising device is the periscope, which (like a camera obscura) consists of a tube with a prism or inclined mirror at the upper end with a reflecting table below. The upper part of the periscope is designed to project several feet above water when the boat is entirely submerged. The unsteadiness of the boat, however, interferes seriously with the effectivness of this instrument; moreover, the projecting tube may betray the boat's position. In place of a compass a gyroscope has been experimented with, but the results were not satisfactory. All boats are fitted with small conning towers projecting a short distance above the hull and having glass covered peep holes of considerable size. This conning tower can be used when cruising at the surface and its top may be opened if the water is very smooth. In most boats the opening in the top of the conning tower forms the principal way of ingress and egress.

To attain a reasonable habitability in a submarine boat is very difficult indeed. The boats are not easily susceptible of being warmed or cooled; in fact, few attempts have been made in either direction, so that in very warm water or in very cold it is possible to remain in the boats only a very short time without suffering from the unsuitableness of the temperature. So far as the vitiation of the air due to the breathing of the crew is concerned, the problem may be regarded as practically solved; but storage batteries, steam motors, oil motors, and oil give off gases which are not only annoying and injurious, but may prove dangerous. It may be possible to reduce troubles of this sort to satisfactory limits by inclosing the machinery in air-tight casings, but in the handling and inspection some gas is sure to escape. There can be no cooking, no proper sleeping accommodations, no proper water-closets, and the natural light is feeble. The motion is as trying as it is on a surface boat. A short consideration of these things is sufficient to show that the ease of securing fair habitability increases with the size of the boat, to which of course there is a limit.

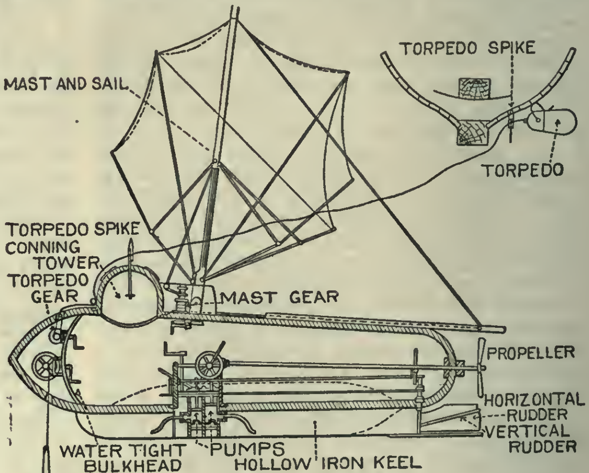
The conditions affecting the stability of an entirely submerged vessel differ considerably from those affecting the stability of one floating on the surface. (See Shipbuilding.) Since the sectional area of the immersed body remains unchanged at all angles of heel, the position of the centre of buoyancy is constant; the righting moment therefore grows more slowly as the boat heels. By suitable ballasting or arrangement of weights adequate transverse stability is not very difficult to attain. But longitudinal stability is quite another matter. Any possible assistance from ballasting or the arrangement of permanent weights is insignificant, and the change of trim due to the using of fuel and shifting of weights (torpedoes, men, liquid in partly filled tanks, etc.) is a very serious matter. It is counteracted by the use of horizontal rudders, or shape of the hull, or quickly shifting water-ballast. If the boat has a slight surplus buoyancy the tendency to rise to the surface can be counteracted by vanes or the shape of the head which tends to make the boat descend so long as it is moving. But as the effect of hull shape or permanent vanes changes with the speed, while the buoyancy effort is constant, horizontal rudders are a necessity. From these facts it follows that short, deep, and broad boats are most stable, but such a shape is incompatible with speed.

The difficulties experienced in discharging torpedoes are closely connected with the question of stability. In addition to confined space in which torpedoes are operated, and the difficulty of giving them the correct direction at the moment of firing, it is necessary that the boat should be nearly horizontal when the torpedo is fired, else the latter will take too deep a dive or rise to the surface at the beginning of its run. The shock of firing and the sudden release of weight at the bow as the torpedo leaves it causes great longitudinal disturbance in the boat, and may bring it to the surface, while the change in permanent trim adds to the difficulty of maintaining a constant depth.

The submarine torpedo boat as developed in 1903 was certainly far from a perfect weapon, being of little use except in smooth water, difficult to use at night, and having a very short radius of action. But, under favorable circumstances, it was thought that it might achieve a great success, while the knowledge of the presence of submarines in a port cannot but have a powerful effect upon the nerves of the officers and crews of blockading vessels.



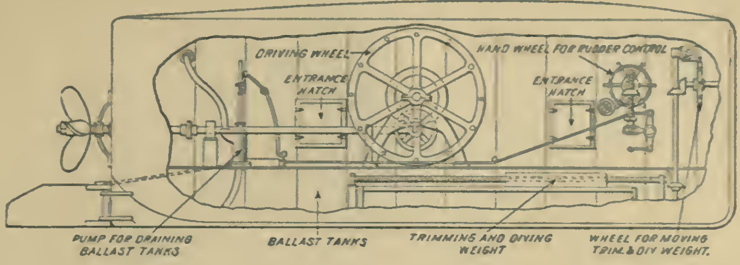
BUSHNELL'S BOAT (1775).



FULTON'S NAUTILUS (1801).

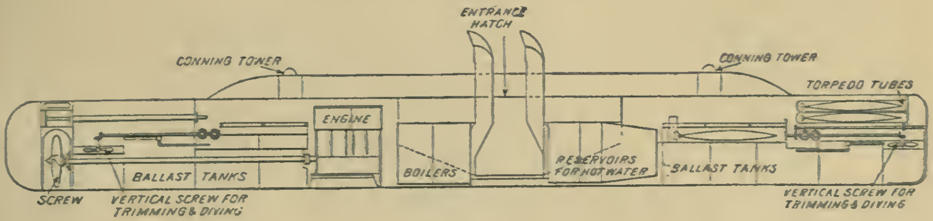
When or by whom was built the first submarine boat will probably never be known. It is said that Alexander the Great was interested in submarine navigation, while subaqueous attack of vessels was studied at least as early as the thirteenth or fourteenth century. M. Delpeuch states that some English ships were destroyed in 1372 by fire carried under water. In the early part of the seventeenth century submarine boats were numerous, and in 1624 Cornelius Van Drebbel exhibited to King James I. on the Thames a submarine boat of his own design. By 1727 no less than 14 types of submarines had been patented in England alone. In 1774 Day began experiments with a submarine boat at Plymouth, England, losing his life in the second submergence trial. In the following year David Bushnell built his first boat, with which Sergeant Lee attacked H. M. S. *Eagle* in New York Harbor. Lee actually got under the ship, and the attack failed only because the screw by which the torpedo was to be attached to the *Eagle's* bottom was not sharp enough. Robert

SUBMARINE TORPEDO BOATS


DRIVING WHEEL
HAND WHEEL FOR RUDDER CONTROL
ENTRANCE HATCH
ENTRANCE HATCH
PUMP FOR DRAINING BALLAST TANKS
BALLAST TANKS
TRIMMING AND DIVING WEIGHT
WHEEL FOR MOVING TRIM. & DIV. WEIGHT.

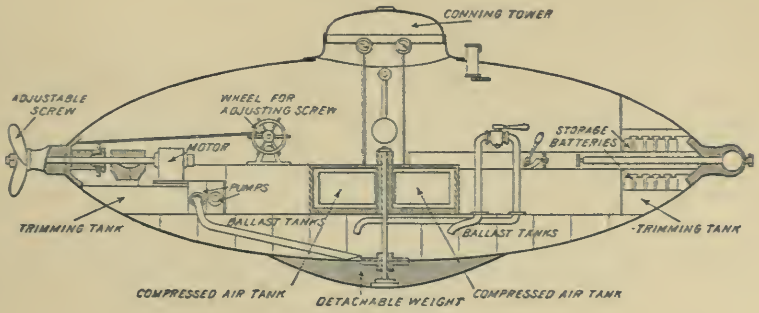
1

"PLONGEUR-MARIN"—GERMAN—1851



2

NORDENFELDT "No. 4"—ENGLISH—1887



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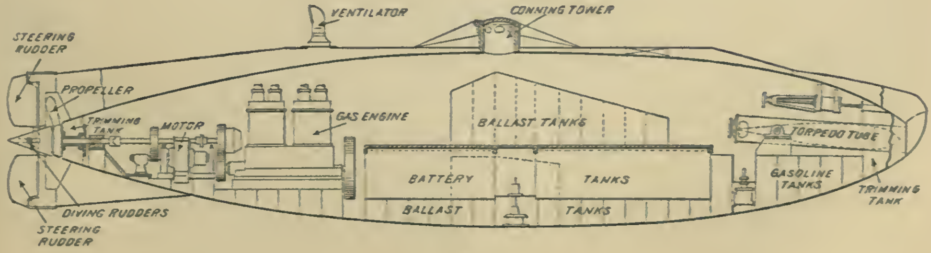
"GOUBET"—FRENCH—1889



4

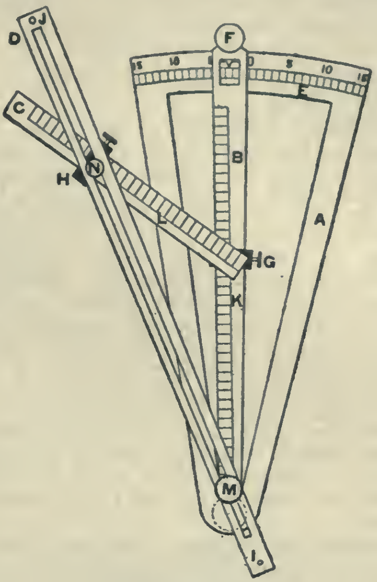
HOLLAND "FULTON"—UNITED STATES—1901

Fulton's experiments in France and America (1795-1812) demonstrated that a vessel could be built which could descend to any given depth and reascend at will. Plunging mechanism was devised about the middle of the eighteenth century, but Fulton developed the vertical and horizontal rudders and provided for the artificial supply of air. A form of periscope existed in 1692 and an improved kind was patented in 1774; in 1854 Davy still further developed it. Phillips's wooden boat on Lake Erie was crushed by the water pressure, and the same fate befell Bauer's iron boat *Plongeur-Marin* (Fig. 1 on Plate) at Kiel in 1850. In 1863 McClintock and Howgate built a semi-submarine hand-propelled boat for the attack on the Federal fleet, but it sank four times, each time drowning the entire crew of eight men. In the same year several larger boats propelled by engines were commenced in Europe, and these at intervals were followed by others designed by Hovgaard, Goubet, Zédé, Nordenfeldt, Tuck, Holland, etc. The French Navy began experimenting with submarine boats about 1885. The *Gymnote* was built in 1888 and the *Gustave Zédé* in 1893. The *Morse* was commenced in 1894, but remained uncompleted until 1899, pending additional experiments with the *Gymnote* and the *Zédé*. In that year the construction of submarines was actively commenced, 10 being launched in 1901. In 1886 Nordenfeldt built two large submarines for Turkey, but little was ever done with them after they passed into Turkish hands. In 1889 Spain built the *Peral*, Portugal following with the *Plongeur* in 1892. Italy built the *Delfino* in 1895. The United States had the submarine boat under consideration for several years. The first boat ordered (about 1895) was never completed, but seven of the Holland type were ordered in 1900 and one was purchased when nearly complete early in that year.

Consult: Sleeman, *Torpedoes and Torpedo Warfare* (2d ed., Portsmouth, England, 1889); Delpeuch, *La navigation sous-marine à travers les siècles* (Paris, 1902); Burgoyne, *Submarine Navigation* (London and New York, 1903); Buchard, *Torpilles et torpilleurs* (Paris, 1889); *Proceedings of the United States Naval Institute*, particularly No. 100, December, 1901 (Annapolis, current).

TORPEDO BOAT DESTROYER. See TORPEDO BOAT.

TORPEDO DIRECTOR. An instrument designed to indicate the proper moment at which to fire a torpedo from a ship or torpedo boat. It is placed on deck, or in a port or air-port giving a clear view of the enemy. The type shown in the sketch is for a bow torpedo tube on a torpedo boat; a broadside director differs chiefly in having a greater arc of train for the arm B. The instrument consists of a metal sector, A, graduated along the limb E into degrees of arc. On this are three movable arms, B, C, and D. B and D are pivoted on A at the centre of the arc E, while C pivots on the sliding block G. B and C are graduated into similar and equal divisions, representing the speed of the torpedo and the enemy respectively. The arm B is first set parallel to the axis of the torpedo tube, and the block G is set at the division of the scale, K, corresponding to the speed of the torpedo. The block H is set at the division of the scale L which corresponds to the estimated speed of the enemy, and the arm C is swung around until parallel to his supposed course. Then the clamp-screws M and N are screwed down. The direction MN (or IJ) is therefore the direction in which the enemy must be in order to be hit by the torpedo moving in the direction MF, if the estimated speeds of enemy and torpedo are correct. The moment that the enemy is on the proper bearing is ascertained by looking over the sights I and J.



TORPEDO DIRECTOR.

TORPEDO NET. A net made of heavy wire rings connected with one another by small steel rings and surrounding a vessel of war below water as a defense against torpedoes. The net is made up in sections about 15 by 20 feet in size, and these sections join to make the total protection, which is divided into three parts called the 'main defense,' 'bow defense,' and 'stern defense.' All except the main defense are frequently omitted, and it only can be carried if the vessel is moving slowly, while no nets are of any use if the ship is moving at fair speed. The type of net most in favor is that devised by Mr. Bullivant, an Englishman in the employ of the Admiralty. The Bullivant net is made of wire rings or grommets (see KNOTTING AND SPLICING) six inches in diameter connected to each other by galvanized steel rings. Each section weighs about 400 pounds and has a heavy piece of chain at the foot to keep it as nearly vertical as possible when the ship is under way or anchored in a current; the sections are joined to each other by stout wire lashings. The upper edge of the net has small rings sliding on a wire rope, called a jackstay, which is shackled to the outer ends of the booms. Each of the booms is of hollow steel tubing, and is about 30 feet long. The inner end is fitted with a ring which passes through another ring at the upper end of a pivot bolt which works in a lug secured to the ship's side. The outer end is fitted with two topping lifts and two guys. The booms are placed about 45 feet apart. When not in use the booms are swung in alongside and with the net landed on a sort of shelf, or if there is no shelf the net is drawn up snugly and the whole lashed to eyebolts on the ship's side. Torpedo nets are not regarded with favor by many naval officers, as they cannot be used except when at anchor, and many torpedoes are now fitted with net cutters which enable them to get through.

TORPEDO SCHOOL. See NAVAL SCHOOLS OF INSTRUCTION.

TORPEDO STATION. A torpedo supply station and headquarters for torpedo boats. The United States naval torpedo station is on Goat Island, Newport Harbor. All torpedoes for the navy are sent there from the makers and are inspected, tested, and put into adjustment for service. In addition, all necessary supplies for working torpedoes are made there, together with torpedo mines, guncotton, primers for heavy guns, and certain other ordnance supplies and fittings. There is also a small factory for the manufacture of smokeless powder, the larger naval powder factory being at Indian Head proving ground. Some of the schools for officers and enlisted men of the navy are also located at the torpedo station—the petty officers' school, torpedo school, electrical school, school for training torpedo boat firemen, and the torpedo school for officers.

TORQUATO TASSO, tôr-kwä′tô täs′sô. A tragedy by Goethe (1790) suggested by a visit to Sorrento and Sicily. It deals with the sorrows of an idealistic poet in a jealous artificial court, and in its emotional element is largely autobiographical.

TORQUAY, tôr-kē′. A fashionable health resort and watering place on the south coast of Devon, England, occupying a cove on the north side of Tor Bay, 23 miles south of Exeter (Map: England, C 6). Marble works and terracotta manufactures are its industrial specialties, and it is an important yachting station. Its harbor has an area of 36 acres. Till the beginning of the nineteenth century Torquay was an assemblage of fishermen's huts. About that time the advantages of its climate and freedom from fogs caused it to be resorted to by consumptive patients; and it soon attained a European celebrity. Saint John's, a fine church of modern Gothic architecture, the town hall, a museum, a theatre, and an opera house are the chief structural features. Torquay was incorporated in 1892. It owns valuable property, municipal waterworks, electric lighting plant, pleasure grounds, baths, a sanatorium, and a refuse destructor, and supports technical schools. Kent's Cavern, discovered in 1824, and the Brixham Cave, discovered in 1858, are rich in fossils, and have supplied the earliest English evidences of prehistoric man. After the defeat of the Spanish Armada, Don Pedro's galley was brought into Tor Bay, and an old thirteenth-century building, where the survivors were housed, is known as the 'Spanish barn.' Torquay was the landing place of William of Orange in 1688. Population, in 1891, 33,825; in 1901, 33,625.

TORQUEMADA, tôr′kȧ-mä′ᴅȧ, JUAN DE, also known by the Latinized form TURRECREMATA (1388-1468). A Spanish theologian and cardinal, born at Valladolid. He entered the Dominican Order in 1403 and completed his studies at the University of Paris in 1424. After presiding over houses of his Order at Valladolid and Toledo, he was made master of the sacred palace by Eugenius IV. in 1431, and employed in various important negotiations. He was made a cardinal-priest in 1439, exchanging his title later for the cardinal-bishopric of Albano and in 1464 for that of Sabina. He devoted the large revenues of various preferments which he held to church building and works of charity, but attained greater renown by his numerous theological writings, many of which dealt with the controversies of the day. He took part in the councils of Constance, Basel, and Florence, and drew up the plan for the union between the Greek and Latin churches at the last named. Consult Lederer, *Der spanische Cardinal Johannes von Torquemada* (Freiburg, 1879).

TORQUEMADA, TOMAS DE (1420-98). A Spanish Inquisitor-General. He was born at Valladolid, of the same family as that to which the famous theologian, better known as Turrecremata, belonged. He entered the Dominican Order, and became prior of the monastery at Segovia, a post which he held for twenty-two years. In 1478 the Inquisition was reëstablished in Spain by Ferdinand and Isabella, and four years later some assistants were given to the first Inquisitors. Torquemada was among these, and so distinguished himself by his zeal that in 1483 he was named by Sixtus IV. Grand Inquisitor for Castile and Aragon. He erected four tribunals, at Seville, Cordova, Jaén, and Villa Real, the last of which was afterwards transferred to Toledo. The Grand Inquisitor was assisted by a council of theologians and jurists named by the King, but deriving their jurisdiction from the Inquisitor-General, in virtue of the latter's Papal authority. In political and legal questions he was obliged to act only in concert with them, but merely asked their advice in theological matters. Torquemada drew up the code of procedure, which was confirmed by the Pope, though the Holy See steadily impressed upon the Inquisitors the necessity of exercising charity toward those who were accused of heresy, and frequently mitigated the rigor of their sentences, or, if the matter was dealt with independently by the Spanish Government, complained strongly. Torquemada took a prominent part in the expulsion of the Jews from Spain. Toward the end of his life he retired into the Dominican monastery of Avila, where he died. Consult de Molenes, *Documents inédits: Torquemada et l'Inquisition* (Paris, 1897). As a typical representative of the Spanish Inquisition, Torquemada has been frequently condemned by Protestant historians for wanton cruelty. For a fuller discussion of the charges made by them, see INQUISITION.

TORQUES (Lat. *torques, torquis,* twisted neck-ring, necklace, collar, from *torquere,* to rack, twist, torment). A species of gold ornament, meant to be worn round the neck, which was much in use in ancient times, both among Asiatic and North European nations. It consisted of a spirally twisted bar of gold, bent round nearly into a circle, with the ends free, and terminating in hooks, or sometimes in serpents. Numerous examples of the torques have been dug up in Great Britain and Ireland, as well as in France, and are to be found in archæological collections.

TORRE DEL GRECO, tŏr′râ dĕl grā′kô. A seaport and bathing resort in the Province of Naples, Italy, situated at the base of Vesuvius, 7 miles southeast of Naples (Map: Italy, J 7). The town has been largely rebuilt since the great eruption of Vesuvius in 1861. It manufactures wine, coral-ware, lava-ware, and rope. There are shipbuilding yards. The inhabitants are largely engaged in the coral, tunny, oyster, and sardine fisheries. Torre del Greco suffered severely from lava streams in 1631, 1737, and 1794. Population (commune), in 1881, 27,562; in 1901, 33,299.

TORRE DELL' ANNUNZIATA, -än-nōōn′-tsē-ä′tȧ. A seaport in the Province of Naples, Italy, situated at the base of Vesuvius, 12 miles southeast of Naples (Map: Italy, J 7). It makes a specialty of macaroni. There are fine thermal baths. It has a Government arms factory, extensive fisheries, and a trade in wine and lava products. Population (commune), in 1881, 22,013; in 1901, 28,143.

TORREDONJIMENO, -dŏn-ʜê-mā′nô. A town in the Province of Jaén, Spain, 8 miles west of the city of Jaén, on the right bank of the Salado de Porcuña. It is a well-constructed town with regular plazas and wide streets. There are gypsum quarries in the vicinity. Spirits and soap are the chief manufactures. Population, in 1900, 10,044.

TORRE MAGGIORE, mȧd-jō′râ. A town in the Province of Foggia, Italy, about 20 miles northwest of Foggia (Map: Italy, K 6). It has a famous Benedictine abbey and large oil refineries. Population (commune), in 1901, 11,054.

TOR′RENS, Lake. A large lake depression in South Australia, situated about 30 miles north of the northern extremity of Spencer Gulf (Map: Australia, F 5). It is about 130 miles long with an average breadth of 20 miles, but is very shallow. In the wet season it receives a number of streams from the Flinders Range, but for a large part of the year it is only a salt marsh.

TORRENS, Henry Whitelock (1806-52). An English writer, born at Canterbury, and educated at Charter House, and Christ Church, Oxford. He held various positions in the civil service and in 1837 became one of Lord Auckland's secretaries, but his reputation rests upon his translation of the *Arabian Nights*. The first volume appeared in 1838. The work was never completed, but the existing fragment is considered superior to any later version. His collected works were published by J. Hume in 1854 (Calcutta and London).

TORRENS, Robert (1780-1864). An Irish economist. He is best known as an economist, and as one of the first to state the law of diminishing returns, the modern theories of wealth, and theory of international trade, and is credited with having proposed the separation of the Bank of England into banking and issue departments. His publications include *An Essay on Money and Paper Currency* (1812), *An Essay on the Production of Wealth* (1821), *Letters on Commercial Policy* (1833), *On Wages and Combinations* (1834), and *Tracts on Finance and Trade* (1852).

TORRENS, Sir Robert Richard (1814-84). An English colonial statesman, born at Cork, and educated at Trinity College, Dublin. He went to South Australia in 1840, and in 1857 became Colonial Treasurer and Premier. In the following year were passed the land laws which bear his name, whereby public registration was substituted for conveyancing. (See Torrens System.) In 1863 Torrens retired from Australian public life, returned to England, and in 1868 entered Parliament, where he sat for Cambridge until 1874, but failed to introduce his reform in the land laws. His publications include *The South Australian System of Conveyancing* (1859), and *Transfer of Land by "Registration of Title" as now in operation in Australia under the "Torrens System"* (1863).

TORRENS, William Torrens McCullagh (1813-94). An Irish politician and author, who in middle life (1863) assumed his mother's name of Torrens. He was born at Greenfield, near Dublin, was educated at Trinity College, Dublin, and was admitted to the Irish bar in 1836 and the English in 1855. In 1842 he was one of the founders of the Mechanics Institute of Dublin. Elected to Parliament in 1847, he sat for Dundalk until 1852, was returned in 1857 for Yarmouth, but was unseated on petition, and then sat for Finsbury from 1865 to 1884. He was known for his interest in social questions. He introduced the Artisans' Dwellings Act, and that by which the School Board of London was established. His publications include *The Industrial History of Free Nations* (2 vols., 1846), *The Lancashire Lesson* (1864), *Our Empire in Asia: How We Came by It* (1872), and a *History of Cabinets* (2 vols., 1894).

TORRENS SYSTEM. A system of registration of titles to land introduced into South Australia by Sir Robert Richard Torrens, in 1857, in the Real Property Act drafted by him. The chief novelty of the system is the provision for the guaranty of properly registered titles by the Government. The Torrens system was adopted in most of the Australian colonies, in New Zealand, and British Columbia, and a somewhat similar system was introduced into California and a few other States. See Title, Registration of. Consult: Yeakle, *Torrens System;* Dumas, *Registration of Title Under Torrens System* (1900).

TORRES NOVAS, tŏr′râs nō′väs. A town of the District of Santarem, Portugal, 56 miles northeast of Lisbon. It is in an extensive olive-producing region, and has important oil mills and cotton and linen manufactories. Population, in 1900, 10,738.

TORRES (tŏr′rĕs) **STRAIT.** The channel which separates New Guinea from the Australian continent (Map: Australia, G 1). It is about 100 miles in width. Its navigation, though practicable, is rendered difficult by the innumerable shoals, reefs, and islands. It was discovered by Torres in 1606.

TORRES VEDRAS, vā′drȧs. A town in the District of Lisbon, Estremadura, Portugal, on the left bank of the Sizandro, 24 miles northwest of Lisbon on the Lisbon-Figueira railroad. Its population in 1900 was 6891. It carries on some trade in wine. The Lines of Torres Vedras consist of three lines of fortifications, begun by Wellington in 1809 and behind which he retired in October, 1810, before the invading army of Massén. He held the lines against all the attempts on the part of the French, and in August, 1811, forced Masséna to retreat. The first of these lines, extending from Alhandra, on the Tagus, to the mouth of the Sizandro, on the seacoast, was 29 miles long; the second lay from 6 to 10 miles behind the first and had a length of 24 miles; the third, situated to the southwest of Lisbon, at the very mouth of the Tagus, was very short, being intended to cover a forced embarkation, if that became necessary. The entire ground thus fortified was equal to 500 square miles.

TOR'REY, Bradford (1843—). An American ornithologist and author, born at Weymouth, Norfolk County, Mass. He was educated in the public schools, taught for two years, then entered business in Boston, and in 1886 became a member of the staff of the *Youth's Companion* of that city. Among his books, marked by accurate and discriminating observation and a happy style, are *Birds in the Bush* (1885), *A Rambler's Lease* (1889), *Spring Notes from Tennessee* (1896), and *A World of Green Hills* (1898).

TORREY, Charles Turner (1813-46). An American reformer, born at Scituate, Mass. He graduated at Yale in 1830, studied theology, and became pastor of a Congregational church in Princeton, N. J. Later he had charge of a church at Salem, Mass., but finally gave up his pastoral duties to devote himself entirely to the abolitionist movement. He removed to Maryland, and in 1843, for writing an account of a slaveholders' convention held at Baltimore, he was arrested and thrown into prison. He became an efficient 'official' of the underground railroad, and in 1844 was convicted of having attempted to help slaves to escape and was sentenced to a long term in the State penitentiary. Two years later he died in prison of consumption. His body was taken to Boston, where it was given a public funeral. Everywhere he was hailed as a martyr in the anti-slavery cause, and the words "Torrey's blood crieth out" became a watchword for the abolitionists. He wrote *A Memoir of William R. Saxton* (1838), and *Home, or the Pilgrims' Faith Revived* (1846), a volume of sketches written in prison.

TORREY, John (1796-1873). An American botanist. He was born in New York State, graduated at the New York College of Physicians and Surgeons, 1818; was professor at West Point, 1824-27; in the College of Physicians and Surgeons, 1827-55; at Princeton, 1830-54; chief assayer in the United States Assay Office, New York, 1853-73. His best known publications are: *Catalogue of Plants Growing Spontaneously within Thirty Miles of New York* (1819); *Flora of the Northern and Middle States* (1824); *Flora of the State of New York.* With Prof. Asa Gray he began the publication of *Flora of North America* (1838-43). His valuable herbarium and botanical library he presented in 1860 to Columbia College, in which institution he held a professorship of chemistry at the time of his death.

TORREY, Joseph William (1828-84). An American newspaper man and merchant, born at Bath, Me. He was for a time connected with the Boston *Times* and the *Carpet Bag.* In 1853 he went to Australia, where he entered a commercial house, and in 1859 to China, where he became editor of the *Hong Kong Times* and the *China Mail.* He engaged in commerce, organized the American Trading Company of Borneo, and in 1865 was recognized by the Sultan as Rajah of the Marudu and Ambong districts. He retained the position until 1879, when he became secretary of the American legation at Bangkok. He returned to the United States in 1883.

TORREYA (Neo-Lat., named in honor of John *Torrey*). A small genus of the order Coniferæ, somewhat resembling the yews. They are found in North America and Eastern Asia. *Torreya taxifolia*, a Florida species, reaches the height of 50 feet and has a close-grained and strongly scented wood. The name Tumion has been adopted for this genus by some botanists on account of the name Torreya having been used for another plant.

TORREY BOTANICAL CLUB, The. A scientific society in New York City, incorporated in 1871, and now one of the six associated societies forming the Scientific Alliance (q.v.). It has a valuable herbarium of several thousand specimens, illustrating the flora within one hundred miles of New York, exhibited at the Museum of the New York Botanical Garden, which is the home of the club. The membership in 1903 was 342, of whom 196 were active members. The club publishes the *Bulletin, Torreya,* and *Memoirs.*

TORRIANI, Maria. See Torelli-Torriani, Maria.

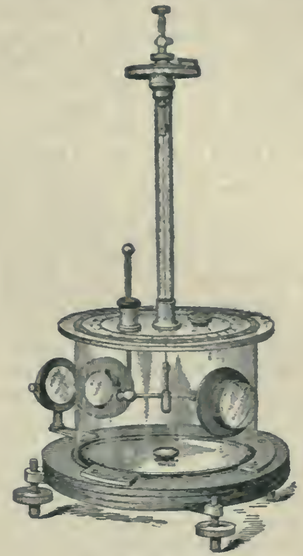
TORRICELLI, tôr'rê-chĕl'lê, Evangelista (1608-47). An Italian mathematician and physicist, born at Piancaldoli, or, according to some authorities, at Modigliana, in the Romagna. From about 1628 he studied mathematics in Rome, under Benedetto Castelli (1577-1644), the favorite disciple of Galileo. Galileo's theories on force and motion especially engaged his attention, and led to his publishing a *Trattato del moto* (1641), a meritorious work, but containing few new discoveries of consequence. He was then invited by Galileo to visit him, and aided the old philosopher, now blind, in the preparation of his *Discorsi.* On Galileo's death he was appointed his successor in the chair of philosophy and mathematics at Florence. Torricelli was the first to use a column of mercury in a tube closed at one end to balance the pressure of the atmosphere, and found that a much shorter column could be used than in the case of water, as in Galileo's experiment. This feat, actually performed by his assistant, Viviani, furnished him with the idea of the barometer (q.v.) in which the space above the mercury in the closed tube has since been known as a Torricellian vacuum. Torricelli also effected the quadrature of the cycloid, but in this he was anticipated by Roberval. He was also the first to construct a simple microscope and improved the telescope.

TORRIGIANO, tôr'rê-jä'nô, Pietro (also Torrigiani and Torregiani (c.1472-1522). An Italian sculptor, born in Florence. He was a fellow student of Michelangelo in the Giardino Mediceo, and was jealous of him because of his superior talent and his intimacy with their patron, Lorenzo de' Medici. The result was a quarrel in which Michelangelo received permanent disfigurement. Torrigiano fled to Rome, where he modeled the stuccoes in the Borgia Tower for Pope Alexander VI. He was taken by Florentine merchants to London, where he worked for King Henry VIII., executing the bronzes for the tomb of Henry VII. in Westminster Abbey. He also made a bronze monument for the Duchess of Richmond, and works in marble and wood. He afterwards did some work in the Cathedral of Seville, and executed figures of Saint Jerome and Saint Leo for the Girolamiti of that city. Imprisoned on a charge of heresy by the Duke of Arcos, for destroying a statue of the Virgin for which he considered himself underpaid, Torrigiano starved to death in confinement.

TOR′RINGTON. A borough in Litchfield County, Conn., 26 miles west of Hartford, on the Naugatuck River, and on the New York, New Haven and Hartford Railroad (Map: Connecticut, C 2). It has a public library with more than 5200 volumes, and a fine municipal building. Torrington is extensively interested in manufacturing, its various industries in the census year 1900 having had an invested capital of $6,544,511, and an output valued at $10,017,121. The leading products are brass articles, hardware, needles, bicycles, novelties, woolen cloth, and machine tools. The government is vested in a warden and burgesses, who hold office for one year. Population, in 1890, 4283; in 1900, 8360. Torrington was settled in 1737, and was incorporated in 1740 as a town, and in 1887 as a borough. Consult Orcutt, *History of Torrington* (Albany, 1878).

TORRINGTON, Frederick Herbert (1837—). An English musician, born at Dudley, Worcestershire. In 1853 he became organist at Saint Anne's, Bewdley, and in 1856 organist at Great Saint James's Church in Montreal, Canada. He was organist and musical director at King's Chapel, Boston, until 1873; afterwards he became organist and choirmaster at the Metropolitan Church at Toronto, Canada, and conducted the Philharmonic Society there. He founded in 1886 the first Toronto musical festival, and, in 1888, instituted the Toronto College of Music. Among his works are organ-music, choruses, hymn-tunes, and services.

TORSION BALANCE. An instrument originally designed by the Rev. John Mitchell and after his death improved by Henry Cavendish, who used it in performing the well-known Cavendish experiment of determining the mass of the earth. The apparatus was reinvented by Coulomb, and is often known by his name, having been used by him to study electrical and magnetic attractions. It consists of a horizontal rod suspended by a fine wire or in the most recent experiments a fibre of quartz, and carrying at either end two small spheres having a mass equivalent to one gram. Adjacent to but on opposite sides of these small masses are two large spheres of lead which attract the two smaller masses and cause the horizontal rod to deflect, the movement being observed by a mirror and telescope and scale as in the case of the reflecting galvanometer. The force of attraction between two different masses can thus be ascertained, and as the attraction of the earth for a unit mass as well as its radius is known, we can thus determine the mass of the earth. In electricity, charged conductors were substituted for the masses, and to study the strength and action of magnetic poles a long thin magnet was suspended and a similar magnet placed in a vertical position near one of its poles. The amount of force exerted was ascertained by finding the angle through which it was necessary to turn the head carrying the wire in order to keep the suspended bar at its original position. The Cavendish experiment enables the physicist to compute the mass of the earth and to determine also its mean density, which according to Boys is 5.5268.


TORSION BALANCE.

TORSK (Swed., Dan. *torsk*, dialectic Swed. *trosk*, Icel. *orskr*, L.G., Ger. *Dorsch*, torsk, codfish, haddock; connected with Russ. *treska*, codfish, Skt. *tars*, to thirst, and ultimately with Eng. *thirst*), or Cusk. A small cod (*Brosmius brosme*) of the European side of the North Atlantic, taken in deep water and regarded as valuable. It is usually about 20 inches long, and is distinguished by its long dorsal fin and yellow color.

TORSO (It., stump, trunk.) An ancient statue of which only the body remains. Of such imperfect relics of classic art, the most famous is the *Torso of the Belvedere* in the Vatican, the work of Apollonios, son of Nestor, an Athenian. It is a masterpiece of the later Greek sculpture (first century B.C.), showing a thorough mastery of the treatment of the nude in all its details, though without the ideality of the best period. It represents a man of gigantic build, seated on a rough rock over which a skin is thrown. It is usually called Hercules, though Sauer prefers to consider it Polyphemus. No successful or convincing restoration has yet been made. The common story that it was discovered in the Campo del Fiore at the beginning of the sixteenth century and placed, by order of Pope Julius II., in the Vatican, is certainly wrong. It is only known that it was formerly in the possession of the Colonna family, and was brought to the Vatican by Pope Clement VII. (1523-34). Consult: Loewy, *Inschriften der griechischen Bildhauer*, No. 343 (Leipzig, 1885); B. Sauer, *Torso von Belvedere* (Giessen, 1894).

TOR'STENSON, Lennart, Count of Ortala (1603-51). A Swedish general, born at Torstena, West Gothland, August 17, 1603. He became a royal page in 1618 and attended Gustavus Adolphus in most of his earlier campaigns. When Gustavus entered Germany in 1630, Torstenson was captain of the body-guard; and the brilliant services he rendered at Breitenfeld, the Lech, and in other battles, were rewarded with rapid promotion. Taken prisoner at the storming of Wallenstein's camp near Nuremberg (September 3, 1632), he was released in February of the following year and served till 1635 in Livonia, returning in that year to duty under Bernhard of Weimar and Banér, the successors of Gustavus. In 1641, on the death of Banér, he was appointed to the command of the Swedish forces in Germany. His military career was marked by brilliancy of conception, fertility of resource, resolute daring, and extraordinary rapidity of execution. He invaded Silesia in May, 1642, routed the Imperialists at Glogau and Schweidnitz, reduced most of Moravia, and being pressed back into Saxony by the Archduke Leopold William and Piccolomini, turned upon his pursuers (November 2, 1642), and signally defeated them on the historic field of Breitenfeld. He then laid Moravia and Austria under contribution. The Emperor, Ferdinand III., despairing of protecting his territories from Torstenson, negotiated with Christian IV. of Denmark to make a diversion by invading Sweden; but Torstenson, with characteristic promptitude, left Moravia in September, 1643, traversed Saxony, burst into Holstein, and in less than six weeks subjugated the Danish mainland. The Imperialists under Gallas followed him to aid their allies, but arrived too late, and were routed and driven into Saxony, and again totally defeated at Jüterbog, in attempting to bar Torstenson's return into Bohemia (1644). The Swedish general won a great victory over Hatzfeld at Jankau (March 6, 1645), and carried his arms to the Danube. The Emperor was compelled to flee from Vienna; the Saxons again joined the Swedes; and the Danes, routed at sea as well as on land, sought peace. In 1646 disease compelled Torstenson to resign the command and retire to Sweden, where he was created a count and appointed to various high offices. He died at Stockholm, April 7, 1651. Consult De Peyster, *Torstenson* (New York, 1886). See Thirty Years' War.

TORT (Fr., wrong). A civil wrong other than a breach of contract, which entitles the injured person to a common-law action for damages. It must be admitted that this is rather a general description than an accurate definition of the important legal term before us. And yet, the present state of English law does not warrant a more specific statement. A breach of contract, without excuse, is undoubtedly wrongful, and entitles the party harmed by such breach to a common-law action for damages. But this wrong is always treated under the head of contract (q.v.), and is never spoken of as a tort. The right to damages for breach of contract flows from the agreement of the parties, while that for a tort is conferred by the law, "independent of any previous consent of the wrongdoer to bear the loss occasioned by his act." Again, a trustee who uses trust property for his own benefit without authority wrongs his *cestui que trust*. As the latter's redress, however, is not to be obtained in a common-law action, but by a proceeding in equity, the term 'tort' is not applied to it. The same is true of an inexcusable refusal to pay salvage as redress, for it is to be sought in admiralty and not at common law. These limitations upon the term, it will be observed, are the results of what may be called accidents of legal procedure.

A tort is, as said above, a 'civil' wrong. This element distinguishes it from a crime. It is true that the same act or omission may subject the wrongdoer to a tort action and also to a criminal prosecution. One person deliberately, and without excuse, attacks and wounds another. This assault and battery is a tort, as it gives to the injured person a common-law action in damages, for the invasion of his right of personal security. It is also a crime, as it violates a right of the State by a breach of the peace and by harming one of its citizens.

This branch of our law was one of the latest to receive systematic treatment, either by judges or by text writers. Frederick Pollock declared, in 1886, that the really scientific treatment of this topic by judges begins with the decisions of the last fifty years. In 1882 the New York Court of Appeals asserted that an accurate and perfect definition of a tort was nowhere to be found; nor did it essay to formulate one. The earliest treatise in which an attempt was made to systematize the law of torts was published in 1859.

Various classifications of torts have been suggested. One of them is as follows: "First, lawful acts done by wrongful means or of malice. Second, unlawful acts. Third, events caused by negligence." The first includes deceit, slander of title, malicious prosecution, and malicious interference with contracts between others. The second class includes assault and battery, conversion, defamation, false imprisonment, nuisance, trespass, and some other forms of tort. The third embraces the various phases of negligence. (See these various topics in this Encyclopædia.) A similar classification was suggested by a learned judge in a recent decision of the House of Lords, and has received some judicial approval in the United States. It follows the ordinary classification of personal rights. The first class of torts, according to his suggestion, includes all wrongful invasions of the right of reputation. The second class includes such invasions of the rights of bodily safety and freedom. The third class includes such invasions of the rights of property.

The domain of tort in our law is more extensive than that covered by actions *ex delicto* in Roman law. Speaking broadly, a wrongful intent was necessary to such actions. Mere negligence might subject one to an action *quasi ex contractu* if by agreement he had assumed a duty of care; but otherwise it subjected him to no liability. Certain wrongs were styled *quasi ex delicto*, but as a rule the actionable character of these was of prætorian origin. In

Louisiana, whose jurisprudence rests upon a basis of Roman law, civil wrongs are divided into 'offenses,' or illegal acts which are done wickedly and with intent to injure, and 'quasi-offenses,' or those which cause injury to another but proceed from error, neglect, or imprudence. The term 'quasi-tort' has made its appearance in judicial decisions and recent legal treatises, both in England and the United States. It is not used as synonymous with the 'quasi offense' of Louisiana, nor with the 'quasi-delict' of Roman and Scotch law. It designates an act or omission, which subjects the wrongdoer to a contract or to a tort action, at the injured party's option; such, for example, as a merely negligent injury by a common carrier to a passenger. Consult: Hilliard, *The Law of Torts* (Boston, 1859); Addison, *A Treatise on the Law of Torts* (London, 1860; Albany, 1876); Bishop, *Commentaries on the Non-Contract Law* (Chicago, 1889); Cooley, *The Law of Torts* (Chicago, 1895); Jaggard, *The Law of Torts* (Saint Paul, 1895); Clerk and Lindsell, *The Law of Torts* (2d ed., London, 1896); Pollock, *The Law of Torts* (London and New York, 1901); Sohm, *The Institutes of the Roman Law* (Oxford, 1892).

TORTOISE, tôr′tus (OF. *tortue*, *tortugue*, Fr. *tortue*, tortoise, from Lat. *tortus*, twisted, so called on account of its crooked feet; probably influenced its termination by Eng. *Porpoise*). A turtle of terrestrial habits. The term is rather indefinite, but usually distinguishes land chelonians from marine species, although tortoise-shell is exclusively a marine product, and certain fresh-water turtles, as the terrapins, are commonly spoken of as marsh-tortoises. Its most exact application is probably to the family Testudinidæ, in which the shell is always covered with well-developed horny shields. It includes the terrapins or aquatic 'mud turtles' of the genera Emys, Chrysemys, and similar groups, in which the feet are adapted for both walking and swimming, and the carapace is often ornamented by gay colors or sculpturings. Many are almost wholly terrestrial, as is the case with the common box-tortoise (see Turtle) of the United States. Near allies are the famous Greek tortoise of the Mediterranean region and many other species of the typical genus Testudo; also the Florida 'gopher' (q.v.).

The most important and distinctive members of the group are the gigantic land-tortoises of various oceanic islands, now extinct or nearly so. (See Extinct Animals.) All these belong to the genus Testudo and differ little except in size from the other members of the family. Some of them are not larger than other large turtles, but those most noted greatly exceed any other living forms, although surpassed by the *Testudo atlas* of the early Pliocene in India, whose shell was six feet or more in length. Others, with shells about four feet in length, were its contemporaries in Europe and in North America. Their representatives survived until a recent date or still live in the Galápagos Islands, Madagascar, and the Mascarene Islands, but nowhere upon any continent.

Specimens of small species have been known to live more than 100 years, and one, at least, more than 150 years. The Madagascar species (*Testudo Grandidieri*) became extinct probably before that island was discovered by white men, but at least two species of the Camoros have remained until within historic times. One (the elephant tortoise, *Testudo gigantea*, see Land Tortoise) is now extinct in its original home, the North Island of Aldabara, but preserved in the Seychelles, and a specimen living in England in 1897 then measured 52¼ × 50 inches over the curve of its shell, and weighed 358 pounds; another in Saint Helena was more than a century old in 1900. Daudin's tortoise, of South Aldabara, also survives in small numbers, and several were taken to Europe in 1895, one of which at least 100 years old had a shell 55 inches long. Still larger is a representative alive in Mauritius, whose recorded history goes back to 1766, when it had already reached large size; it is of a species (*Sumeirei*) native to the Seychelles, to which also belonged the tortoise which lived at Colombo from 1797 to 1898. Several other species, probably or surely extinct, inhabited Rodriguez and other islands of the Indian Ocean, where they were found in abundance by the early voyagers and planters, but were slaughtered for food or as curiosities.

The Galápagos Islands had several species of similar gigantic tortoises, one to each island of the archipelago, which differed from the Eastern ones mainly in having longer necks and smaller heads. Some were long ago exterminated by man or by the pigs which Ecuadorans turned loose upon the islands a century ago; others still survive in small numbers, although in 1893 and again in 1898 large numbers were taken away and distributed to zoölogical gardens in various parts of the world, New York and Washington getting several old and young specimens. The largest collection of all living species is that at Tring Park, England, where the biggest known Galápagos tortoise (*Testudo elephantopus*) is one measuring 56 × 49 inches over the curve of its carapace, which was taken from Duncan Island in 1813 to Rotuma, thence to Sydney in 1880, and finally to England.

Consult: Günther, *Gigantic Land-Tortoises* (London, 1877); Günther, *Proceedings Linnean Society* (Presidential address, 1898—"a fascinating review of the whole complicated subject"); Gadow, *Amphibia and Reptiles* (London, 1901); Darwin, *A Naturalist's Voyage* (London, 1860); *Report United States National Museum* (Washington, 1889). Compare Turtle; and see illustration under Land Tortoise.

TORTOISE-BEETLE, or Shield-Beetle. A leaf-beetle of the subfamily Cassidinæ. The adults are rounded convex beetles with a curious marginal expansion of the upper surface, and with the power of withdrawing the head into the thorax, which gives them a resemblance to a tortoise. Their larvæ are flattened, fringed with spines, and the anal end of the body is provided with a forked appendage which is bent forward over the back; to this are attached the cast-off skins of the larva and its excrement as a protective covering. A remarkable group of tortoise-beetles, belonging to the genus Porphyraspis, cover themselves in the larval state with a dense coat of fibres of the palm tree, upon which they live, each of the fibres being many times the length of the insect's body and elaborately curved so as to form a round nest under which the larva lives. Many species have a brilliant golden green or iridescent metallic coloring which disappears after death, but may be restored by moistening the dead insect. Several very beautiful species occur upon the morning-glory and upon sweet potato (see Sweet Potato Insects), a large species (*Physonata unipunctata*) feeds upon the wild sunflower, and a very common brick-red species (*Chelymorpha argus*) feeds upon the milkweed.

TORTOISE-SHELL. The semi-transparent and beautifully mottled material of the scales covering the carapace of the hawksbill (q.v.), a marine turtle found in all tropical seas. In this species the thirteen shield-plates do not join at the edges, but overlap posteriorly; the larger central ones are broadly triangular in outline, keeled, and six or seven inches broad, and those of a large turtle may weigh eight pounds. They are rarely thick enough to serve the ornamental purposes to which tortoise-shell is usually applied, but when heated in oil or boiled in water may be welded together under pressure, or molded into a form which will be retained when cooled. "In genuine articles of Oriental manufacture these welds can generally be detected, or their compound nature is indicated by the beautiful pattern, which is too regular in the imitations now common." Even the shavings and fragments are welded into serviceable pieces. The turtles are taken usually when they come ashore to lay their eggs; and the plates are (or were) sometimes removed by roasting the living animal until they were loosened and could be torn off; this was done under the belief that when the mutilated creature was returned to the sea the plates would regrow, but there is no evidence that this occurs, and the turtle probably dies. This cruel process, moreover, injures the tortoise-shell. The best and proper way is to kill the turtle and then detach the plates by immersion in boiling water. In its nature and chemical composition the material closely resembles horn (q.v.). The use of tortoise-shell has long been known. Julius Cæsar found great quantities of it in the storehouses of Alexandria. The Romans veneered furniture with it. In modern times, in addition to comb-making, tortoise-shell is made into card-cases, trays, handkerchief-boxes, and various other articles of ornament and the toilet. It is also used still to inlay expensive furniture, the Chinese and Japanese producing the most complicated and beautiful examples of this sort of art.

TORTOISE-SHELL BUTTERFLY. Any one of the butterflies of the Fabrician genus Vanessa. They are usually of medium size, and have the wings on the upper side of some shade of black or brown marked with red, yellow, or orange. The commonest species in the Eastern United States are the following: *Vanessa antiopa*, sometimes called the mourning-cloak (q.v.), and in England known as the Camberwell beauty. *Vanessa Milberti* is common in the Northern United States and Canada. Its caterpillars feed upon the nettle plants of the genus Urtica. *Vanessa Californica* is confined to California, and in the larval stage feeds upon Ceanothus. *Vanessa j-album,* the 'common tortoise,' is a northern species whose larvæ feed upon willows.

TORTO′LA. One of the Virgin Islands (q.v.).

TORTONA, tôr-tō′nȧ. A town in the Province of Alessandria, Italy, on the Scrivia, 12 miles east of Alessandria (Map: Italy, C 3). It has a ruined castle overlooking the town. The town manufactures silk, markets grain and wine, and quarries stone. Tortona was destroyed by Frederick Barbarossa in the twelfth century for its allegiance to the Guelphic cause. Population (commune), in 1901, 17,452.

TORTOSA, tôr-tō′sȧ. A fortified town of Spain, Province of Tarragona, 42 miles from the city of Tarragona, picturesquely situated on a sloping eminence overlooking the Ebro, from the mouth of which it is distant about 22 miles, and which is navigable to this town for vessels of light draught (Map: Spain, F 2). The town has a cathedral with fine carved work and marbles. There are manufactures of rope, paper, leather, soap, and pottery, of palm-leaf and feather-grass, but the fisheries give employment to most of the people. In the vicinity are ruins of a Roman city. Tortosa is subject to frequent disastrous floods, which have necessitated an almost entire rebuilding of the city. Population, in 1900, 24,306.

TORTRICIDÆ. See Leaf-Roller.

TORTUGA, tôr-tōō′gȧ, or **TORTUE,** tôr-tụ′. An uninhabited island off the northern coast of Haiti, West Indies (Map: Antilles, L 4). Area, about 80 square miles. Its surface is broken. It was formerly occupied by buccaneers, and produced sugar, tobacco, etc.

TORTUGAS, tôr-tōō′gaz. A group of islands off the coast of Florida. See Dry Tortugas.

TORTURE (Lat. *tortura,* a twisting, torture, from *torquere,* to rack, twist, torment). The infliction of severe bodily pain either as punishment or for purpose of revenge or for the purpose of compelling the person tortured to give evidence or make confessions in judicial proceedings. Among primitive and savage peoples torture has been used as a means of ordeal (q.v.), and as a means of punishing captured enemies. During the Middle Ages the Church made use of torture as a means of compelling religious conformity and for the purpose of extorting evidence in heresy trials. Throughout Southern and Western Europe the most extreme cruelties were practiced for this purpose (see Inquisition), and it was not until 1816 that torture was finally prohibited by Papal bull. Examination by torture, otherwise called 'the question,' has been largely used in many countries as a judicial instrument for extracting evidence from unwilling witnesses, or confessions from accused persons. In ancient Athens slaves were always examined by torture, and their evidence seems on this account to have been deemed more valuable than that of freemen. No free Athenian could be examined by torture, but torture seems occasionally to have been used in executing criminals. Under the Roman Republic only slaves could be legally tortured, and, as a general rule, they could not be tortured to establish their master's guilt. Under the Empire, however, torture, besides being much used in examining slaves, might by order of the Emperor be inflicted even on freemen, to extract evidence of the crime of *læsa majestas,* a prerogative frequently exercised by the Roman emperors. Cicero and other enlightened Romans condemned its use. Until the thirteenth century torture seems to have been unknown to the canon law; about that period the Roman treason law began to be adapted to heresy as *crimen læsæ majestatis Divinæ.* A decree of Pope Innocent IV. in 1282, calling on civil magistrates to put persons accused of heresy to the torture, to elicit confessions against themselves and others, was probably the earliest instance of ecclesiastical sanction being extended to this mode of examination. Gradually the ecclesiastical courts developed from the Roman law and applied a system of torture which reached its culmination in the atrocities of the Inquisition. The influence of the Church during the Middle Ages undoubtedly contributed to the adoption of torture by the civil tribunals. It was early adopted by the Italian municipalities, but its introduction into Western Europe as an instrument of judicial inquisition as distinguished from the ordeal or compurgation was slow. It first appeared in France in the latter part of the thirteenth century and in Germany in the fifteenth century, and ultimately became a part of the legal system of every European nation except Sweden and England. The use of torture seems to have been repugnant to the genius of the law of England, and it never became a part of the common law, although its use by exercise of the royal prerogative was lawful both in State trials and in the case of ordinary crimes. The first instance we have of its use is in 1310, in aid of the ecclesiastical law, during the struggle between Pope Clement V. and the Templars. Edward II., when applied to to sanction the infliction of torture by the Inquisitors in the case of certain Templars accused of heresy and apostasy, at first refused; but on a remonstrance by Clement, he referred the matter to the council; and on the recommendation of the council, the Inquisitors were authorized to put the accused to the torture, but without mutilation or serious injury to the person, or effusion of the blood. During the Tudor period the council frequently assumed the power of directing torture-warrants to the lieutenant of the Tower, and other officers both against State prisoners and those accused of other serious crimes; and similar warrants were at times issued under the sign manual. Under James I. and Charles I. torture was less resorted to, and only in State trials. In 1628, in the case of Felton, the assassin of the Duke of Buckingham, the judges declared the examination of the accused by torture, for the purpose of discovering his accomplices, to be illegal. The last recorded instance of the use of torture in England was in the reign of Charles I. (1640) to compel a confession of treason. The use of torture was never legal in the English colonies, and the few instances of torture in the American colonies were properly forms of execution, or the infliction of *peine forte et dure* as a means of compelling the defendant to plead to an indictment.

Even during the period when the use of torture was most prevalent its cruelty was recognized and its employment deplored as an evil necessary to the due administration of justice. In all ages there have been leading writers and thinkers who denounced the use of torture, not only because of its cruelty and its debasing effect upon public morals, but because of its unreliability as a means of discovering the truth, since it oftentimes led the innocent from weakness and exhaustion to plead guilty or accuse others of crimes which had not been committed. The horrors of the Inquisition and the excessive use of judicial torture from the fourteenth to the sixteenth century led to a gradual but nevertheless progressive change of public sentiment, which ultimately caused its disuse in all the countries of Europe. The use of torture was abolished in Prussia, Saxony, Austria, and Switzerland by the middle of the eighteenth century. Its use in Russia was limited by command of Catharine II. in 1762, and finally abolished in 1801. In France it was abolished in 1789 (although temporarily restored by the Bourbons in 1814), in Württemberg in 1806, in Bavaria in 1807, in Hanover in 1822, and in Baden in 1831.

The instruments and methods of judicial torture have been numerous. Among the Greeks torture was inflicted by the rack, the scourge, by thrusting the victim bent double into a vault which compelled him to retain that position until his suffering became extreme, the injection of vinegar into the nostrils, and torture by application of fire. The Romans also made use of the rack, torture by fire, the scourge, and mutilating the flesh by hooks. The most celebrated instrument of torture is the rack, an oblong horizontal frame, on which the accused was stretched, while cords, attached to his legs and arms, were gradually strained by a lever or windlass, an operation which, when carried to extreme severity, dislocated the joints of the wrists and ankles. It is as old as the second century in the south of Europe, and seems to have been known in one form to the Greeks, but is said to have been unknown in England till introduced into the Tower by the Duke of Exeter, constable of the Tower, whence it acquired the name of the 'Duke of Exeter's daughter.' In Germany the rack was sometimes furnished with a roller, armed with spikes, rounded off, over which the sufferer was drawn backward and forward. The wheel, upon which the victim was bound and his bones broken by the gradual application of force, was also used throughout the Middle Ages. Among the lesser tortures may be mentioned the thumbikins, boots, pincers, and manacles; and in England an instrument called the Scavenger's (properly Skeffington's) daughter, the invention of Sir William Skeffington, lieutenant of the Tower in the reign of Henry VIII. This enumeration, however, by no means includes all the methods, ingenious and unspeakably cruel, by which torture was inflicted upon innumerable victims during the Middle Ages. Consult: Jardine, *Reading on the Use of Torture in the Criminal Law of England* (London, 1837); Lea, *Superstition and Force* (Philadelphia, 1866); and Stephen, *History of the Criminal Law of England* (London, 1883).

TORUS (Lat., protuberance, mattress, bed). A bold and simple architectural molding, of convex outline, used in doorways and cornices, but especially in the bases of columns immediately above the plinth.

TORY (from Ir. *toridhe, tornidhe, tornighe,* pursuer, plunderer, from *torighim,* to fancy, pursue). The name of one of the historic parties in England. It was originally the term applied to Irish brigands and about the year 1680 was given as a nickname to the supporters of the Duke of York, afterwards James II., when his exclusion from the succession on account of his (Catholic) religion was proposed by Shaftesbury. It was intended to imply that those who opposed the exclusion were 'Papists.' About 1830 the name 'Conservative' began to take the place of Tory. In the United States during the Revolution the adherents of the Crown were called Tories. See WHIG AND TORY.

TORZHOK, tôr-zhôk′. A district town in the Government of Tver, Russia, situated on the Tvertza, 294 miles southeast of Saint Petersburg (Map: Russia, E 3). In its vicinity lace, and gold, and silver embroideries are extensively produced by peasant women. Torzhok was a dependency of Novgorod in the tenth century. Population, in 1897, 12,800.

TOSCHI, tô′kê, PAOLO (1788-1854). An Italian engraver, one of the last representatives of the old school of line work. He was born at Parma, went to Paris in 1808 to study engraving under Bervic, with whom he remained until 1819, when he returned to Parma and founded with his friend Antonio Isac a school of engraving. In 1820 he was appointed by Maria Louisa, Duchess of Parma, ex-Empress of France, director of the Academy of Fine Arts, which he was the means of greatly improving and enlarging. His best known works are from Gérard's "Entrance of Henry IV. into Paris" (1818); Daniele da Volterra's "Descent from the Cross;" Raphael's "Spasimo" (Madrid); Correggio's "Madonna della Scodella," and a series of that master's Parmesan frescoes.

TOSTI, tô′stê, FRANCESCO PAOLO (1846—). An Italian-English song-composer, born in Ortona di Mare, in the Abruzzi. After studying at the Naples Conservatory, he was appointed an instructor there. He resigned in 1869, went to Rome and appeared in concerts as a singer, after which he was made vocal instructor at the Court, Rome. In 1875 he went to London, and in 1880 was appointed singing teacher to the royal family. His works are: *The Grand Duke* (opera, 1888); *La prima donna* (opera, 1889); and numerous Italian and English songs and duets, which have become very popular. Perhaps his best-known songs are "For Ever and For Ever," and "Good-Bye."

TOS′TIG (died 1066). A powerful English earl, brother of King Harold II. He was probably the third son of Earl Godwin, and shared in his father's banishment, returning with him in 1052. Edward the Confessor was very fond of Tostig, and when Earl Siward died in 1055, Tostig received Northumbria, Northamptonshire, and Huntingdonshire. Tostig proved an able and energetic ruler, restoring security to the disordered country. But his tyranny alienated the Northumbrians, and in 1065 they declared Tostig an outlaw and chose Morcar in his place. Harold sided with the rebels against his brother, and as a result Tostig was banished, though Edward regretted it exceedingly. In 1066, when Harold had succeeded Edward the Confessor as King of England, Tostig offered his support to William of Normandy. This offer was accepted and Tostig thereupon went to King Harald Haardraade of Norway, and induced him to make an invasion into England. But on September 25, 1066, King Harold met them at Stamford Bridge and totally defeated them. Harald Haardraade and Tostig were both slain. Consult Freeman, *History of the Norman Conquest*, vols. ii. and iii. (3d ed., Oxford, 1877). See HAROLD II.

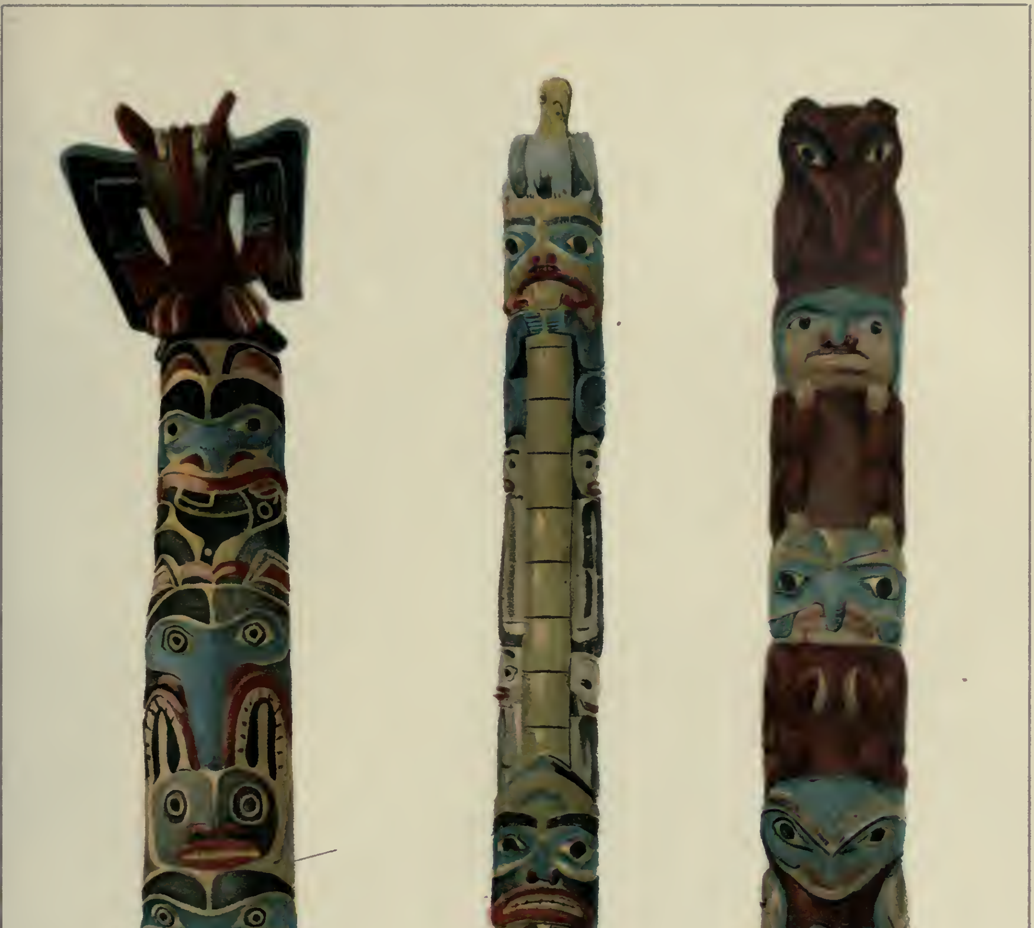
TOTAL ABSTINENCE. See TEMPERANCE.

TOTANA, tô-tä′nȧ. A town of the Province of Murcia, Spain, 24 miles southwest of the town of that name, on the left bank of the Sangonera (Map: Spain, E 4). A gorge divides the town into two parts, the *Barrio de Sevilla* and the *Barrio de Triana*. The town is celebrated for its oranges, the mining of saltpetre, linen-spinning, and especially for its *tinajas* (terra-cotta jars), widely used for holding oil and wine. Water is brought to the fountains by an aqueduct seven miles long. The town is connected by a canal with the seacoast at Mazarrón. Population, in 1900, 13,714.

TOTEMISM (from *totem*, from Algonquin *nt' otem*, my family token). The worship of a totem. Primarily a totem is a natural object employed by the American Indians to designate a certain relationship between groups of human and non-human individuals. The relationship is always peculiarly close, but not always of the same sort. The only general characteristic of all forms of totemism is the belief in a closer connection between certain groups of men and certain groups of non-human objects than naturally exists between all men and all non-human objects. Thus totemism is distinguished from fetishism (q.v.), though the latter has frequently been confounded with it. In true totemism the object of human regard is not an individual object, as it is in fetishism, but is the group of objects with which certain men (and women) as a group feel themselves to be related by a peculiarly close tie. Thus if a clan call the sun their brother, they are not totemists in the strict sense of the word. On the other hand, the Hindu who calls the monkey his brother is also not a totemist, although the monkey represents (as the sun does not) a group, for in this case the same Hindu calls other animals his brothers as well.

In totem-brotherhood, however, there is an important outer symbol, the name. Thus, when a savage names himself after an animal species, calls the individual animal of that species his brother, and refuses to kill it, the animal (species) is his totem, which is generally tribal and hereditary. The reason why a tribe revere a particular species of animal or plant is, according to Frazer, that the life of each individual of the tribe is bound up with some one animal or plant of the species, and that his or her death would be the consequence of destroying that particular animal or plant. Hence Frazer defines the totem as the receptacle of the life of the totemist, "in which the individual deposits his soul." The same mysticism pervades the elaborate theories of other scholars who regard the connection with the totem as a blood-relationship between men and animals (imagined to be the ancestors and brothers of men), and the first totemic sacrifices as a renewal of the blood-bond between the divine animal ancestor and his human descendants. According to this theory, the altar was at first the bethel or home of the divine animal ancestor, on which blood was shed to renew the bond and so strengthen the human group of worshipers.

TOTEM POLES, SOUTHERN ALASKA



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But while this theory explains certain forms of totemism, it fails to explain all, and here it must be admitted that the word totemism is not used either by Frazer or by others as if it stood for a well-defined conception. For a clan may have at the same time various totems; the totem, again, is not constant, but may be exchanged for another; the sexes in the same clan are credited with possessing different totems; any one family in a clan may have its special totem; any individual may have a private totem besides his clan totem; a totem may be no one group of objects, but be the odds and ends of any animal or vegetable group; the tribal totem may be divided, and each clan have as its totem a part; or, instead of a divided totem, there may be, besides the tribal totem, a number of 'honorific' totems; and finally, totems may be natural phenomena, clouds, lightning, thunder, or even colors. These different sorts of totems are of course not found together. The 'honorific' totem, for example, is characteristic of some Indians of the Northwest; the totem of odds and ends, such as the tails of animals and pieces of string, is found in Samoa; the cloud and lightning totems, in Australia; and the color-totem, blue or red, among certain Indian tribes of the Middle West.

Though these varieties seem to lack all coherence, there has been claimed for totemism this common bond, that in all its varieties it at least conditions the matters of bed and board. That a totemist must marry outside of his totem group and must not eat of his totem (if, as in most cases, this is an animal or a vegetable) are the foundation stones of certain theories of totemism. But totemism can no longer be said to bear this implication, for neither has the eating of the totem nor exogamy anything to do with the most primitive forms of totemism.

The most striking fact in the totemism of the Australian, which is most primitive in type, is that it has nothing to do with regulating marriage, nor has the child necessarily either its mother's or its father's totem. Therefore, the totem is not a mark of blood-kinship. According to Australian belief, all the spirits live in certain restricted localities, and a man's totem is determined by the locality in which the spirit enters his mother's body, conception being thus explained. Further, far from exogamy being the result of totemism, exogamy is by no means a totemic law. There is in some tribes no restriction on marriage within the tribal group, and in fact endogamy, or marriage within the tribal group, appears to have been the first rule.

Not less important are the facts in regard to the relation between the totemist and his food. Here, as in many other cases, it is clear that the animal or plant first venerated by a savage is the food that preserves his life. The redskin does not eat maize because he regards it as his sacred ancestor, but it is sacred and his parent because he is dependent upon it for sustenance. Among the Australians it is the totem animal which was eaten by predilection in the original form of the institution. Just as utility deified the Hindu's cow and the Indian's maize, so the opossum was sanctified by the Australian who lived upon it, and as such it became his totem. For this reason the Australians have certain totem rites, the object of which was simply to increase the food supply. But, on the other hand, as the Waganda tribe in Africa spared certain animals because they were indigestible, so in Australia the men of the wildcat totem might eat wildcat on a certain occasion when it was strictly prohibited to those of that totem with whom it was likely to disagree, such as the aged. In this instance the Australian eats his totem as far as health permits. The totem may be killed by those not belonging to the totem group, and the latter will even aid the alien to kill their own totem.

In the course of time, however, the sacredness of the totem, as among the majority of the redskins, becomes such as to prevent general slaughter of the totem animal. Thus we find that, whereas the Australians of ancient days (as reported by tradition) might eat freely of the totem animal (or plant), the modern descendants of those primitive Australian totemists dare not do this so freely. But even to-day the totem animal is not considered a kinsman whom it would be wrong to kill; the connection is rather spiritual, as indicated by the circumstance that it is among those tribes that we find rain and sun regarded as 'totems.' The explanation is in accordance with the notion of conception as given above. The spirit of the man belongs to the same locality as the spirit of the rain or of the sun. The sun supply and the rain supply are aided by the same sort of rites as those instituted to increase the food supply. There is no question of blood-kinship, but of a brotherhood based largely on a locally limited interchange of spirits, a restricted metempsychosis. The blood of a kangaroo man (one who belongs in the kangaroo totem) is not shed as a symbol of kinship and communion, but for the avowed purpose of frightening away other kangaroo spirits, that they may escape in their terror into female kangaroos and so increase the food supply. The whole system is at bottom economic rather than religious.

The historical explanation, as opposed to the theoretical mystical explanation of a primitive blood-communion with gods, shows that blood-communion and sacrifice of the totem are far from primitive traits, and offers an orderly and natural sequence in the totemist's evolution. Nor is there anything improbable in the totemist's changed attitude toward the totem at different points in the historical series. In the first place, we find actually existent these two phases, one of food supply, the other of the sacred inviolable totem, in the development of the Australians themselves. For had the latter phase been original, it is impossible that any legends could have arisen to reflect a phase in which a totem was the chief food of the community; and yet all the tribal legends represent the totem in this way. Moreover, the connecting link in the series is fortunately preserved in the well-known account of Agatharchides concerning the troglodytes of East Africa, who two thousand years ago pastured their herds there and lived upon them, drinking their milk and blood and occasionally eating the flesh of the cattle, but not very willingly, because "they regarded the cattle as their parents, inasmuch as they got their sustenance from them."

The institution of totemism, however, is not homogeneous, and different causes may have resulted at different times in totemism of different sorts which have a general similarity. Indigestion, as among the Waganda, may have resulted in one clan refusing to eat one group of animals; while the American Indian, who takes as his private totem the animal seen in a dream the night before he is initiated into the tribe, may often have converted his own totem into that of his tribe. Honorific totems are merely assumed for politeness, so to speak. They are at least always of secondary origin. Color totems and odds and ends as totems are little more than fetishes and may be explained accordingly. Sex totems are not true totems at all, but deserve a specific name. Certainly in such cases there is neither blood-kinship nor any trait of real totemism. Nor is it a proof of totemism when a race holds the belief that its ancestors were divine and includes among its many ancestral gods divine animals, any more than it is totemic to derive a race from a tree. The Algonquin Indians, for example, like the ancient Scandinavians, hold that all men are descended from an ash-tree; yet this tree is not their totem. It must be remembered also that when an institution is once established it moves forward of itself. Hence there may be clans which take to themselves totems unsuitable as food merely because other clans in their environment have totems, which are no longer interpreted as providers of food, but only as tutelary objects. In some cases totems may be assumed as coats of arms are assumed, simply to be in the fashion. Thus a tribe in Bengal a few years ago assumed as a tutelary divinity the dog, and the dog is to-day practically their totem. The reason why they chose any such divinity was simply that all their neighbors had totems and they wished to be fashionable, while the reason they selected the dog was that 'it was useless when dead' (i.e. it could not be eaten, and so might as well serve as a totem). Then, too, there are cases where what seems to be a genuine totem shows itself on inspection not to be of the same class with cases of genuine totemism. Thus an African selects before death the animal he will become after death, and this (species) then becomes sacred to his descendants.

Frazer divides totemism into what he calls the Egyptian kind and the Aino kind. Among the ancient Egyptians it was the custom, as it is to-day the custom among the Todas of India, to slay certain animals only as a sacrament; while among the Caucasian tribes and the Ainos of Japan it is customary to kill as a sacrament certain animals which are also killed regularly. But these two kinds are only stages of totemism. The sacramental slaying of an animal regularly killed is an expiation, based upon the same principle as that which induces a savage to apologize to a bear before killing it, but all sacrifice of totems is non-primitive.

The theory has recently been advanced that totemism was at first a kind of writing, indicating a clan; that those men called e.g. Beavers came to believe they were 'beaver sons;' and that worship of the beaver totem arose from this belief. In the most primitive totemism, however, the only support given to this version is that the totem is tattooed on the body of a clansman, which, obviously, might be due to a prior respect for the totem.

In conclusion, certain aspects of totemism may be mentioned because they have been more or less utilized in creating doubtful history. Thus totem-poles have been cited as originating all idol-worship, and the practices of decorative mutilation and tattooing have been referred to totemism though they are found where no totemism exists. More important is the fact that the sacrifice of the totem, whether piacular or not, appears to be of secondary origin; for this does away with the further claim that ceremonies in relation to the birth and death of vegetation (such as the spring and harvest festivals of India, Babylonia, Germany, etc.), are borrowed from totemism, a contention no longer upheld by the best authorities. A further misunderstanding on the part of some writers is due to a confusion in regard to the relation between taboo and totemism. These in themselves have nothing to do with each other. On the contrary, they are often found in inverse proportion. Thus in Polynesia there is no totemism except in Samoa, while taboo (q.v.) is the chief religious factor in all Polynesia. In a word, totemism often entails taboo, but taboo does not imply totemism.

Totemism is far from universal. It is found among the American Indians, the Australians, certain Africans, the Egyptians, etc., but not only are there tribes even in America which have no totemism, but there are whole races, such as the Eskimo, which show no trace of it, and others, such as the Chinese, which have scarcely any totemism. The races most discussed in this regard are the Semites and Aryans. In proof of the Aryans having been totemists the reverence paid by the Greeks to fishes and storks, the existence of a wolf clan, and the 'murder' of an ox have been cited. The 'wolf' and 'bear,' Greek tribal names, have also been regarded as a proof of totemism. But here, as among the Semites, the connecting links which should prove the existence of the totemic institution are always found to be wanting. Reverence paid to animals is no proof of totemism, and still less proof is furnished by men having animal or vegetable names. The only evidence for the existence of early Vedic totemism is found in such names. The only ancestor man is called Cucumber, and at once the inference is drawn that we have to do with the Cucumber clan of totemists. But in New Zealand, where totemism is unknown, a chief was also called Cucumber, and the reason is expressly "because he crept so rapidly and so stealthily" (around his enemies). The vital point in all such cases is whether families of men are regarded as related to families of vegetables or animals. Among the Aryan Hindus, the Teutons, and the Romans, or even among the Greeks, there is not the slightest proof of any such belief. It has been shown, indeed, that the Semites believed in kinship between men and gods, and the proof of a belief in kinship between gods and animals has been thought possible; but in respect of the most important third proof, kinship between groups of men and groups of beasts, no satisfactory evidence has been offered.

Consult: Tylor, *Early History of Mankind* (London, 1870); Lubbock, *Origin of Civilization* (ib., 1884); Robertson Smith, *Kinship and Marriage* (ib., 1885); Frazer, *Totemism* (Edinburgh, 1887); id., *The Golden Bough* (2d ed., London, 1900).

TOTE'RO. A North American Indian tribe. See TUTELO.

TÓTH, tōt, Koloman (1831-81). An Hungarian poet, born at Baja, County of Bács-Bodrog. He took part in the Revolution of 1848, and published in 1852 his first collection of patriotic poems, which achieved instant success. The next year appeared *Paul Kinizsi*. Then came a number of plays, one of which, *Egy királyné* ("A Queen," 1857), took the Academy's prize. In 1860 Tóth founded the comic paper *Bolond Miska* ("Foolish Michael"). The same year he was elected to the Kisfaludy Society, and in 1861 to the Academy. The play *A nők az alkotmányban* ("Women in Constitutional Life," 1871) was the first to be well received on the stage, Tóth's popularity being in the field of patriotic verse.

TOT′ILA. An Ostrogothic king whose real name was Badvila. He was chosen in 541 to occupy the throne made vacant by the assassination of his uncle Hildibald. He prosecuted the war with the forces of the Eastern Emperor not only with great success, but also with chivalrous generosity and humanity. After reducing Southern Italy, he laid siege to Rome, to relieve which Justinian once more sent out the celebrated Belisarius. The city fell, however, in 546, and after five years of fruitless warfare, in which he was poorly supported by his Government, Belisarius asked to be recalled. Totila thereupon ravaged Sicily, reduced Sardinia and Corsica, and harassed the coasts of Greece, but in 552 was defeated and killed at Taginæ (or Tadinæ) by an army under command of the eunuch Narses.

TOTLEBEN, tōt′lā-ben, or **TODLEBEN**, Franz Eduard Ivanovitch, Count (1818-84). A Russian general of engineers. He was born at Mitau, Courland, May 20, 1818, and after studying at Riga was admitted as a student to the college of engineers at Saint Petersburg. He served as a lieutenant of engineers in the Caucasus campaign of 1848-51, and in 1854 took part in the siege of Silistria. When the French and English troops undertook the siege of Sebastopol, Totleben, then a colonel, was sent to assist in its defense. The fortifications were placed under his direction. The principle on which he acted was to watch the works of the allies, and to establish against them on every point a superiority of fire, by multiplying the number and increasing the calibre of his guns. The prodigious activity displayed by the Russians in making good the damage sustained by the heavy fire of the enemy filled the allied army with astonishment. Massive ramparts mounted with formidable batteries rose at each threatened point within the line of defense. In June, 1855, Totleben was wounded and he was forced to relinquish active supervision of the defense. After the conclusion of peace he expanded what was at first a mere engineer's report into a history of the war in the Crimea, entitled *Défense de Séwastopol*. For his services Totleben was made adjutant to the Emperor, and in 1869 general of engineers. In the Russo-Turkish War of 1877-78 Totleben was intrusted with the investment of Plevna after repeated assaults on the works had been repulsed with immense slaughter. He succeeded in completely cutting off the city from all outside relief, so that finally nothing was left to Osman Pasha but to attempt to break through the lines of the besiegers, in which he failed. In April, 1878, he received the supreme command of the Russian forces in Turkey. He became Governor-General of Odessa in 1879 and commandant of Vilna in the following year. He died at Soden, Germany, July 1, 1884, and was buried in Sebastopol. (See Crimean War.) There are biographies of Totleben by Brialmont (Brussels, 1884) and by Krähmer (Berlin, 1888).

TOTO′NAC. An ancient cultured nation whose territory embraced the northern portion of the present State of Vera Cruz, with the adjacent portion of Puebla, Mexico. Their language has numerous Mayan and Nahuatlan affinities, but appears to be of distinct stock. They claimed to have come from the northwest about eight hundred years before the Spanish Conquest and to have been the builders of the remarkable ruins of Teotituacan, about ten miles northwest of the City of Mexico. For several centuries they had maintained their independence, but had been conquered by the Aztec emperors some time before the coming of the Spaniards. Cortez made his first landing in their territory. They were fully as highly advanced as the Aztecs. Their capital, Cempoalla, was about five miles from the seacoast, with houses built of brick and mortar, each house in the centre of a small garden watered by a constantly flowing stream, and the city itself was surrounded by fruit trees and fields of grain. Their religion was a ceremonial sun-worship, and they practiced circumcision and head-flattening. They still constitute an important part of the population of their former territory, retaining many of their ancient rites interwoven with those of the conquering religion.

TOTONICAPAN, tō′tô-nê-kâ-pän′. A town in the department of the same name, Guatemala, 61 miles northwest of the capital city (Map: Central America, B 3). Its population is almost wholly native, of Quiché descent, and its industries accordingly consist of simple weaving and wood and stone work. The country is mostly sterile. The town was the centre of the Quiché opposition to Alvarado. Population, about 20,000.

TOT′TEL, Richard (c.1525-94). An English publisher, compiler of the celebrated *Tottel's Miscellany*. Of his early life nothing is known. Granted in 1553 a seven years' patent to print law books, and charter member of the Stationers' Company in 1557, his patent was renewed for life in 1559. He reached a high position in the Stationers' Company, finally dropping out of it in 1589 on account of ill health. Besides the law books which he issued, Tottel published a few volumes of general literature which invest him with a literary and bibliographic interest. Among these were More's *Dialogue of Comfort* (1553); Lydgate's *Fall of Princes* (1554); Hawes's *Pastime of Pleasure* (1555); Grimald's translation of *De Officiis* (1556); and Surrey's translation (1557) of the second and fourth books of the *Æneid*—the earliest English blank verse known. The *Miscellany* appeared June 5, 1557, and contained 271 unpublished poems by Surrey, Wyatt, Grimald, Forrest, Heywood, Thomas, Vaux, and others unidentified. The verse of Surrey and Wyatt is not known to have appeared anywhere else. The book was the first of poetic anthologies in England.

TOT′TEN, Joseph Gilbert (1788-1864). An American soldier, born at New Haven, Conn. He graduated at West Point in 1805; and during the

War of 1812 served as chief engineer in the campaign of 1812-13 on the Niagara frontier and in that of 1813-14 on the Lake Champlain line of operations; and participated in the battle of Queenstown Heights, the capture of Fort George, the attack on La Cole Mill, and the battle of Plattsburg. For gallant conduct in the last-named engagement he was brevetted lieutenant-colonel. In 1847, during the Mexican War, he directed the engineering operations in the siege of Vera Cruz, and for his services was brevetted brigadier-general. During the Civil War he served as commander of the corps of engineers (1861-64); as president of a board to regulate and fix the ordnance of permanent fortifications and field batteries (1861-62); and on April 21, 1864, one day before his death, was brevetted major-general, United States Army, for "long, faithful, and eminent services." He was much interested in the natural sciences, and was an authority on conchology. Two species of shells, the *Gemma Tottenii* and the *Succinea Tottenii*, were named in his honor. He published: *Reports on National Defenses* (1851); *Essays on Ordnance* (1857); and other works.

TOTTENHAM, tŏt′en-am. A town in Middlesex, England, a connecting suburb of London, six miles northeast of Saint Paul's (Map: London, C 8), on the river Lea, which affords good bathing and boating. The town is undergoing much modern improvement; owns its water-works; maintains a free library, recreation grounds and parks, including the Bruce Castle Park, the site of the old Bruce estate and castle in which King Robert's father died in 1303. Alexandra Palace, a favorite metropolitan pleasure resort, is partly within the urban limits. Population, in 1891, 71,343; in 1901, 102,519.

TOTTORI, tŏt-tō′rē. The capital of the Prefecture of Tottori, in Western Hondo, Japan, 70 miles northwest of Kobé (Map: Japan, D 6). It has manufactures of cotton and silk goods. Population, in 1898, 28,496.

TOUCAN (Brazilian *toucano*, probably nose-bone, less plausibly explained as meaning feather, or of onomatopoetic origin). A bird of the family Rhamphastidæ, related to the barbets, jacamars, and puff-birds (qq.v.), and not very distantly to the woodpeckers, and containing about 50 known species, all natives of tropical America, and remarkable for the magnitude of the bill. They are divided into two groups, the true toucans (Rhamphastos) and the araçaris (Pteroglossus), of which the latter contains the greater number of species; the former has the larger bill, and the tail is shorter. There is a difference also in the prevalent colors, the araçaris generally exhibiting much green and yellow, while the true toucans have the ground color of the plumage usually black; the throat, breast, and rump often gayly adorned with white, yellow, and red. The colors, however, are not in general finely blended, but appear in strong contrast. The legs of toucans are short; the feet have two legs before and two behind. The form of the body is short and thick; the tail is comparatively short, rounded or even, and is turned up over the body when the bird is at roost. The enormous bill is at the base, of the full width and depth of the head, and is in some species more than half the length of the body. It is arched toward the tip, irregularly toothed along the margins of the mandibles, and extremely cellular and light, yet strong in structure. The tongue is very long, narrow, and singularly feathered on each side, and takes an important part in gathering food. Toucans eat fruits with avidity, but they also seize and devour small birds, lizards, etc. They make a curious clattering noise with their great mandibles and also emit a harsh cry. They live chiefly in the depths of the South American forests, in small flocks. They lay two white glossy eggs in hollows of trees, making little if any nest for them, are easily tamed, and in captivity readily eat rice, bread, potatoes, eggs, meat, and many other kinds of food, and make amusing pets. The colors of the bill are, in most of the species, very brilliant during life, but disappear from stuffed specimens in museums. The largest species, as the toco of Argentina (*Rhamphastos toco*), are about 24 inches in length, the bill in this species measuring 7½ inches, and the tail 10 inches. One of the most familiar species is the Brazil ariel, in which the throat is yellow and the rump scarlet. See Plate of Hornbills and Toucans.

TOUCEY, tou′sĭ, Isaac (1796-1869). An American politician, born at Newton, Conn. He was educated privately, studied law, and was admitted to the bar at Hartford in 1818. From 1822 to 1825 he was State's Attorney for Hartford County, and from 1835 to 1839 was a member of the United States House of Representatives. He was again State's Attorney in 1842-44, and was elected Governor by the Legislature in 1846 when the election was thrown into that body. From June, 1848, to March 3, 1849, he was Attorney-General of the United States. In 1850 he served in the State Senate, and in 1852 in the State House of Representatives. In 1852-57 he was United States Senator and under President Buchanan he was Secretary of War. It was charged by the Republicans that he had manifested his sympathy with the Southern cause by sending the warships of the United States to distant stations so that they could not readily be gotten together.

TOUCH (OF. *toucher*, *tocher*, Fr. *toucher*, It. *toccare*, from Germ. **tukkōn*, OHG. *zuckan*, Ger. *zücken*, to twitch; connected with OHG. *ziohan*, Ger. *ziehen*, Goth. *tiuhan*, AS. *tēon*, to draw). One of the five special senses; the tactile sense. The sense of touch is widely distributed, but it must be distinguished from the other varieties of common sensation—pain, and temperature perception. These are perceived through the same nerves—the sensory—but the nerve fibres which are identified with the sense of touch proper are provided with special end organs, and the sense, moreover, is only exercised in any degree of perfection in those parts where there is an abundance of special end organs. These are of two kinds: *touch corpuscles*, situated chiefly in the skin; and *end bulbs*, found mainly in the mucous membranes. The lips and genital organs, being on the border line of skin and mucous membrane, are possessed of both touch corpuscles and end bulbs. The *Pacinian corpuscles* are widely distributed, but their part in connection with the tactile sense is only partially understood. They are numerous as the nerves of the palmar surface of the fingers, but, when found, are situated deeply in the skin or in the subcutaneous tissue. The acuteness of the sense of touch depends to some extent on the cutaneous circulation, and this is largely influenced by the surrounding temperature. The numbness produced by the application of cold to the surface of the body is thus explained.

The acuteness of the sense of touch is commonly measured by an instrument known as the æsthesiometer and consisting of two needle points in arms movable upon a graduated scale. A pair of compasses may be used in the same way. The nearer together the points can be separately perceived the greater the delicacy of touch. The distance at which these two points can be separately distinguished in various parts of the body is indicated in the following table:

Tip of tongue	1.1	m.m.
Palm of terminal joint of finger	2.2	"
Palm of second joint of finger	4.4	"
Tip of nose	6.6	"
White part of lips	8.8	"
Back of second joint of finger	11.1	"
Skin over cheek bone	15.4	"
Back of hand	29.8	"
Forearm	39.6	"
Sternum	44.0	"
Back	66.0	"

It will thus be seen that the point of greatest delicacy of touch is the tip of the tongue, and the seat of the least developed tactile sense is the skin over the spinal column. The sense of touch, like all other perceptions, can be sharpened by exercise. This improvement is not to be explained by an increased development of the terminal organs, nor by a growth of new nerve fibres in the skin, but by a more exact limitation of the sensational areas in the brain. Many artisans acquire a highly specialized sense of touch. The delicacy of the tactile sense in the blind is a well-known condition; these people are able to read fine raised letters, and to make various articles of delicate structure, in a manner impossible to individuals who can see. See PSYCHOLOGY; SENSATION; and SKIN.

TOUCH. In music, a term denoting the manner in which the digitals of a keyed instrument are manipulated. Most important are the smooth legato touch and the detached staccato touch. It is of vital importance which muscles are employed in playing different passages. The muscles of the fingers, the wrist, and the arm produce very different effects, generally distinguished as tone-color. Thus, when we speak of a pianist as lacking in color, it means that he employs one set of muscles almost to the exclusion of others. It is the matter of touch that produces what are called singing, velvety, or hard tones.

TOUCHSTONE, or LYDIAN STONE. A hard, black, siliceous stone or flinty jasper used for testing the purity of precious metals, especially gold. The stone originally used was a peculiar bituminous quartz from Lydia, in Asia Minor. When a piece of gold is rubbed across the surface of the stone it leaves a streak which is more or less reddish, according to the amount of copper that it contains, and by comparing the streak with those of alloys of known composition, the expert can determine approximately the value of the metal.

TOUCH-WOOD. The decayed wood of willows and some other trees used as tinder. See AMADOU.

TOUCHWOOD, LADY. (1) In Congreve's *Double Dealer*, the wife of Mellefont's uncle. Mellefont does not respond to her advances, and in revenge she accuses him of dishonorable proposals. (2) In Mrs. Cowley's *Belle's Stratagem*, a loving wife guarded by a jealous husband.

TOUL, tōōl (anciently *Tullum Leucorum*). A fortified town, capital of an arrondissement in the Department of Meurthe-et-Moselle, France, 14 miles west of Nancy (Map: France, M 3). The former Cathedral of Saint Etienne is noted for its graceful proportions, octagonal towers, and thirteenth-century cloisters; the fine Gothic Church of Saint Gengoult also has elegant cloisters, in the flamboyant style of the sixteenth century, and the eighteenth-century episcopal palace is now used as the town hall. The bishopric, founded in the fifth century, was suppressed at the time of Napoleon. In the latter part of the Middle Ages, and later down to 1552, Toul was a free city of the German Empire. In that year it was seized by Henry II. of France. In 1790 its fortifications were reconstructed upon the Vaubanian principle. In 1814 the town was stormed by the Russians, and on September 23, 1870, it was taken by the Germans after a siege of nearly six weeks. Population, in 1901, 12,287.

TOULMIN, tōōl′min, HENRY (1767-1823). An American jurist, born at Taunton, England. He removed in 1793 to Virginia, and from 1794 to 1796 was president of Transylvania University. In 1796-1804 he was Secretary of State of Kentucky, and in the latter year was appointed judge of the United States Circuit Court of Mississippi. Subsequently he served in the Alabama Legislature, and assisted in framing the Constitution of that State. He published *A Description of Kentucky* (1792); a *Collection of the Acts of Kentucky* (1802); a *Digest of the Territorial Laws of Alabama* (1823).

TOULMIN, JOSHUA (1740-1815). A Unitarian clergyman. He was born in London; became pastor of a dissenting congregation in Colyton, Devonshire, in 1761. In 1765 he accepted a call from a Baptist congregation in Taunton. He then became a Unitarian, and in 1804 became minister of a Unitarian congregation at Birmingham. He published many biographies, including *Memoirs of Faustus Socinus* (1777); also *A Historical View of the State of the Protestant Dissenters in England Under King William* (1814); and edited Neal's *History of the Puritans* (new ed., 5 vols., 1822). A volume of sermons was published after his death (1825).

TOULON, tōō′lôN′. The capital of an arrondissement in the French Department of Var, a fortress of the first class, and the second naval station in France (Map: France, M 8). It is situated on a fine and well-protected bay of the Mediterranean, 42 miles east-southeast of Marseilles, and is partly surrounded by hills, crowned by detached forts. The old town in the southern part of the city is of uninviting appearance. Surrounding it on the north are the modern quarters embellished with wide avenues and fine buildings. In the old town is situated the only ancient building of any particular architectural value—the Sainte Marie-Majeure Church. It is Romanesque and dates from the eleventh century. It contains a handsome reredos. Besides the numerous naval and military open spaces and grounds (including the Place d'Armes) in Toulon, there are, in the northern part, two spacious and prominent squares—the Place de la Liberté (the finest in the new town) and the Jardin de la Ville, an attractive promenade. The most important avenue of the city—the Boulevard Strasbourg—connects the two squares, and on it are the Musée Bibliothèque (a handsome modern Renaissance edifice) and the immense Marine Hospital. The Place d'Armes, to the southeast and near the port, is the main square in the city.

The harbor has five principal basins. It connects with surrounding bays, which stretch away under hills bristling with forts, and extends past Fort de l'Aiguillette out into the great harbor or roadstead which opens into the sea. The port has an easy access and is well sheltered. The marine arsenal, an immense and complete establishment with its buildings, basins, and canals, adjoins the city on the west. It dates from the time of Henry IV., and on an enlarged scale was planned by Vauban. It embraces 650 acres. Over 12,000 men are employed.

Toulon has a lyceum, the Ecole Rouvière, marine schools, a marine library, a marine botanic garden, and a marine observatory. The leading theatre is a splendid modern edifice containing 1800 seats. Shipbuilding, iron and copper founding, lace-making, fishing, and viticulture are the main industries. The vicinity produces olives and figs. The principal exports are wines, oils, and fruits. In 1899 there entered and cleared 755 vessels of 323,415 tons. The population, in 1901, was 101,602.

Toulon is the ancient Telo Martius, noted for its dye-works. It was destroyed by the Saracens in 889, and like calamities befel it in the twelfth century. It surrendered to the forces of Charles V. in 1524, and also in 1536. Henry IV. and Louis XIV. fortified it. It repelled the allied fleets of England and Holland in 1707. In 1793 it was turned over by the Royalists to the English and their allies. It was thereupon besieged by the forces of the Convention, Napoleon Bonaparte gaining there great distinction as commander of the artillery. The town was taken in December and its inhabitants were ruthlessly punished. Consult: Teissier, *Notice sur les archives communales de la ville de Toulon* (Paris, 1863); Lambert, *Histoire de Toulon* (Toulon, 1885-90); Rozet, *Essai sur la climatologie de Toulon* (Paris, 1890).

TOULOUSE, tōō'lōōz'. A city of France, the former capital of Languedoc, and the present capital of the Department of Haute-Garonne. It is situated 130 miles southeast of Bordeaux (Map: France, H 8). Toulouse lies in a rich valley on the right bank of the navigable Garonne. It is subject to high winds, to floods, and to very hot weather in summer. Three bridges across the river connect the city with the Faubourg Saint-Cyprien on the west bank. The noble Pont Neuf, a stone bridge of seven arches, dates from 1543. The streets of Toulouse are for the most part narrow, unattractive, and poorly paved. Two wide lines of boulevards, however—the outer one following the canals—divide the city pleasantly from the surrounding suburbs, and many extensive improvements have latterly been begun. On the extreme east is the Parc du Caousou.

In the centre of the town, in the Place du Capitole, stands the 'Capitole,' or town hall. It dates from the sixteenth century, but has recently been almost wholly reconstructed. It possesses little architectural merit. The edifice owes its name to the city magistrates, or 'Capitouls,' who ceased to exercise their functions about the time of the French Revolution. It is the seat of the famous Académie des Jeux-Floraux—an ancient literary institution which lends especial renown to the city. These Jeux-Floraux, or Floral Games, which date from 1324, are poetical tournaments, in which the prizes allotted on May 3 of each year consist of flowers of gold and silver. In the 'Capitole' also are an academy of legislation, founded in 1851, and an academy of science, inscriptions, and belles-lettres, founded in 1640.

Near the 'Capitole' are the Municipal Theatre and a square donjon, restored by Viollet-le-Duc. The latter contains the city's archives. Farther south is the museum of fine arts, occupying in part an ancient Augustine convent. In this section of the city is the Cathedral of Saint Etienne—a curious inharmonious edifice belonging to different times and architectural types.

In the extreme southern part of the city are the Jardin des Plantes and the Jardin Royal. Here splendid, spacious avenues unite in the sightly Grand Rond, which is decorated with statues. To the west is the Palace of Justice—formerly the Palace of the Parlement, with several beautiful rooms. In the vicinity stands the statue of Cujas, the great French jurist, a native of Toulouse. Northward is the Church of La Dalbade, whose square tower, splendid Renaissance portal, and interior merit mention. Prominent among the old mansions in the vicinity is the Hôtel Lasbordes—a splendid creation of Bachelier, much of whose work is to be seen in Toulouse. Farther north, near the Pont Neuf, is the church of La Daurade. Not far away is the lycée, occupying part of the extensive Renaissance establishment of the merchant Bernuy who guaranteed the ransom of Francis I. after Pavia. In the vicinity is the Protestant church. To the north of the 'Capitole' and connected with it by the Rue du Faur, the most important street in the city, is Saint Sernin—the finest church in Toulouse. It is a superb cruciform Romanesque structure, begun in the eleventh century, and restored under Viollet-le-Duc. The splendid octagonal tower rises 210 feet, with tiers of triangular arches. Saint Saturnin, the martyred apostle of Toulouse, is buried here.

At the head of the educational institutions stands the university (q.v.). There are a splendid school of medicine, a school of fine arts, a veterinary college, an observatory, an artillery school, a museum of industrial art and antiquities, and, in addition, many learned societies which occupy now the splendid Hôtel d'Assezat, bequeathed to them in 1896. The city library has 70,000 volumes.

Toulouse is a city of wealth and prominence industrially and commercially, owing to its commanding position in the south of France. The Canal du Midi (q.v.) is here joined by the Canal Latéral, and thus commerce between the Atlantic and the Mediterranean is accommodated by water, Toulouse being the centre of this traffic. Much of the commerce from interior France to Spain also passes through Toulouse. The trade of the city is very extensive in wine and grain. There are two historic mills on the river. One is known to have existed in 1182; the other traces its origin back to the ninth century. There are a national tobacco factory, employing about 1300 persons, iron and copper foundries, a cannon foundry, and carriage and farm machinery works. Stained glass is also manufactured. The population in 1901 was 147,696.

History. Toulouse, the ancient Tolosa, was long prominent before the Romans came into Gaul. It was taken by the Consul Cæpio in B.C. 106, and he despoiled its great shrine of the rich treasures for which it had been famous. It became the chief city of the Visigoths in 419 and it fell into the hands of the Franks in 507. It was long important as the seat of the counts of Toulouse. In the early part of the thirteenth century it suffered terribly in the Albigensian troubles. In 1562 4000 Huguenots were killed in Toulouse. The Protestant Jean Calas, made famous by the noble exertions of Voltaire, was broken on a wheel here in 1762, on an unjust charge. At Toulouse Toult made an unsuccessful stand against Wellington on April 10, 1814. Consult: *Toulouse histoire, archéologie monumentale facultatir*, etc. (Toulouse, 1887); Du Mège, *Histoire des institutions de Toulouse* (Toulouse, 1844); Jourdan, *Panorama historique de Toulouse* (Toulouse, 1877).

TOULOUSE, County of. A feudatory State, which played a prominent rôle among the principalities of mediæval France. It was established by Charles the Great in 778, and its rulers became hereditary about the middle of the ninth century. The dominion of the counts finally extended over the whole of Languedoc, over Rouergue, and over part of Guienne and Province. Count Raymond IV. had a distinguished share in the First Crusade (1096-99). He died in 1205. His son, Bertrand, established the principality of Tripolis, on the coast of Syria. Raymond VI. (1194-1222) is celebrated as a patron of the Provençal poets and in connection with the Albigensian wars. Having refused to take severe measure against the Albigenses, he incurred the wrath of the Church, which let loose against him the crusading forces of Simon de Montfort, to whom Raymond's possessions were transferred by Pope Innocent III. Raymond was unable to make head against the invaders, who overran and laid waste his country. Simon de Montfort fell at the siege of Toulouse in 1218, and not long after Raymond succeeded in recovering a part of his lands. He enjoyed his regained power, however, only for a brief time, dying in 1222. His son Raymond VII. (1222-49) secured possession of most of the dominions of his house, but in 1229 he was forced to cede a large part to Louis IX. of France and acknowledge him as his overlord. His daughter and heiress, Jeanne, was married to the King's brother, Alphonse, Count of Poitou, on whose death, in 1271, the County of Toulouse was united with the French crown.

TOULOUSE, University of. A French university, founded as a result of the Albigensian heresy and the crusade against Toulouse, as a bulwark of orthodoxy, by Pope Gregory IX., in 1230-33. It is the first of European universities founded by deliberate purpose, and thus became the model for later foundations. It was made up chiefly of migrants from Paris, and was for many years not very prosperous. Its chief purpose was originally theological, but it developed into a noted school of law, and eventually took up the royal as against Papal interests. It was particularly rich in colleges, no fewer than ten well-endowed foundations being enumerated. At the Napoleonic reorganization it was, like other universities, merged into the national system. It includes now four regular faculties, law, philosophy, mathematics—science and medicine—pharmacy, besides the faculty of Protestant theology of Montauban, and the two 'free faculties of theology and philosophy.' In 1901 it had a budget of 1,011,613 francs and 2040 students.

TOUR, tōōr, Maurice Quentin de la. See La Tour, Maurice Quentin de.

TOURACOO, or Touraeo. Same as Turacu (q.v.).

TOURAINE, tōō-rān′. One of the former provinces of France, corresponding to the present Department of Indre-et-Loire. The district has received the name of the 'Garden of France.' The capital was Tours (q.v.). After having been under the rule of its own counts Touraine was united about the middle of the eleventh century with Anjou. Along with Anjou, it passed in 1154 to England. It was reacquired by France half a century later, was made a duchy in 1356, and was definitively united with the crown in 1584. See "Map of France, Showing Former Provinces," under France.

TOURANE, tōō-rän′, or Touran. A town of Annam, 40 miles southeast of Hue (q.v.). It is well built and extends along the left bank of the river for two miles. There are large substantial markets, a silk filature, an opium farm, etc. Numerous steamers maintain communication with Europe and the adjacent ports, and there is an extensive commerce carried on in sugar, rattan, bamboo, areca nuts, silk, and cassia. Tea, coffee, and the mulberry are cultivated in the neighborhood. Population, in 1897, 4650, of whom 100 were Europeans.

TOURASSIAN EPOCH. The name applied to an epoch of European prehistoric archæology at the end of the Paleolithic period, just before the close of the Quaternary. It is so named from the rock shelter of Tourasse, at Saint-Martory, Haute-Garonne, France. The climatic conditions were very much as at present, and the fauna of to-day was abundant. Industry and art declined and caused a hiatus between the Paleolithic and the Neolithic periods.

TOURCOING, tōōr′kwăN′. The capital of an arrondissement in the Department of Nord, France, 7½ miles northeast of Lille (Map: France, K 1). It is practically a part of the great industrial centre Roubaix. The town has a fine modern Gothic church, a large new town hall, a chamber of arts and manufactures, and schools of painting, drawing, music, and architecture. In 1866 a monument was erected to commemorate the defeat here in 1794 of the English and Austrians by Jourdan and Moreau. The wool-manufacturing output of this district represents nearly the entire output of Northern

France. There are manufactories of velvet pile carpets, woven goods, and furniture stuffs, also cotton, linen, and silk mills, dye works, machine shops, and a sugar refinery. Population, in 1891, 65,477; in 1901, 79,243.

TOURGEE, to͞or-zhā′, ALBION WINEGAR (1838—). An American novelist, born in Williamsfield, Ohio. He graduated from the University of Rochester, N. Y., in 1862, receiving his degree while serving in the Federal Army. He had been wounded at Bull Run, and was discharged, but reëntered the service, only to be taken prisoner at the battle of Murfreesboro, Tenn. Immediately after the war he became an editor and took up the practice of law at Greensboro, N. C. From 1868 to 1875 he was judge of the Superior Court of North Carolina, and was later (1881-84) editor of *The Continent* at Philadelphia. He was appointed United States consul at Bordeaux in 1897 and was transferred to Halifax in 1903. His numerous novels were founded chiefly on his experience in the South during the Reconstruction period. The list includes: *Toinette* (1874); *A Fool's Errand*—perhaps his best-known work (1879); *Bricks Without Straw* (1880); *John Eax and Mamelon* (1882); *Hot Plowshares* (1883); *An Appeal to Cæsar* (1884); *Black Ice* (1888); *Button's Inn* (1887); *With Gauge and Swallow* (1889); *Letters to a King* (1889); *Pactolus Prime* (1890); *Murvale Eastman, Christian Socialist* (1890); *Out of the Sunset Lea* (1892); *An Outing with the Queen of Hearts* (1894); *The War of the Standards* (1896); and *The Mortgage on the Hip-Roof House* (1896). Tourgee also wrote legal books, *North Carolina Code of Civil Procedure* (1878), and *A Digest of Cited Cases* (1879).

TOURMALINE (Fr. *tourmaline*, from Singhalese *tournamal*, *turamali*, tourmaline). A complex aluminum boro-silicate, containing also chromium, iron, magnesium, and the alkalies. It crystallizes in the hexagonal system. According to composition, several varieties are distinguished, as chromium tourmaline, iron tourmaline, lithium tourmaline, magnesium tourmaline, and magnesium-iron tourmaline. It has a vitreous lustre, may be either transparent or opaque, and may be colorless as well as blue, green, red, brown, and black. Some crystals are red internally and green externally, and still others are red at one extremity and green, blue, or black at the other. Tourmaline is the most dichroitic of all gems. The mineral is usually found in granite, gneiss, or mica schist. It occurs also in dolomite, granular limestone, and in certain contact rocks near dikes of igneous rocks; also in rolled pebbles in alluvial deposits. The white or colorless tourmalines are called *achroite*, the black varieties *aphrizite* and *schorl*, while those of various shades of blue are known as *indicolite*, the red varieties as *rubellite*, and the green transparent specimens from Brazil are known as *Brazilian emeralds*. The colored crystallized varieties of tourmaline, when transparent, are highly prized as gem-stones. They are found in Burma, Ceylon, and India, in the Urals, the Harz, and Brazil, while in the United States splendid specimens occur in Maine, especially near Paris, also in Massachusetts, Connecticut, New York, and California. Consult Hamlin, *The Tourmaline* (Boston, 1873).

TOURNACHON, to͞or′nȧ′shôN′, FÉLIX (1820—). A French author, artist, and aëronaut, better known under the pseudonym Nadar. He was born in Paris; studied medicine at Lyons; and returned to Paris as a journalist. In 1849 he founded the *Revue Comique*, and in 1854 published *Le Panthéon-Madar*, a gallery of contemporary celebrities. He soon afterwards engaged in experiments in aërial navigation, and constructed *Le Géant*, the largest balloon hitherto made. In it he made a number of ascensions, and was once carried as far as Hanover. During the siege of Paris by the Prussians he made use of his knowledge as an aëronaut to carry information to the outside country, and commanded the company of aëronauts of the Place Saint-Pierre, Montmartre. Among his numerous published works are: *La robe de Déjouire* (1841; 2d ed., 1859); *Quand j'étais étudiant* (1857); *Mémoires du Géant* (1864); *Le droit au vol* (1865); *Les ballons en 1870* (1871); and *Le monde où l'on patauge* (1883).

TOURNAMENT (OF. *tournoyement*, *tournoiement*, from *tournoier*, to joust, tilt, tourney, wheel about, from *tourner*, to turn, from Lat. *tornare*, to turn in a lathe, from *tornus*, from Gk. τόρνος, compasses, carpenter's chisel; connected with τείρειν, *teirein*, to pierce, Lat. *terere*, OChurch Slav. *trŭti*, Lith. *triti*, to rub). A knightly sport of the Middle Ages, in which combatants engaged one another with the object of exhibiting their courage, prowess, and skill in the use of arms. It existed first probably in France, whence it spread to Germany and England, and afterwards to the south of Europe. A tournament was usually held on the invitation of some prince, who sent a king-of-arms or herald through his own dominions and to foreign courts. The intending combatants hung up their armorial shield on the trees, tents, and pavilions around the arena for inspection, to show that they were worthy candidates for the honor of contending in the list in respect of birth, military prowess, and character. The combat took place on horseback, or at least was always begun on horseback, though the combatants who had been dismounted frequently continued it on foot. The usual arms were blunted lances or swords; but the ordinary arms of warfare, called arms *à l'outrance*, were sometimes used by cavaliers who were ambitious of special distinction. The prize was bestowed by the lady of the tournament on the knight to whom it had been adjudged, he reverently approaching her, and saluting her and her two attendants. The period when tournaments were most in vogue comprised the twelfth, thirteenth, and fourteenth centuries; and the place where the most celebrated English tournaments were held was the tilt-yard near Saint James's, Smithfield, London. The Church at first discountenanced tournaments, some of its decrees prohibiting persons from engaging in them under pain of excommunication, and denying Christian burial to a combatant who lost his life in one. The Church seems, however, to have looked with more favor on these combats after the middle of the thirteenth century. During the fifteenth and sixteenth centuries tournaments continued to be held, but the alteration in the social life and warfare of Europe had changed their character, and they are rather to be regarded as state pageants than as real combats. The death of

Henry II. of France, in 1559, consequent on the loss of his eye at a tournament, led to their general abandonment, both in France and elsewhere.

Military Tournaments. The modern military tournament embraces all the personal skill in the use of arms of the ancient chivalric tournament and has much of its pageantry. New inventions and contact with many nations have incorporated into military necessities and pastimes many novelties unknown in ancient times, and these find their supreme exposition in the national tournaments of both America and England. There is no mystery about the origin of the modern military tournament; data, place, and reason are all available. In 1878 the Staff of the Military Gymnasium, Aldershot, gave an exhibition of military exercises at the Albert Hall in London in aid of the widows and orphans of the British soldiers killed in the Zulu war. It was of necessity very limited in its functions; but the next year a fully organized competition in the use of weapons of offense and defense, between all branches of the service, cavalry, infantry, artillery, engineers, and hospital corps, was held. The programme was (and still is) practically divided into two parts: one coming strictly within the line of military duty, such as feats of strength and skill with sword, lance, sabre, and bayonet, and horsemanship, including riding and driving; the other division consisting of sports and pastimes, such as tent-pegging, mounted wrestling, etc. To such an extent did the desire to compete extend in Great Britain that it has become necessary to impose the restriction of passing through and obtaining the first place in merit in a district tournament as a condition precedent to competition at the national tournament. The peg used in tent-pegging is an ordinary wooden tent-peg three inches broad and a foot long, driven nearly perpendicular into the ground until less than one-half of it is in sight. The trooper rides at the gallop, strikes it if possible, and without relaxing the grasp of his lance or the speed of his horse, wrenches the peg out of the ground and carries it away on his lance point. In America the military tournament held each year in Madison Square Garden, New York, has become a recognized institution. It differs from the British tournament in that the latter consists of competitions as well as of exhibition performances, while in America it is made up entirely of exhibition work. The cadets of West Point invariably take part in the tournaments, which have been regularly held since 1897.

TOURNAY, t͞oor′nȧ′, or **TOURNAI**. The capital of an arrondissment and the largest town in the Province of Hainault, Belgium, 48 miles south by west of Ghent, on the Scheldt River, here spanned by several bridges (Map: Belgium, B 4). The most striking edifice is the twelfth-century Cathedral of Notre Dame, in the Romanesque style. The nave, dating from 1146, and the façade with its porch and sculptures are of special interest. Other architectural features of the town include the twelfth-century belfry, the Church of Saint Quentin, in the Transitional style, the Church of Saint Brice, with the tomb of Childeric, and the Church of Saint Jacques. The thirteenth-century bridge, the art gallery, the museum of natural history, and the old monastery buildings, now utilized as the municipal headquarters, are also noteworthy. The public library has 60,000 volumes. Manufacturing is the principal industry, the town being noted for its carpets and high-grade porcelain. Cotton and woolen goods, linen, and liquors are also produced. Population, in 1900, 37,069. Tournay, the ancient *Civitas Nerviorum* or *Turnacum*, was for a time the capital of the kingdom of the Franks. A bishopric was founded here in 484. The town was at various times and for long periods a possession of France, which finally relinquished it in 1748. It is famous for the gallant defense made by its garrison, under the Princess d'Epinoy, against Alexander of Parma in 1581.

TOURNEFORT, t͞oorn′fôr′, Joseph Pitton de (1656-1708). A French botanist, born at Aix, Provence. After having explored the flora of his native district, he was sent, at the King's expense, to Spain, Portugal, England, and Holland, the Grecian Archipelago, and Thrace, the shores of the Black Sea, and Asia Minor, and other parts of the East, adding many species to the list of known plants. He published several botanical works, and a *Voyage to the Levant* (1717). His botanical system, which maintained its ground till the time of Linnæus, was of great use in promoting the progress of botany; but he rendered still greater service to science by grouping plants in genera.

TOURNEUR, tẽr′nẽr, Cyril (1575?-1626). An English dramatist. He found employment in the Low Countries, and served as secretary to Sir Edward Cecil in the expedition to Cadiz (1625). He is the author of two plays: *The Atheists Tragedie* (written about 1603; published 1611) and *The Revenger's Tragedie* (published 1607). The latter is a powerful though lurid tragedy. Tourneur also wrote elegies and other non-dramatic pieces. Consult his *Plays and Poems*, edited by J. C. Collins (2 vols., London, 1878); and the two plays edited, with Webster, by J. A. Symonds ("Mermaid Series," ib., 1888).

TOURNIQUET (Fr. *tourniquet*, turnstile, *tourniquet*, from *tourner*, to turn). An instrument for compressing an artery of the thigh or arm, either for the purpose of preventing too great a loss of blood in amputation, or checking dangerous hemorrhage from accidental wounds, or stopping the circulation through an aneurism.

The common tourniquet consists of three parts —viz. (1) a pad to compress the artery, (2) a strong band which is buckled round the limb, and (3) a bridge-like contrivance over which the band passes, with a screw whose action raises the bridge and consequently tightens the band.

To prevent the loss of venous blood during an amputation, it is customary to elevate the limb to a vertical position or to strap it with an elastic bandage for several minutes before the tourniquet is applied. The older forms of tourniquet are now almost universally replaced by a simple rubber strap or piece of rubber tubing which is passed several times around the limb under tension and fastened. This general type is known as Esmarch's tourniquet.

TOURS, t͞oor. A city of France, the capital of the Department of Indre-et-Loire. It is 147 miles southwest of Paris, in the rich level valley of the Loire, on the left bank of that stream, and extends two miles southward to the Cher (Map: France, G 4). The pleasant situation and the equable climate attract many English and American families as sojourners. Two great lines of boulevards, extending throughout the city, cross at its geographical centre, where the modern Palace of Justice adorns a fine square. In this square stands Fournier's bronze statue of Balzac. The famous stately French-Gothic Cathedral of Tours rises in the northeastern part of the city, near the river. It dates from 1170, was finished about 1550, and is exceptionally complete as to execution. The flamboyant turreted façade is sumptuous, and the rose window is of an exquisite pattern. Near the centre of the city are the striking detached towers of Saint Martin and Charlemagne—remains of the celebrated Church of Saint Martin marking the site of the tomb of the saint. The church was rebuilt about the twelfth century in splendid proportions. The structure was torn down in 1802, making way for a street. Near by the new Basilica of Saint Martin is being built. The ruined château Plessis-lès-Tours, identified with the life of Louis XI., and known to the lovers of Scott, lies just southwest of Tours.

The city has an art school, a large and a small seminary, the Collège de Saint Louis de Gonzaga, and a drawing school. The public library contains 100,000 volumes; also 1800 manuscripts, some of which are precious. In the archiepiscopal palace is a museum of archæology, paleontology, art, coins, etc. The Museum of Tours, near the river, has some 500 pictures of small value and collections of sculptures, enamels, antiquities, etc. The city has manufactures of steel, machinery, iron implements, silk stuffs, corsets, leather, confectionery, painted glass, pottery, and chemicals. There are printing works. The trade is very active, both by rail and by river. The population of the commune in 1901 was 58,409.

History. Tours, named from the Gallic tribe of Turones, was an active ally of Vercingetorex against the Romans. It was later the Roman Cæsarodunum. The place became at a very early date the seat of an important bishopric, which soon rose to the rank of an archbishopric. Numerous councils were held here. Tours was taken by the Visigoths in 473 and by Clovis in 507. It is famous for the momentous battle fought in the direction of Poitiers in 732, when Charles Martel (q.v.) repulsed the vast invading army of the Saracens. The city was the capital of Touraine (q.v.). It rose to great importance under the Valois kings, Louis XI. in particular favoring the city, which for a time was a great seat of the silk manufacture. The States General were repeatedly assembled here. In October, 1870, the Government of National Defense was organized at Tours, whence it was removed in December to Bordeaux. The Germans occupied the city from January 8 until March 8, 1871. Consult: Giraudet, *Histoire de la ville de Tours* (Paris, 1878); Grandmaison, *Tours archéologique* (Tours, 1879); Chevalier, *Tours capitale* (Tours, 1896).

TOURVILLE, tōōr'vēl', Anne Hilarion de Cotentin, Count de (1642-1701). A French admiral. He was born at Tourville, near Coutances, November 24, 1642. He entered the French Navy, and became a captain at twenty-five, having distinguished himself by service against the Turks and Algerians. In 1669 he participated in the French expedition for the relief of Candia, and in 1672-73 took part in the naval war waged by the combined fleets of France and England against the Dutch. He fought with distinction at Agosta, off the coast of Sicily, in April, 1676, and received the command of a squadron with which in June of the following year he won a decisive victory over the allied British and Dutch off Palermo (June 2d). He became lieutenant-general of marine, and from 1682 to 1688 saw active service against the Barbary pirates, varied by his share in the bombardment of Genoa in 1684. In 1689 he was made a vice-admiral and commanded the French fleets in the operations against England and Holland. In June, 1690, he entered the English Channel at the head of a powerful fleet, and inflicted a disastrous defeat on the united English and Dutch armament near Beachy Head. In 1692, Louis XIV. having decided upon an invasion of England on behalf of James II., a fleet was assembled at Brest under Tourville in order to protect the descent. With 44 ships of the line Tourville assailed an Anglo-Dutch fleet of 82 vessels under Lord Russell off Cape La Hogue, and after a desperate fight was decisively beaten (May 29th). Tourville, however, suffered no discredit for this defeat, in which his talents and courage were abundantly displayed. In 1693 he was made a marshal of France, and in June defeated a British-Dutch fleet under Sir George Rooke off Cape Saint Vincent, capturing 27 ships of war and merchant vessels and destroying 45 others. He was subsequently charged with the defense of the Mediterranean coasts of France, but saw no active fighting. He died in Paris, May 28, 1701. Fraudulent *Memoires* in Tourville's name were published in 1742-58. Consult Delarbre, *Tourville et la marine de son temps* (Paris, 1889).

TOUSSAINT, tōō'săN', Anna Louisa Geertruida (1812-86). A Dutch novelist, born at Alkmaar, of parents descended from French Protestant refugees. In 1851 she married the architectural painter Jan Bosboom (1817-91) and thenceforth lived at The Hague. The reputation won with her first works, *Almagro* (1837), *De Graaf van Devonshire* (1838) and *De Engelschen te Rome* (1839), was enormously increased on the appearance of *Het huis Lauernesse* (1841, 10th ed. 1885), an historical romance of the Reformation, which was translated into several languages. Among her other historical novels, dealing mainly with English, Dutch, and Spanish scenes, the Leicester trilogy, *Leycester in Nederland* (1846), *De Vrouwen uit het Leycestersche tijdvak* (1849-50), and *Gideon Florensz* (1854-55), is the most remarkable. Subsequently she was eminently successful with modern character delineations, of which *Majoor Frans* (1874) is an excellent example. Fine artistic workmanship distinguishes her dialogue-tale *Raymond de schrijnwerker* (1880). For her life, consult Jan ten Brink (Amsterdam, 1886).

TOUSSAINT, François Dominique, called L'Ouverture (1743-1803). A Haitian soldier and statesman. He was born near Cape Français, in the island of Haiti, in 1743, and was a full-blooded negro, his father and mother both being African slaves. He was coachman and afterwards assistant to the overseer of his master's sugar plantation, and acquired some little education, which he used to good advantage. When the French Revolution, which largely affected the fortunes of French Haiti, broke out, he was the overseer of his master, a planter named De Libertat. The population of French Haiti in 1790 numbered about 500,000, of whom 38,360 were Europeans, 28,370 free mulattoes, and the remainder negro slaves. There were thus three sharply defined castes with different interests. The Europeans jealously guarded all political privileges. The free mulattoes were nevertheless an intelligent class and large property-owners. A decree of the French Constituent Assembly, May 15, 1791, gave to all free persons of color the privileges of French citizenship, but the white planters of Haiti, an arrogant colonial aristocracy, did everything in their power to delay the application of the decree. On August 23, 1791, the slaves became a factor in the problem by rising in a fierce insurrection, which led whites and mulattoes to drop their quarrel in the face of a common danger. Toussaint took part in the uprising, and won a prominent place among the leaders of the insurrection. The revolt was temporarily suppressed, but the repeal by the French Assembly in May, 1792, of the decree of 1791, alienated the mulattoes, throwing them on the side of the negroes, and reopening the civil war. For a while Toussaint took service with the Spaniards in the east of the island, with whose aid he overran a part of the French territory. Commissioners from France attempted to settle the troubles of the island and finally proclaimed universal freedom in August, 1793. This decree was ratified by the National Convention a few months later. This won Toussaint over to the side of the French Republic, and he came to the front as the recognized leader of his race. The English at this time had seized Port au Prince, and were besieging the French Governor, Laveaux, in Port de la Paix. Toussaint went to his assistance, and it was Laveaux who, by his exclamation, *Mais cet homme fait ouverture partout*, gave Toussaint the surname *l'Ouverture*, by which he has since been known. Toussaint was made a general of division and acted with great vigor against the Spanish, who had been seeking to secure control of the western part of the island. In 1796 Toussaint was made commander-in-chief of the French forces on the island, and signalized himself in the following year by compelling the surrender of the English who had invaded Haiti. He soon came into conflict with Hédonville, the French Commissioner, whom he compelled to sail for France. Hédonville, however, had succeeded in stirring up dissension between the negroes and the mulatto element, and in 1799 a fierce civil war was waged between the blacks under Toussaint and the mulattoes under General André Rigaud. After being reduced to desperate straits Toussaint finally, in December, 1799, succeeded in crushing his opponent. By January, 1801, he had brought the whole island under his power. He now became virtually a dictator, but ruled the island with moderation and firmness, and with justice toward the different classes of the population. The prosperity of the island revived under his measures. His private life was rational and modest, but in public he assumed an elaborate state for the purpose of impressing his followers. He had an administrative council of nine, eight of whom were white men. A constitution was drawn up, providing for free trade and naming Toussaint life President. This was submitted to Napoleon, who saw in it a move toward independence (which it probably was), and determined to put down the Haitian leader. After the Treaty of Amiens had freed him temporarily of danger from England, the First Consul proclaimed the reëstablishment of slavery in the island. Toussaint replied by a declaration of independence in July, 1802. Napoleon sent General Leclerc with 30,000 men to reduce the Haitians to submission. Leclerc was joined by many of Toussaint's enemies, among them being Rigaud, and the future rulers, Pétion and Boyer. The French commander, after failing to obtain possession of Toussaint's person by treachery while conducting his campaign, sought to arouse discontent among Toussaint's followers and to bribe his officers with flattering promises. He was slowly gaining ground in this campaign of deceit and force combined, when he foolishly announced his intention of restoring slavery and thereby united the negroes once more about their leader. Leclerc then recalled his blundering declaration, promised liberty and a general representative assembly, and won over several of the negro chiefs, who were finally joined by Toussaint, anxious as he always seems to have been for the greatest good of his people. He was treacherously arrested after he had made his submission, taken to France and imprisoned without trial in the Château Joux, near Besançon, where he died April 27, 1803, from cruelty and neglect. The negroes were roused to fury by this treachery and renewed the war. They succeeded in driving out the French in the same year that Toussaint died. Toussaint l'Ouverture is perhaps the most conspicuous example of the possibilities, intellectual and moral, of the pure-blooded negro, even without especially favoring conditions. Consult the *Mémoires* by himself (1853); Saint Remy, *Vie de Toussaint l'Ouverture* (Paris, 1850); Beard, *The Life of Toussaint* (London, 1853); Gragnon-Lacoste, *Toussaint L'Ouverture, général en chef de l'armée de Saint Domingue, surnommé le premier des Noirs* (1877), based on the l'Ouverture family papers.

TOWAGE (from *tow;* connected with AS. *tēon*, Goth, *tiuhan*, OHG. *zogan*, *ziohan*, Ger. *ziehen*, to draw, Lat. *ducere*, to lead). Assistance in propelling or drawing rendered by one vessel to another. Towing is usually done by tugs, but the service may be performed by any sort of a vessel. A vessel thus assisted is commonly referred to as a *tow*. A tug is not held to the strict responsibility of a common carrier, and is liable only for lack of reasonable skill in such service, and for negligence. The master of the tug is obliged to see that the tow is properly made up, having regard to the voyage to be made; must have skill in navigation, and be reasonably familiar with the course to be followed. The master of the tow must follow all reasonable orders of the master of the tug as to steering, etc. A tug should not abandon a tow, except in cases of extreme necessity, and, in general, it may be said that it must seem inevitable that the tug will be lost unless the tow is abandoned in order to justify that course. The charges for towage constitute a maritime lien upon the tow, which will follow it until paid. All questions of towage are governed by admiralty law. Consult the authorities referred to under ADMIRALTY. See RULES OF THE ROAD.

TOWAN′DA. The county-seat of Bradford County, Pa., 80 miles northwest of Wilkesbarre, on the Susquehanna River, and on the Lehigh Valley Railroad (Map: Pennsylvania, E 2). It has the Susquehanna Collegiate Institute and a public library. Towanda is the shipping centre of a rich farming section, but is primarily known for its industrial interests. There are a large toy manufactory, furniture and shoe factories, a flour mill, foundry and machine shops, planing mills, etc. The government is vested in a burgess, chosen every three years, and a council. Towanda was settled in 1770, and was first incorporated in 1828. Population, in 1890, 4169; in 1900, 4663.

TOWER (AS. *tur*, from Lat. *turris*, Gk. *τύρρις*, *tyrris*, *τύρσις*, *tyrsis*, tower). Generally, except in fortresses (see FORTIFICATION), a building higher than its horizontal dimensions. The round towers of Ireland have been much discussed, and various fantastic explanations have been given for their appearance in the island in considerable numbers. The round tower accompanying a church in the mountain regions of Spain, or in the flatlands of Northern Italy, is admitted to be a bell-tower of an ancient type; but those of Ireland have such small window-openings that it is evident that no pains were taken to let the sound of the bells reach the community outside. These towers are, moreover, very slender, high, and costly in comparison with the very humble churches which stand near them; and the soundest conclusion seems to be that they were intended partly as watch-towers, partly as places for the deposit of valuables in the case of sudden forays. These round towers of Ireland are wholly without architectural effect. On the other hand, the Tower of Sant' Apollinare in Classe, near Ravenna, is an interesting architectural design, although it has lost its belfry story; and that of Sant' Apollinare Nuovo, within the city, is one of the most beautiful towers in Italy. Each of these bell-towers is of circular plan. Another form of round tower worthy of special note is the minaret of the Mohammedan cities. See MINARET.

In antiquity the tower was a rare thing, used only for defense, and occasionally for lighthouse purposes, though the form of those buildings is not accurately known. In the Far East the tower is associated with the double purpose of commemoration and religious sacrifice, in such builds as the Stupa and Tope (q.v.) of Southern Asia, and the Paoh-Tah or octagonal tower of China. The lofty wooden structures connected with the Buddhist temples of Japan are, like the Indian and Chinese towers, emblematic and commemorative rather than useful in any way; they are the central and culminating feature of the temple-group and no more. (For the wide use of the tower in Mohammedan architecture, see MINARET.) In the Christian world, the tower appears in Italy at an early time, and in the North at least as early as the eighth century. In the North, at least, its obvious purpose of carrying large bells high above the roofs of neighboring buildings is complicated with a certain adaptation of the structure to purposes of defense against an enemy. In Italy the detached and separate tower (see CAMPANILE) held its own until the complete disappearance of mediæval architecture in the fifteenth century; but in the North it is found incorporated with the main structure of the Church at a period at least as early as the eleventh century. The tower generally stands upon the ground, with its vertical lines easily seen from foundation to summit; and this remains true throughout the Middle Ages except for the central towers of the cruciform churches. These last-named towers are built over the open interior, and are supported on four great arches or groups of arches, two of which span the nave, springing across the church from side to side, while two others continue the wall of the nave longitudinally. The complete Gothic cathedral has at least seven towers, two to the west front, four to the transept fronts, and one over the crossing. These towers all resemble one another in their appearance as seen from without. Throughout Italy the classically designed churches are apt to retain their mediæval campanili. Consult Sutter, *Turmbuch* (Berlin, 1895).

TOWER, tou′ẽr, CHARLEMAGNE (1848—). An American capitalist and diplomat, born in Philadelphia. He was educated at Harvard. From 1882 to 1887 he was president of the Duluth and Iron Range Railroad and managing director of the Minnesota Iron Company. He then removed to Philadelphia, where during the next ten years he was an officer in various important corporations. He was United States Minister to Austria-Hungary from 1897 to 1899, and was Ambassador to Russia from 1899 to 1902, when he replaced Andrew D. White (q.v.) as Ambassador to Germany. He published: *The Marquis de La Fayette in the American Revolution* (2 vols., 1895); and *Catalogue of a Collection of American Colonial Laws* (1890).

TOWER, ZEALOUS BATES (1819-1900). An American soldier, born at Cohasset, Mass. He graduated with first honors at West Point in 1841; served under General Scott in the Mexican War; led the storming column at Contreras, and was wounded at Chapultepec. At the outbreak of the Civil War he was chief engineer in the defense of Fort Pickens. In November, 1861, he was made brigadier-general of volunteers, and on August 30, 1862, was severely wounded at Manassas. After recovering he was superintendent of West Point from July until September, 1864. He then became chief engineer of the defenses of Nashville, Tenn., and his skillful work at that place contributed to the total defeat of General Hood in December, 1864. He was brevetted major-general in the United States Army in March, 1865, and in November of that year became lieutenant-colonel in the engineer corps. He was promoted colonel in January, 1874, and retired in 1883.

TOWER BRIDGE. A drawbridge spanning the Thames just below the Tower of London, opened in 1894. The carriageway, at a height of 29½ feet, consists of two approaches of 270 feet, and a central span of 200 feet, with a rising draw formed by twin bascules, which can be raised in 1½ minutes. There is an elevated footway above the draw, which is used when the draw is open, 142 feet above the river, reached by elevators and stairs. The Gothic towers are of steel and masonry. The cost was over £1,000,000.

TOWER HILL. An elevation northwest of the Tower of London, formerly the public place of execution for persons sentenced for treason. Here many of the most noted men of England were put to death, their bodies being buried in the adjacent Chapel of Saint Peter ad Vincula.

TOWER OF LONDON. In feudal days a powerful fortress, and long afterwards a State prison of gloomy memories. It is now a Government storehouse and armory. It is a collection of buildings in the form of an irregular quadrilateral on rising ground adjoining the Thames, on the north bank and immediately to the east of the City of London. The space occupied is between twelve and thirteen acres, and the whole is surrounded by a broad but shallow moat. Usually the moat is dry, but the garrison can flood it by sluices from the Thames. The moat is bordered within by a lofty castellated wall, with massive flanking towers at frequent intervals. Within this wall rises another of similar construction, but of greater height, within which are the various barracks and armories; and in the centre of all is the lofty keep or donjon known as the White Tower. This last named building, erected by the Bishop of Rochester, in the time of William the Conqueror, is the most interesting in the whole structure. Its walls are in parts 16 feet thick, and of solid masonry. The White Tower was the Court of the Plantagenet kings, whereas the various other towers are principally noteworthy on account of the illustrious prisoners who have been confined in them. In the northwest corner of the quadrangle is Saint Peter's Chapel, now the garrison church. In another part is the Jewel Office, containing crown jewels of enormous value, crowns, sceptres, golden dishes, tankards, saltcellars, and other plate and jewelry. Near this building is the Horse Armory, which contains a collection of ancient and mediæval arms and armor, the latter exhibited in complete suits on wooden figures of men and horses. Some of these figures represent English kings arrayed in the armor which the kings actually wore while living. To the Jewel Office and the Armory visitors are admitted on payment of a small fee.

Early writers have alleged that Julius Cæsar built the Tower of London as a Roman fortress. The spot was in fact occupied by some structure before the time of William the Conqueror, as is shown by the massive foundations discovered in the course of later erections; but of the nature of these earlier buildings we know little. The White Tower, already mentioned, is the beginning of the historical Tower of London. During the reigns of the first two Norman kings, the Tower seems to have been used as a fortress merely. In Henry I.'s time it was already a State prison. That monarch and his successors gradually increased the size and strength of the ramparts and towers, until the whole became a great feudal stronghold. The kings frequently lived there, holding their courts, and often sustaining sieges and blockades at the hands of their rebellious subjects. On the accession of Queen Elizabeth, however, the Tower ceased to be a palace. Of the long list of executions for political offenses which it witnessed, those of Lords Kilmarnock, Balmerino, and Lovat, after the rebellion of 1745, were the last.

In 1841 a fire broke out in the Bowyer Tower, and extended to the armories, causing the destruction of numerous modern buildings and many thousand arms. At present the Tower of London is in charge of the War Department, and contains arms and accoutrements for the complete equipment of a large army. The mint and public records were formerly kept in it, but have now been removed to more suitable buildings. The government of the Tower is vested in a constable, who has great privileges, and is usually a military officer of long service and distinguished rank, whose position is honorary; the deputy constable, also an officer of repute, is the actual governor. He has under him a small staff and the corps of yeomen of the guard, more commonly known as 'beef-eaters.' (See BEEF-EATER.) Consult: Dixon, *Her Majesty's Tower* (London, 1869-71); Loftie, *Authorized Guide to the Tower of London* (London, 1886); Temple, *Tower of London, Its History and Contents* (London, 1876).

TOWER OF THE WINDS. An octagonal building, north of the Acropolis of Athens, belonging to the second or first century B.C. The tower, 42 feet high and 26 feet in diameter, bears on the upper part of each side the representation of a wind. It was originally surmounted by a bronze weather-cock in the form of a Triton. Besides indicating the direction of the wind, the exterior walls were marked to serve as a sundial, and there appears to have been connected with the tower a water clock, the method of operating which has not been clearly ascertained.

TOWER-SHELL.

TOWER-SHELL. One of the elongated, tightly coiled shells of the gastropods of the family Turritellidæ, allied to Vermetus (see WORM-SHELL), about 100 species of which are known from the warmer seas, and many fossil forms. Most of them are covered with a brownish epidermis, which, when removed, exhibits a delicately sculptured and often finely colored surface. Only the lower part of the spiral is occupied by the adult animal, the distal half of the shell being partitioned off.

TOWERS OF SILENCE. The structures upon which the Parsis (q.v.) and Ghebers (q.v.) expose the bodies of their dead to be devoured by vultures or dogs in accordance with the precepts of their religion as taught by Zoroaster (q.v.). The prescription for building these structures is as old as the Avesta (q.v.) where they are described and called Dakhmas. The best modern specimens are to be seen on Malabar Hill. Bombay, India, and across the Bombay Harbor at Ooran; there is also one near Teheran and another near Yezd in Persia, where the ruins of a deserted 'tower' are likewise to be seen. The older shape of the Dakhmas seems to have been rectangular; the modern towers are circular, but less high than might be imagined. The best constructed are of massive stone or of bricks covered with cement. They are 20 or 30 feet high, 75 to 100 in diameter, and they resemble huge gas reservoirs in form. The top is open to the sky; the floor below is built of large slabs resembling flagging-stones; in each slab is a slight depression called a *pavi* in which the body is laid for the 'heaven-sent birds' to devour. Small ducts lead from every pavi into the central pit where the bones are placed after the body has been denuded of flesh by the vultures, which is accomplished in a few hours. From this central well there run four carefully constructed drains, at right angles, to carry away any deposit that might remain and conduct it through chalk, quicklime, sand, and other absorbents lest the earth might be defiled by its contact. There is little, however, to be led off thus, for the tropical sun soon parches the bones and reduces them to dust. Herodotus (*Hist.* i. 140) alludes to this method of disposing of the dead in ancient Iran, and the Zoroastrians, who have kept it up till the present day, maintain that it is a solution of the sanitary question even in plague times. See Karaka, *History of the Parsis* (London, 1884); Modi, *A Tower of Silence* (Bombay, 1885); Jackson, "The Parsee Towers of Silence," in the *Evening Post*, June 8 (New York, 1901).

TOWLE, tōl, George Makepeace (1841-93). An American historian and journalist, born in Washington, D. C. He graduated at Yale in 1861, and at the Harvard Law School in 1863, and practiced law in Boston. He was United States consul at Nantes (1866-68), and at Bradford, England (1868-70), was editor of the Boston *Commercial Bulletin* (1870-71), an editor of the Boston *Post* (1871-76), and later was connected with *Appleton's Journal, The Art Journal,* and *The Youth's Companion.* His works include: *History of Henry the Fifth, King of England* (1866); *The Eastern Question* (1877); *Principalities of the Danube* (1877); *Beaconsfield* (1878); *Young Folk's Heroes of History* (1870-82); *Modern France, 1851-79* (1879); *Certain Men of Mark* (1880); *England and Russia in Asia* (1885); *England in Egypt* (1885); *Young People's History of England* (1888); and *Young People's History of Ireland* (1887).

TOWN (AS. *tūn*, OHG. *zūn*, Ger. *Zaun*, hedge, inclosure; connected with Ir. *dūn*, Welsh *din*, hill fort). The name applied generally throughout the United States to small municipalities or urban communities between the village and the city. In New England it more often denotes a quasi-corporate area, either urban or rural, constituting a subdivision of the county, which elsewhere is usually called the township or supervisor's district. (For the urban town, see Municipality and Municipal Corporation.) The New England town is the most important local administrative unit in the governmental system. The centre of political activity is the 'town meeting,' which meets usually once a year and may be attended by all the legal voters of the town. It discusses measures of common interest to the town, elects the town officers, and votes the taxes for the ensuing year. The government of the New England town is, therefore, a pure democracy, and the only real example of the kind in the American political system. The 'town meeting' governs through a body of officers, varying according to the needs of the community. These are usually the selectmen, varying in number from three to nine, who are the executive magistrates of the town, the town clerk, treasurer, constables, tax assessors, overseers of the poor, and school trustees. In some towns there are such officers as field drivers, pound-keepers, fence-viewers, measurers, sealers, etc. In England the word town applies to the small municipalities as in the United States, although the word borough is used to designate certain of the old towns. See Township. Consult: Ashley, "The Anglo-Saxon Township," in *Quarterly Journal of Economics;* Adams, *Study of Church and Town Government* (1892); Bryce, *American Commonwealth* (London and New York, 1900).

TOWN HALL. A building for the legislative and administrative business of a town or city. In the wider sense it comprises two chief divisions, the public offices of the Mayor and various municipal administrations, and the chambers for the meetings of the legislative bodies of the city (Aldermen and Council). In small towns court rooms and a jail are added, and a large public hall is also often provided. A belfry and clock-tower is a feature of nearly all French, German, Flemish, and British town halls, and of many of the more notable American examples. The French treat with especial effectiveness the entrances, lobbies, and grand stairways of their town halls.

The oldest examples of the town hall in Europe belong to the Middle Ages. They date from the time of recognition of the right of municipal self-government, of which they are the expression. In Southern France the town hall of Saint Antonin (twelfth century) is one of the oldest in Europe. In Italy there grew up by the thirteenth century almost as many States as cities, each of which provided itself in time with one or more municipal buildings according to its particular form of administration. Of these the greater part date from the late thirteenth and the fourteenth centuries, some of the most important being those at Cremona (1245); at Sienna the superb red brick Palazzo Pubblico with its slender tower (1289); at Pistoia the two palaces del Podesta and del Comune (1294-1385); at Florence the vast Palazzo Vecchio (1298), with its impressive tower overhanging the street; the Doge's Palace at Venice; the elegant Palazzo del Consiglio at Verona (1473). The Renaissance added but few to the Italian list. In Germany the *Rathaus* or Municipal Council house appears in the fourteenth century (e.g. Brunswick), but the finest and most numerous examples belong to the Renaissance, as at Bremen, Cologne, Lübeck, Altenburg, Augsburg, and Nuremberg, with picturesque towers and high gables. But few mediæval town halls remain in France, that of Compiègne being the finest (late fifteenth century).

The Renaissance gave France the fine town halls of Beaugency, Reims, Rouen, Lyons, and Paris, the last two now replaced by modern edifices, recalling the original structures. The Paris example is the largest and most splendid of modern town halls, especially in its interior decorations. Very notable are the sumptuously ornate Belgian town halls of the fifteenth century at Brussels, Louvain, Ghent, Bruges, and Oudenarde and the fine Renaissance structure at Antwerp. In Great Britain it was not until the nineteenth century that the town hall became important; it forms one of the most interesting and successful subjects of recent architectural design, as, for example, at Sheffield and at Oxford. The splendid new town hall at Hamburg is the finest of recent German works in the same line, far superior to the modern Gothic town hall at Vienna.

In the United States the Philadelphia City Hall is the largest and ugliest of modern examples; that at New York, dating from 1809, one of the most refined and elegant. The earlier town halls of the United States follow Colonial or 'Greek revival' models; the more recent are in the style of the French Renaissance or in what may be called the neo-Roman style. The majority lack distinctive architectural merit of a high order, but recent designs show improvement, and there are a few among them worthy of high praise. See MUNICIPAL ARCHITECTURE.

TOWN'LEY, CHARLES (1737-1805). An English collector of classical antiquities, born in Lancashire. He was educated on the Continent under the tutorship of John Tuberville Needham, and upon visiting Rome and Florence, in 1765, became interested in the study of antiquities. He received much helpful advice from Winckleman and other archæologists, and in 1768 began his collection of antiquities. After returning to England in 1772, he bought two houses in London, where he established his museum. He made frequent visits to Rome, and until 1780 continued to add to his acquisitions, including the Nollekens (q.v.) collection. In 1786 he was made a member of the Society of Dilettanti, and in 1791 trustee of the British Museum. He died in Westminster, January 3, 1805. The Townley marbles and terra-cottas were purchased for the British Museum for £20,000, and in 1814 his bronzes, coins, gems, and drawings were also acquired. His collections in the Museum are described and illustrated by Ellis, *Townley Gallery* (London, 1846).

TOWNLEY, JAMES (1774-1833). An English minister of the Wesleyan denomination. He was born in Manchester. His early education was gained in the school of the Rev. David Simpson, of Macclesfield. He joined the Wesleyan Conference in 1796, and was elected secretary of the Wesleyan Missionary Society, 1827. As a scholar he was second only to Adam Clarke in the denomination. His most important work was *Illustrations of Biblical Literature, Exhibiting the History and Fate of the Sacred Writings, Including Notices of Translators and Other Eminent Biblical Scholars* (3 vols., 1821; 2 vols., 1842).

TOWNLEY, JAMES (1714-78). An English clergyman, born in Barking, near London. He was educated at the Merchant Taylors' School, London, and at Saint John's College, Oxford. After holding various preferments in the Church, he was appointed, in 1760, head-master of the Merchant Taylors' School, and in 1772-77 was vicar of Hendon, in Middlesex. He is best remembered as the author of the satirical farce *High Life Below Stairs* (Drury Lane, October 31, 1759), which has been translated into French and German, and has been performed throughout the world. It was formerly attributed to Garrick. Two other farces written by Townley did not succeed. Consult Genest, *Account of the English Stage*, vol. iv. (Bath, 1832).

TOWNS'END, EDWARD WATERMAN (1855—). An American journalist and novelist, notable for his studies of lower New York life and dialect. He was born in Cleveland, Ohio. After a common-school education, he became engaged in journalism in New York, and attracted attention by sketches of Bowery life done in the picturesque slang of the streets, and contributed to the *Sun* and the *Journal*. These are collected in part under the titles *Chimmie Fadden and Major Max* (1895); *Chimmie Fadden Explains, Major Max Expounds* (1895); and *Near a Whole City-Full* (1897). *A Daughter of the Tenements* (1896) and *Days Like These* (1901) are novels, also of New York life. Later books are *Chimmie Fadden and Mr. Pard* (1902) and *Lees and Leaven* (1903).

TOWNSEND, GEORGE ALFRED (1841—). An American journalist, born in Georgetown, Del. He was educated in Philadelphia, and was successively connected with the *Inquirer* and *Press* of that city, the New York *Herald* and *World*, and the Chicago *Tribune*. He first gained distinction as a war correspondent. Among his books the most noteworthy are: *Campaigns of a Non-Combatant* (1865); *Poems* (1870); *Washington Outside and Inside* (1871); *Tales of the Chesapeake* (1880); *The Entailed Hat* (1884); and a drama, *President Cromwell* (1885). Much of his newspaper correspondence was over the signature Gath.

TOWNSEND, LUTHER TRACY (1838—). A Methodist Episcopal theologian, educator, and author. He was born at Orono, Me., graduated at Dartmouth College, 1859, Andover Theological Seminary, 1862, and served as adjutant in the army, 1863-64. He entered the New England Conference, 1862, was professor of Hebrew and Greek in Boston University School of Theology, 1867, professor of historical theology, 1868, professor of practical theology, 1869-93, emeritus 1893—. The best known of his publications are: *Credo* (1869); *Sword and Garment* (1871); *The Supernatural Factor in Revivals* (1877); *The Intermediate World* (1878); *Pulpit Rhetoric* (1886); *Story of Jonah in the Light of Higher Criticism* (1897); *Evolution in Creation* (1899); *Anastasis* (1900).

TOWNSEND, THOMAS SEAMAN (1830—). An American compiler, born in New York City. From 1860 to 1901 he collected and arranged all important items concerning the Civil War that appeared in the newspapers of the country, thus forming a chronological history of incalculable value to future historians. This enormous collection of one hundred and twenty-five volumes is now in the Columbia University Library. It is entitled the *Townsend Library of National, State, and Individual Civil War Records*. He published *Honors of the Empire State in the War of the Rebellion* (1889).

TOWNSEND, WILLIAM KNEELAND (1849—). An American jurist, born at New Haven, Conn. He graduated at Yale College in 1871 and the Yale Law School in 1874. He engaged in legal practice at New Haven, and in 1892 was appointed judge of the United States District Court for the District of Connecticut, and in 1902 judge of the United States Circuit Court, second circuit. In 1881 he became professor of the law of contracts at Yale. He wrote *The New Connecticut Civil Officer.*

TOWNSEND'S WARBLER. A wood-warbler (*Dendrœca Townsendi*) of the Pacific Coast of the United States, black and yellow in colors (see Colored Plate of WOOD-WARBLERS), and having the general habits of its congeners. (See WARBLER.) It is not numerous, and lives in the mountain forests. This and several other birds of the West owe their names to the naturalist J. K. Townsend, who, in 1834, in company with Thomas Nuttall (q.v.), traveled overland to the Pacific Coast and brought to the notice of science many novel species of animals.

TOWNSHEND, toun′zend, CHARLES, second Viscount (1674-1738). An English statesman. A descendant of a very ancient English family of Norfolk, he succeeded to the peerage in 1687, was educated at Eton and King's College, Cambridge, and took his seat as a Tory in the House of Lords in 1697. He was named by the Godolphin Administration one of the commissioners for arranging the union with Scotland (1706); was joint plenipotentiary with Marlborough at Gertruydenberg; and negotiated with the States-General in 1710 the Barrier Treaty, which pledged the States-General to the Hanoverian succession, and England to procure the Spanish Low Countries for the United Provinces, as a barrier against France. In 1712, upon the formation of the Harley Ministry, Townshend was dismissed from his places, and the Barrier Treaty was censured by the House of Commons, which voted that Townshend and all who had been concerned in the treaty were enemies to the Queen and kingdom. This persecution raised him from the rank of a follower to the station of a leader. He maintained a close correspondence with the Court of Hanover, and obtained the entire confidence of George I., who on his accession to the throne of England made Townshend Secretary of State, with power to name his colleagues. He selected General, afterwards Earl, Stanhope, and formed a Ministry entirely Whig in its party character. He strengthened it by the addition of Walpole, who, from being at first paymaster of the forces, was soon made Chancellor of the Exchequer and First Lord of the Treasury. Through misrepresentations on the part of his colleagues, Townshend lost favor with the King, and was, in 1716, dismissed from office. After the breaking up of the South Sea Bubble, and the death of Sunderland (q.v.) and of Stanhope, Townshend again (1721) became Secretary of State. But he was no longer the acknowledged leader of the Whigs. The superior talent of Walpole, his financial abilities, and his influence in the House of Commons, caused a change in the relative position of the two Ministers, and converted the two men into rivals and enemies. Townshend, resigning the contest, retired to Rainham, to cultivate his paternal acres. "Never Minister had cleaner hands," said Chesterfield; and his reputation for both private and public integrity remains unsullied.

TOWNSHEND, CHARLES (1725-67). An English statesman. He was the second son of the third Viscount Townshend, and was educated at Leyden and probably also at Oxford. He entered Parliament in 1747, and attaching himself to Lord Halifax, he was given by him a position in the Board of Trade in 1748. In 1754 Townshend was made a Lord of the Admiralty, but resigned the following year. Becoming a member of the Privy Council under Pitt in 1757, upon the dissolution of the Whig Government in 1761 he was won over by Bute with an offer of the post of Secretary of War. On Bute's resignation in 1763 he was appointed president of the Board of Trade. After opposing the Grenville Administration he accepted the position of Chancellor of the Exchequer under Pitt in 1766. But Pitt soon lost control over his colleagues by his acceptance of the peerage and his long periods of illness, so that Townshend began to advocate measures to which Pitt was opposed. In 1767 his first budget was rejected, and he thereupon proposed those taxes on certain goods imported into America which ultimately caused the Revolution. Townshend himself did not live to see this result, but died suddenly on September 4, 1767. He was ranked as an orator with Pitt, and was far more popular than the Great Commoner with the House of Commons. At present he is chiefly remembered on account of the policy which led to the American Revolution. Consult: Fitzgerald, *Charles Townshend, Wit and Statesman* (London, 1866); Cobbett, *Parliamentary History of England to 1803* (London, 1806-20).

TOWNSHIP (AS. *tūnscipe,* from *tūn,* inclosure, town + *-scipe,* Eng. *-ship*). A minor political or territorial division in England and the United States. In England, in Anglo-Saxon times, as a political unit it was known as the *tunscipe;* as an ecclesiastical area it was the parish. As a political unit it had a popular assembly (tun moot); as an ecclesiastical unit it had a vestry meeting. The chief executive officer was the tun reeve. He with the priest and four other persons represented the township in the popular assembly of the hundred and county. Upon the settlement of the American colonies the township was transplanted to America, and still survives, like many other political institutions of English origin. Here it is a subdivision of the county, and its political importance varies with the locality of the State. In New England, under the name of the town, it plays a far more important part in the work of the local administration than the county—in fact, it performs most of the business of local government which in the Southern States is attended to by the county. (See TOWN.) In the Middle and Western States the township plays a somewhat less important part in the work of the local government than it does in New England, the county there sharing with the township many of the important functions of local government.

In the Southern States the township is not an administrative unit of much importance. On account of early social and political conditions there, the county has been from the first the chief unit of local government, although there are signs of development in the Southern township which may increase its administrative importance in the future. In some of the Middle and Western States the town meeting exists, having been transplanted from New England. Elsewhere the chief governing authority is a township board. The township has a quasi-corporate capacity, being able to own real estate and to sue and be sued, but in performing public governmental duties it acts for the State and cannot be held liable for the negligence or tortious acts of its agents. The word township is also applied to the units of the Congressional survey in some of the Southern and Western States, these being rectangular areas 6 miles square, each of which is subdivided into 36 sections containing 640 acres. (See diagram under SURVEYING.) This is probably the most simple system of land division yet established. The Congressional township, as it is sometimes called, is not a public corporation or juristic personality, but a geographical convenience. Consult: Ashley, "The Anglo-Saxon Township," in *Quarterly Journal of Economics;* Bryce, *American Commonwealth* (London and New York, 1900).

TOWNS'VILLE. A fortified seaport on the east coast of Queensland, Australia, situated on Cleveland Bay, at the mouth of Ross Creek, 748 miles northwest of Brisbane (Map: Queensland, E 5). It has a cathedral, court-house, technical school, barracks, etc. Its industrial establishments include foundries, distilleries, and meat-packing establishments. It is the terminus of the railway from Hughenden, 236 miles inland, and has an extensive shipping trade; the harbor is tidal, and has been much improved by two long breakwaters, large vessels being enabled to enter. Population, in 1901, 12,717.

TOW'TON. A parish in Yorkshire, England, about 11 miles southwest of York, noted as the scene of a decisive victory gained by the Yorkist forces under Edward IV. and the Earl of Warwick over the Lancastrians, commanded by the Duke of Somerset and the Earl of Northumberland, March 29, 1461. The battle is said to have been the most sanguinary ever fought on English soil and according to a contemporary statement twenty-eight thousand men were left dead upon the field. The victory secured Edward IV. (q.v.) in possession of the throne. See ROSES, WARS OF THE.

TOXICOLOGY (from Gk. τοξικόν, *toxikon*, poison, neu. sg. of τοξικός, *toxikos*, relating to the bow, from τόξον, *toxon*, bow, so called because first used to poison arrow-points + -λογία, *-logia*, account, from λέγειν, *legein*, to say). The branch of medical science which treats of the nature of poisons, of their morbific effects on the animal system, of their detection in the organs or tissues of the body, of their antidotes, of the treatment of poisoning, and, finally, of the legal questions connected with poisoning. A poison may be defined as any substance which when applied to the body or introduced into the system, in whatever manner, produces death or serious bodily harm. Poisons may enter the body in various ways. The mouth is the usual channel. Poisons may be absorbed by the skin in amounts sufficient to cause death or severe toxic symptoms, as in the case of lotions or salves containing opium, corrosive sublimate, arsenic, carbolic acid, etc. Gaseous or volatile poisons may enter the lungs through the inspired air, e.g. illuminating gas, carbon monoxide, or chlorine. Poisons may gain access to the circulation through ulcerated surfaces or wounds; by direct injection into the tissues, as by hypodermic injection, poisoned arrows, or snake-bites; or they may be introduced by way of the mucous membrane of the rectum, vagina, urethra, nose, or eye.

Most medicinal agents are poisonous if taken in sufficient quantity, and this quantity varies with the individual, the state of bodily health, fullness or emptiness of the stomach, habit, and other circumstances. The influence of habit is shown by opium habitués who take enormous doses of the drug without immediate evil effects. A special susceptibility to certain substances is noted in some individuals. This is called idiosyncrasy. Thus, five grains of quinine have nearly killed certain persons, or produced unpleasant symptoms, as blindness or deafness, in others. Races and individuals, on the other hand, may possess or attain a high degree of immunity to particular poisons; e.g. the Oriental is much less susceptible to opium than the European, and the latter bears alcohol better than savage races. In certain diseases there is a diminished susceptibility to the action of particular poisons, while in others there is increased sensibility. Thus in tetanus (q.v.), hydrophobia, mania, or delirium tremens, doses of various sedatives may be given with benefit which would in health prove fatal; on the other hand, when there is a predisposition to apoplexy an ordinary dose of opium may cause death. Some poisons are harmless when taken into the stomach, but violently toxic when injected beneath the skin.

Poisons may be classified according to their chemical properties or their physiological action. The latter is the usual and most satisfactory basis, and depends upon the effects of poisons upon the system when it is in a healthy condition. According to the physiological classification poisons are divided into two great groups, viz. (1) the *irritants* and (2) the *neurotics*. An *irritant* poison is one which when swallowed produces an irritant effect upon the mucous membrane of the alimentary canal, resulting in nausea, vomiting, purging, pain in the abdomen, cramps in the stomach and other parts of the body. This group is subdivided into (a) *corrosives*, whose action is chiefly local, and (b) the *true irritants*, whose local effects may be slight, but which produce their characteristic effect after absorption. Many drugs act in both ways; for example, oxalic acid and carbolic acid. A *neurotic* poison is one which acts chiefly on the nervous system, producing drowsiness (narcotic), giddiness, headache, delirium (deliriant), stupor, coma, convulsions (tetanic), or paralysis.

Before proceeding to a systematic consideration of poisons a few principles of the general treatment of poisoning may be given. The indications are (1) to neutralize and render harmless the poison by the administration of the proper antidote (q.v.); (2) to remove the poison from the body by inducing vomiting or washing out the stomach; (3) to combat the effects of the poison already absorbed, by giving drugs which are physiologically antagonistic to the one absorbed, and supporting life until the body rids itself of the poisonous substance through the natural excretory channels. Antidotes affect a poison either mechanically or chemically, or both, so as to remove it from the body or alter its character before absorption and thereby prevent its toxic action upon the organism. Mechanical antidotes include the use of the stomach tube or pump, the employment of emetics, cathartics, stimulants, injections, ligations, etc. The true or chemical antidotes include albumen, milk, charcoal, soap, starch, oils, tannin, turpentine, acids, alkalies, potassium, permanganate, sodium, chloride, iodine, iron, etc.

When a poison has been taken by the mouth the stomach should be emptied immediately by means of the stomach tube or emetics, except where there is severe corrosion and perforation of the stomach is feared. A prompt and certain emetic is apomorphine, which has the advantage of acting when given hypodermically. Domestic resources are usually limited to giving large draughts of mustard and warm water, warm milk in large quantities, oils, butter, and lard, common salt solution, soapsuds, and these often act with great promptness. Ipecac in the form of the syrup is found in most households and may be given in doses of one or two tablespoonfuls to adults or as many teaspoonfuls to children. It is a safe and unirritating emetic, but is too slow for emergencies. Other useful emetics are copper sulphate, zinc sulphate, turpeth mineral, and alum. In poisoning it is better to use almost any emetic at once than to lose valuable time getting just the right one. When poisoning is due to irritants after evacuation of the stomach, bland and viscid fluids should be given to protect the walls of the alimentary tract and allay inflammation. These agents are called demulcents, and include flaxseed tea, white of egg, milk, barley water, and the like. Where the poison has gained entrance by inoculation, as in the case of dog-bites or the stings of reptiles, the part should be washed, sucked, and a ligature applied about the extremity above the wound, i.e. between it and the heart. The wound should then be thoroughly cauterized.

The stomach having been emptied, the next step is to administer the proper antidote or physiological antagonist. (See ANTIDOTES.) In general it is to be remembered that alkalies counteract acids and *vice versa*, since they tend to form harmless salts. Poisoning by the irritant metallic salts is best treated with albumen, in the form of white of egg, an inert, insoluble albuminate being formed. The antidote for the vegetable alkaloids is tannin, most conveniently given in the form of strong green tea. Chemical antidotes act only on such portions of the poison as have not been absorbed by the stomach and must be given promptly to be of any use.

Physiological antidotes or antagonists follow the poison into the circulation and combat its effects as long as it remains in the body.

CORROSIVE POISONS include acetic, carbolic, chromic, lactic, oxalic, and salicylic acids; concentrated mineral acids (sulphuric, nitric, etc.); creosote; corrosive sublimate; the caustic alkalies (potassium and sodium dioxide, usually in the form of lye, ammonia, etc.); quicklime; potassium chlorate; and potassium nitrate. These act either on the surface of the body, causing deep and painful destruction of tissue, or internally, by producing intense gastro-enteritis and collapse. The symptoms common to the group are nausea, vomiting, pain, and purging, the vomited and dejected matters being mucous, serous, or bloody. The mouth and lips, hands and face, are frequently burned and corroded. Treatment consists in neutralizing the poison and the giving of demulcents. In the case of weak acids, magnesia, chalk, soap, and dilute ammonia may be given as antidotes; in the event of alkaline poisoning weak acids, such as dilute vinegar or lemon juice, may be given. When the poison is concentrated the stomach tube should not be used. Carbolic acid is probably the most frequently used of the corrosives, and is best antidoted with alcohol diluted and given up to four ounces. The sulphate of magnesia is also a perfect antidote.

TRUE IRRITANTS include, besides certain of the corrosive poisons already mentioned, bromine, cantharides, croton oil, chlorine, antimony, arsenic, copper chromium, lead, tin, zinc, phosphorus, and iodine. In concentrated form most of them cause irritation to the gastro-intestinal tract, but besides this show a specific action on various organs after their absorption by the blood. *Arsenic* is the most commonly employed of this group, accidentally or with homicidal or suicidal intent. The substance is widely used in the arts and is a constituent of some vermin exterminators. Poisoning may be acute or chronic. In acute cases the symptoms are those common to irritant poisons. The chemical antidote is known as 'arsenic antidote,' and may be prepared by adding ammonia water to tincture of iron. It must be freshly prepared. Arsenic poisoning is generally fatal, a small dose (1 to 3 grains) being sufficient to kill. Chronic poisoning by arsenic is also common as a result of inhalation or contact with the various arsenical greens used in coloring wall papers, carpets, etc., grinding arsenic in mills, and from vapors in smelling copper. The symptoms are gastric irritation, cough, sneezing, throat troubles, gradually failing health, and paralysis. See ARSENIC.

Lead poisoning may also be acute or chronic, the latter being the most usual form. Acute cases are due to the ingestion of the acetate (sugar of lead), carbonate, oxide, or chromate of lead and mainly painters suffer. The prominent symptoms are gastro-intestinal irritation, cramps in the legs and abdomen, followed by paralysis of the extremities, convulsions, and coma. The sulphate of magnesia (epsom salt) is the antidote, forming an insoluble sulphate of lead, and acting in addition as a purge. Chronic poisoning arises from handling paints, drinking water conducted in lead pipes, the use of cosmetics containing lead, and eating canned foods contaminated by solder. The symptoms come on insidiously and consist of a peculiar griping colic (lead colic), obstinate constipation, muscular cramps, paralysis of the extensor muscles of the forearms (wrist-drop), and a blue line at the junction of the gums and teeth. Chronic poisoning is treated by removing its source, and by the administration of Epsom salt and potassium iodide to eliminate the lead already absorbed. See LEAD.

Phosphorus poisoning is due to yellow phosphorus, commonly derived from matches or rat poisons. Workers in match factories are most usually attacked, although rat poison is sometimes taken with suicidal intent. The poison is very active and recovery is rare. The prominent symptoms in acute poisoning are vomiting of matters luminous in the dark, a smell of phosphorus in the breath, inflammation of the stomach and intestines, jaundice, convulsions, and coma. Treatment consists in washing out the stomach and the administration of old oil of turpentine, or potassium permanganate.

POISONOUS FOODS. There is a rather large group of foods which, owing either to their inherent properties (mushrooms and other fungi) or to the development of putrefactive bodies within them (ptomaines), produce symptoms of severe poisoning when eaten. The symptoms are very diverse, but intense gastro-intestinal irritation is common to all of them, and they may therefore be appropriately classed as irritants.

Mushroom poisoning arises through mistaking various fungi, such as mushrooms, toadstools, and truffles, for edible varieties. The toxic substance in many of these is muscarine, a deadly alkaloidal poison, producing violent vomiting, colic, thirst, dyspnœa, paralysis, and death.

Ptomaine poisoning is due to the products of putrefactive decomposition in animal or vegetable matter. The ptomaines are alkaloids and resemble chemically many of the vegetable alkaloids, thus leading to confusion or error in toxicological investigations. Not all ptomaines are poisonous and not all food poisons are ptomaines. The foods which sometimes produce symptoms of poisoning, whether ptomaine or other, are corned beef, sausage, pickled or decaying fish, putrid game, cheese, milk, shellfish, particularly mussels, and certain poisonous fish (such as crayfish, land crab, gray snapper, dolphin, etc.). The treatment of food poisoning, from whatever cause, is prompt evacuation of the stomach, preferably by the stomach tube, using plenty of water, and administration of tannic or gallic acid or strong tea. See PTOMAINES; MUSHROOMS.

NEUROTIC POISONS. These act principally through the nervous system, and as a rule produce little or no tissue change.

Alcohol may act as an acute or chronic poison. Its effects are fully considered under INTOXICATION.

Opium and its chief alkaloid *morphine*, laudanum, Majendie's solution (of morphine), and paregoric are often used for suicidal or homicidal purposes. Paregoric particularly is responsible for many cases of opium poisoning in children, being a common ingredient of soothing syrups. Acute opium poisoning is characterized by a short preliminary stage of pleasurable excitement followed by drowsiness, sleep, and complete unconsciousness. In a moderately advanced case, the pupils are contracted to a pin-point, the respirations are slow, the pulse full, the skin moist. The breathing grows slower and slower until death supervenes from respiratory paralysis. The stomach must be promptly emptied, and tannic acid or potassium permanganate given as antidote. Stupor is combated by the administration of strong coffee, atropine, or strychnine, and by cold douches, flecking with wet towels, electrical stimulation, and later by forced artificial respiration. Chronic opium poisoning is seen in those habituated to the drug, both in Eastern and Western countries. See OPIUM.

Cocaine (q.v.) is extensively used as a local anæsthetic, and alarming symptoms have followed its absorption by the mucous membrane, or its hypodermic injection. Death occurs very rapidly (forty seconds to four minutes), with great depression and respiratory or cardiac failure. If the patient can be kept alive for half an hour, recovery is almost certain. If the poison has been taken by the mouth, evacuate the stomach, and in any case fresh air, artificial respiration, and stimulants are called for.

Chloral is quite often injudiciously used by the public to induce sleep and quiet the nerves; it is also taken with suicidal intent and given by criminals (knock-out drops) to induce prolonged stupor, often with fatal results. The patient simply passes into a deep sleep without previous excitement, and death occurs from heart failure. Treatment is like that of opium and cocaine. See CHLORAL.

Belladonna and its alkaloid *atropine* produce, when taken in poisonous amounts, dilatation of the pupil, flushing of the skin, dryness of the mouth, delirium, and sometimes convulsions. Recovery is the rule, but when death occurs it is from paralysis of the heart. Treatment consists in washing out the stomach and opium is the physiological antidote. Similar in their effects and treatment to belladonna are homatropine, hyoscyamus (henbane), hyoscyamine, hyoscine, stramonium, and dulcamara.

Strychnine and *nux vomica*. Strychnine is contained in certain vermin-killers, and is used both for suicide and murder. In poisonous doses it acts principally on the spinal cord, producing cramps and convulsions like those of tetanus (q.v.). Death or recovery is usually speedy. The patient is to be put in a quiet dark room, and tannic acid or charcoal is given, followed by stomach-washing. This must be done before spasms set in. Chloroform and ether control the convulsions, and the bromides and opium act in the same way, but more slowly.

Prussic acid and the various cyanogen compounds, contained in cyanide of potash, cherry-laurel water, bitter almonds, cherry, peach, and plum pits, are exceedingly rapid and fatal poisons. When smaller doses have been taken sulphate of iron may be given as an antidote and affusions and douches of cold water, and a resort to artificial respiration are the most useful measures. See HYDROCYANIC ACID.

Among other substances in the class which are occasionally taken in poisonous doses are aconite, cannabis indica, curare (arrow poison), digitalis, hemlock, and the various coal-tar products, such as acetanilid, phenacetine, and sulphonal (qq.v.).

Anæsthetics (ether, chloroform, and nitrous oxide) act as narcotic poisons when taken in overdose. The symptoms may be divided into two stages, one of excitement with rapid pulse and respiration, struggling and flushed face; and one of depression, in which the muscles are relaxed, the patient is insensible, passes into coma and dies from cardiac or respiratory failure. When dangerous symptoms come on during the administration of an anæsthetic this is to be stopped, the tongue drawn forward, the patient exposed to a current of fresh air or oxygen, and if breathing stops subjected to artificial respiration. Hypodermic injections of atropine or strychnine are also given. The inhalation or drinking of ether and chloroform is indulged in as a habit by a few individuals. See ANÆSTHETICS.

GASEOUS POISONS. The more common of these are carbonic acid gas, carbon monoxide, hydrogen sulphide, sulphurous oxide, illuminating gas, sewer gas and cesspool emanations, and carbonic acid gas (choke-damp) as found in the air of mines, cellars, and wells. Miners are frequently killed by the latter. Carbon monoxide occurs in charcoal fumes, fuel gas, and illuminating gas, and passes into the air of a room from defective flues or pipes. Air containing 1 per cent. of this gas is rapidly fatal. When exposure to this poison has been long and unconsciousness exists, recovery is not probable. The effects of illuminating gas are similar to those of carbonic oxide. Sewer gas is a mixture of sulphureted hydrogen, ammonium sulphide, nitrogen, and carbonic acid gas. The symptoms of the gaseous poisons depend on the amount absorbed and vary from slight headache and dizziness to suffocation and collapse. The treatment is to get the patient into the fresh air, give oxygen, or perform artificial respiration, and stimulate.

ANIMAL POISONS. The stings of insects, the bites of scorpions, tarantulas, snakes, and rabid dogs, are comprised in this group. Their action is complicated. The local effects are irritation, redness, swelling, and œdema, or even gangrene. The poison after entering the circulation may disorganize the blood, causing jaundice, hæmoglobinuria, hemorrhage into the tissues, and cyanosis. There are in addition general symptoms, such as vertigo, dyspnœa, prostration, cardiac paralysis, and finally collapse. The local treatment of such bites consists in the application of a tight band or ligature above the wound to prevent absorption; the destruction by the knife or cautery of the area containing the poison after removing as much as possible by suction; and the administration of stimulants such as ammonia, alcohol, or strychnine, to keep up the strength until the poison is eliminated. Quite recently a serum known as antivenene has been given in snake-bites with excellent results. See GLANDERS; HYDROPHOBIA; SERUM THERAPY.

The medico-legal duties of the medical examiner in cases of fatal poisoning, whether suicidal or homicidal, are: (1) to establish the presence or absence of conditions characteristic of any poison; (2) to preserve all necessary material for subsequent analytical examination, and to avoid introducing possible causes of error; (3) to recognize or exclude natural causes of death; (4) to perform experiments on animals, if necessary, in order to demonstrate the toxic effect of the substance separated by the chemical; and (5) to record carefully all observations and state clearly the conclusions as to the cause of death. Difficult cases constantly arise in which the post-mortem appearances are not decisive, or are consistent either with disease or poison. In performing an autopsy for medico-legal purposes, the identity of the body must first be established and the autopsy should be done in the presence of witnesses. The organs and tissues to be removed and preserved for future analysis are deposited separately in clear glass jars, which are sealed. The tissues and organs to be removed are the stomach, and intestines ligated and unopened; the entire liver; the blood from the heart and vessels; both kidneys; the urine; the entire brain; a large piece of muscle from the thigh; and portions of the bone and spleen. Important information as to the time of absorption is evidenced by the distribution of poison in the various tissues. The unabsorbed residue is found in the stomach and intestines. Poisons in both stomach and liver indicate a short interval between the taking and death; while poison in the liver and other organs, with none in the stomach, indicates a greater interval. Most poisons remain in the liver after disappearing from the stomach and remain longer in the muscles and bones than in any other tissue. Poisons are found in their greatest purity in the kidneys and urine. Proof of poisoning has been established by chemists by analysis of muscles or one kidney, when all the other tissues have been destroyed by the suspected parties. Besides the examination for poisons and their lesions, every organ must be examined for all natural causes of death, and in particular the causes of sudden death (q.v.) should be rigidly excluded. Consult: Witthaus and Becker, *Medical Jurisprudence, Forensic Medicine, and Toxicology* (New York, 1894); Peterson, *Legal Medicine and Toxicology* (Philadelphia, 1903); Brundage, *A Manual of Toxicology* (New York, 1901). See AUTOPSY; MEDICAL JURISPRUDENCE.

TOXIN. A specific bacterial poison whose absorption into the body causes an infectious disease. Though formerly used, as suggested by Brieger, to designate the poison members of the ptomain group (q.v.) of bacterial bases it was fortunately not so restricted. Toxins are not albumins; they are not proteid bodies. It had been surmised that the symptoms presented during diseases induced by micro-organisms were due to the basic poisons known as ptomains. But after using in experiments these bases, it was learned that this was untrue. The ptomains are not as potent as certain chemical products of the bacteria. Moreover, in the highly poisonous cultures of certain germs no ptomains have been formed. This statement is true of diphtheria, as confirmed by Lœffler, Roux and Yersin, Brieger and Fränkel. Some of these investigators established the additional fact that the toxins are formed by synthetical processes, and not by splitting up the constituents of the culture medium or those of the animal body. The germ apparently constructs its toxin out of the components of a harmless menstruum. In several specific infectious diseases special toxins have been isolated. Marmier extracted a specific toxin from glycerin-peptone cultures of the anthrax bacillus, which does not give the reactions of albuminoid substances nor change starch, sugar, or glycogen. Animals immune to anthrax bacillus are immune to this toxin. Alkaline hypochlorites, as well as prolonged isolation in the presence of air, destroys its efficacy. Animals may be immunized to anthrax if treated with carefully graduated doses of this toxin. This toxin is contained in the bacterial cells of anthrax and the culture must be so adapted that opportunity is offered for it to diffuse from the cells. Similarly, the presence of a toxin derived from the comma bacillus has been demonstrated in Asiatic cholera, as also a toxin in tetanus, diphtheria, typhoid fever, and tuberculosis, while in suppuration the poisoning is due to toxin derived from the bacillus staphylococcus. Susotoxin has been isolated in hog cholera, and the toxin mulleīn or morvin is contained in the cell of the glanders bacterium. See Antitoxin; Bacteria, Immunity, and Serum Therapy.

TOXODONTIA, tŏk′sō-dŏn′shĭ-ȧ (Neo-Lat. nom. pl., from Gk. *τόξον*, *toxon*, bow + *ὀδούς*, *odous*, tooth). An extinct suborder of ungulate mammals found fossil in the Tertiary deposits of Argentina and Patagonia, South America. Toxodon was a heavily built animal as large as a rhinoceros, with a large heavy head placed on a short neck which sloped down from the shoulders, so that the head was much lower than the back. The teeth are large, compressed laterally, and either triangular or prismatic in section, and they grew from persistent pulps. The bones of the skeleton are all massive, the legs short and thick, and the feet are three-toed. Nesodon, an earlier genus than Toxodon, was of smaller size and less robust build.

TOXOPH′ILUS. A work in two books on archery by Roger Ascham (q.v.), in the form of conversations between Philologus and Toxophilus on the attractions of books and archery (q.v.).

TOY, Crawford Howell (1836—). A distinguished American Oriental scholar. He was born in Norfolk, Va., and graduated at the University of Virginia in 1856. He studied at Berlin in 1866-68, became professor of Hebrew at the Southern Baptist Theological Seminary in 1869, and professor of Hebrew and Oriental languages and lecturer on biblical literature at Harvard in 1879. His publications include a translation and revision of Erdmann's commentary on Samuel in Lange's series (1877); an edition of Murray's *Origin of the Psalms* (1880); *The Religion of Israel* (1882; 3d ed. 1884); *Quotations from the Old Testament in the New Testament* (1884); *Judaism and Christianity, a Sketch of the Progress of Thought from Old Testament to New Testament* (1890); the Book of Ezekiel in the *Polychrome Bible* (Hebrew text, 1896; English, 1898); and the Book of Proverbs in the *International Critical Commentary* (1899).

TOYAMA, tō′yä′mȧ. The capital of the Prefecture of Toyama, in Japan, situated in the central part of Hondo, near the western coast (Map: Japan, E 5). The old castle is used as a school. There are manufactures of leather. Population, in 1898, 59,558.

TOYN′BEE, Arnold (1852-83). A pioneer of the Social Settlement movement. He was educated at Balliol College, Oxford, and afterwards became a tutor and lecturer there. He was the author of a number of well-known addresses on political economy, but is best known by his efforts to understand the economic and social problems of the working classes of Whitechapel, among whom he made his home, associating himself with the religious work carried on there by his friend S. A. Barnett. Early in life Toynbee had come under the influence of Ruskin, but his sympathy with the artisan class found a means of expression entirely his own. His favorite maxim, "The welfare of the producer is as much a matter of interest to the consumer as the price of the product," voiced the religion of the student of social conditions. His name is associated with the modern Social Settlement (q.v.). Two years after his death in the crowded Whitechapel district, which had been the scene of his efforts, Toynbee Hall was erected by the men of Oxford and Cambridge who had shared his labors there.

TOYNBEE, Paget (1855—). An English philologian, distinguished for his studies in French and Italian literature, a brother of Arnold Toynbee. He was born at Wimbledon, near London. He was educated at Haileybury College, Hertfordshire, and at Balliol College, Oxford, and then became a private tutor (1878-92). He is especially known as a Dante scholar. His works comprise mainly *Specimens of Old French* (ninth to fifteenth century), (1892); *Index of Proper Names in the Works of Dante* (1894, 2d ed. 1897); *Historical French Grammar*, which is a skillful revision and amplification of Bracket (1896); *A Dictionary of Proper Names and Notable Matters in the Works of Dante* (1898); *Ricerche e Note Dantesche* (1899); *Critical Text of the "Divina Commedia"* (1899); *Life of Dante* (1900, revised 1901); and *Dante Studies and Researches* (London and New York, 1902). The "Dante Dictionary" is perhaps the most valuable commentary to Dante.

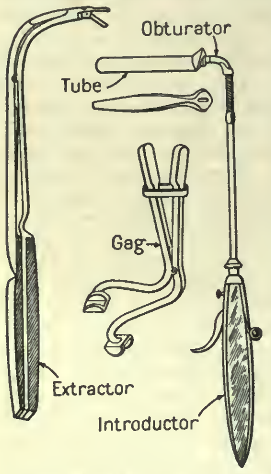
TOYOHASHI, tō′yō-hä′shē. A town in the Prefecture of Aichi, Central Hondo, Japan, 45 miles by rail southeast of Nagoya (Map: Japan, E 6). Population, in 1898, 21,785.

TRACERY (from *trace*, OF. *tracer*, *trasser*, Fr. *tracer*, to trace, track, delineate, from ML. **tractiare*, frequentative of Lat. *trahere*, to draw, drag). A term used of the kind of architectural detail that is connected with pierced or open ornamentation of any member or unit such as a window, arcade, or gallery. It was developed in windows and then extended to almost every part of ecclesiastical structures during the Gothic period. Technically there may be said to be stray examples of simple tracery at an earlier date, as in the case of pierced marble slabs in windows or screens, but tracery as an art and a system sprang up with the fully developed Gothic style in the first decades of the thirteenth century in France, when the whole wall space over the aisles in church interiors was devoted to enormous windows, one in each bay. (See Window.) The general frame of each window inclosed those of several separate lights, and above and between their arched summits were minor foiled openings. The mullions, the cusps, the quatrefoil, and other openings formed what is termed the tracery of the windows, which became more elaborate in the succeeding centuries, seeking ever more complex geometric combinations of lines. The straight lines gradually were replaced in large part by curved lines. The rose or wheel windows, such as those of Notre Dame, in Paris, and the cathedrals of Rheims and Amiens, illustrate the various stages of this development. This tracery spread gradually from the windows until it overran almost every part of the church with its delicate lace patterns, sometimes on a solid ground, sometimes pierced. The earlier plate tracery had at once given way to the molded tracery. The period of a Gothic structure can generally be judged with tolerable accuracy by the style of its tracery. This is particularly the case in England, where two of the three main divisions of the Gothic movement, the Decorated and the Perpendicular, are so called on account of their styles of tracery, which give the key-note to each, and by means of which the merging of one style into the other can be traced. During the Decorated period the tracery became more varied in form, being composed of squares, triangles, and other forms, filled with foils and having the appearance of being packed together. This kind of tracery is called 'geometric.' The windows of the transition from Decorated to Perpendicular had tracery of a more flowing character, while that of the Perpendicular (q.v.) period became almost entirely composed of vertical lines. The flamboyant (q.v.) or contemporary style in France had tracery of a very different description, being as free and graceful as the other was straight and stiff. See Gothic Art.

TRACHEA (Neo-Lat., from Lat. *trachia*, from Gk. *τραχεῖα, tracheia*, trachea, windpipe, rough artery, so called because of the rings of gristle, from *τραχύς, trachys*, rough), or Windpipe. The tube through which air-breathing vertebrates receive air into the lungs. It extends from the throat to the bifurcation of the bronchi. It is sufficiently described in the article Respiration. Tracheotomy (q.v.) is necessary for the removal of foreign bodies lodged in the trachea and bronchi. The trachea shares certain inflammations and morbid processes in common with the larynx and the bronchi. For figure of trachea, see Bronchus.

TRACHEID. Usually elongated, taper-pointed, woody cells, resembling tracheæ in appearance, but not forming a continuous vessel. The wood of many conifers consists almost exclusively of tracheids. See Histology.

TRACHEOTOMY (from Gk. *τραχεῖα, tracheia*, trachea, windpipe, rough artery + *τομή, tomē*, a cutting, from *τέμνειν, temnein*, to cut) and Laryngotomy (from Gk. *λάρυγξ, larynx*, larynx + *τομή, tomē*, a cutting). Opening the trachea by incision in order to admit the entrance of air when suffocation is threatened. Among the conditions which demand tracheotomy are foreign bodies in the air passages, cut throat, diphtheria, œdema of the glottis, and tumors either within the larynx or pressing upon the air passages from without (as a goitre). The air passages may be opened in three different situations—namely, through the crico-thyroid membrane (see Larynx), when the operation is termed laryngotomy; through the cricoid cartilage and the upper rings of the trachea, the operation being known as laryngo-tracheotomy; and through the trachea, below the isthmus of the thyroid gland, constituting tracheotomy proper. Laryngotomy and tracheotomy are more commonly performed than laryngo-tracheotomy, to which no further allusion is required. Laryngotomy is more quickly and easily performed, especially in adult males, and is less dangerous; tracheotomy is a more difficult, tedious, and dangerous operation, but must be employed in some cases (as, for example, where there is any necessity for introducing the forceps and in cases where a tracheotomy tube must be allowed to remain in position for some time). The incision is made in the middle line of the neck, longitudinally, the blood vessels being pushed aside as much as possible with the handle of the knife. When the trachea is exposed and is cut through the wound is held apart with tenacula that the tube may be inserted. As haste is generally necessary, a neat dissection can rarely be made, but great care must be exercised to prevent blood from entering the air passage. When the operation is completed a large curved tube to breathe through is inserted in the aperture, and secured round the neck with tapes.



MINSTRUENTS FOR INTUBATION.

A double tube or canula possesses many advantages, as, by withdrawing the inner one, which should slightly project at its lower extremity, it may be cleared of any mucus or blood that may have accumulated in it, without disturbing the wound. The calibre of the inner tube should always be sufficiently large to admit as much air as usually passes through the chink of the healthy glottis. If left too long, the patient may die of asphyxia. It is therefore necessary to decide and act quickly, selecting a field of operation certainly below the point of obstruction, and a full-sized tube should be inserted. Up to the time of O'Dwyer the operation of tracheotomy was frequently and successfully performed. In 1885 Dr. Joseph O'Dwyer of New York devised instruments wherewith intubation of the larynx was performed as a substitute for tracheotomy. Intubation consists in placing a short tube in position in the larynx, between the vocal cords, its lower end reaching a point as low as an incision would be made if the air passages were opened, and thus admitting air from the throat. The tube may crowd down false membrane ahead of it, and in some such cases tracheotomy may be necessary. Few other dangers are possible. The tube may be removed on the fourth day, or may remain *in situ* till the eleventh day. Its presence causes disintegration of the pseudo-membrane of diphtheria; prevents reflex spasm; and also obviates the granulations which are common and very annoying after tracheotomy. If ulceration be produced by intubation it is superficial and trivial. The recoveries from diphtheria in cases in which intubation is practical average over 50 per cent.

TRACHINIÆ, trā-kĭn'ĭ-ē (Lat. nom. pl., from Gk. Τραχίνιαι, women of Trachis). A tragedy by Sophocles describing the death of Hercules, caused by the poisoned coat of Nessus, sent to him by Deianira, in jealousy of the captured Iole. The play takes its name from the chorus composed of women of Trachis, where Deianira is awaiting the return of her husband.

TRACHOMA, trȧ-kō'mȧ. A disease of the conjunctiva. See Conjunctivitis, section on *Granular Conjunctivitis.*

TRACHYTE, trā'kīt or trăk'īt (from Gk. *τραχύτης, trachytēs*, roughness, from *τραχύς, trachys*, rough). An igneous rock of porphyritic texture, often possessing also flow (rhyolitic) or vesicular textures. It generally exhibits porphyritic crystals of alkali feldspar, with which is usually associated also biotite, hornblende, or augite. The average composition of trachyte is: Silicia, 64 per cent.; alumina, 18 per cent.; oxide of iron, 4 per cent.; magnesia, 1 per cent.; oxide of lime, 2 per cent.; oxide of sodium, 5 per cent.; oxide of potassium, 6 per cent. In composition trachyte differs but little from syenite.

TRACTARIANS. A popular nickname given, in the early days of the Oxford Movement (q.v.), to the party led by Newman, Pusey and Keble, from the *Tracts for the Times*, written by these and other members of the party.

TRACTION ENGINE. See AUTOMOBILE.

TRACTORS, METALLIC. See PERKINS, ELISHA.

TRACT SOCIETIES (Lat. *tractus*, treatment, discussion, handling, drawing, from *trahere*, to draw, drag). The word tract signifies a brief treatise. In the modern use of the term, it is applied almost exclusively to treatises upon religious subjects, and a tract is distinguished from a book mainly by its external (pamphlet) form and its brevity. The earliest illustration of a tract is found in the separate books of the Bible, each one of which, as originally circulated in manuscript form from hand to hand, may be considered a tract. Apart from this, however, we may consider Wiclif, the great English reformer, as the first to begin the work of writing and distributing tracts, which, though laboriously produced by hand, yet obtained a large circulation. With the invention of printing, the possibilities for the development of tract literature were wonderfully enlarged, and the religious movement which culminated in the Reformation may be said to mark the commencement of the general dissemination of Christian literature in tract form.

The availability of tracts as a means for propagating Christian knowledge led to the formation of societies for that express purpose. An early pioneer among tract societies for English-speaking peoples was the *Society for Promoting Christian Knowledge*, which was organized in England in 1698 and incorporated in 1701 to circulate Bibles and religious tracts both at home and abroad. The publication of tracts, begun by John Wesley in 1742, was soon carried forward upon a large scale, and in 1782 he organized the *Society for the Distribution of Tracts Among the Poor.* The first interdenominational union of Christian effort for the circulation of tract literature was effected in 1750, in the City of London, by the formation of the *Society for Promoting Religious Knowledge Among the Poor.* This was followed by the organization of similar societies in other cities, and though none of these maintained a permanent existence, they must be regarded as forerunners of the great tract societies of modern times. In the closing decade of the eighteenth century, at Bath, England, Hannah More (q.v.) initiated a movement for the better circulation of Christian literature by putting forth a series of short religious tales in tract form, named the *Cheap Repository.* In 1795 the *Religious Tract Society of Scotland* (now known as the *Religious Tract and Book Society*) was founded in Edinburgh, by Rev. John Campbell. This was followed, in 1799, by the organization of the *Religious Tract Society of London*, which stands foremost in age and influence among tract societies of the present day.

In America the work of religious publication was begun by the *Methodist Book Concern*, which issued its first publication in 1789. The *Massachusetts Society for Promoting Christian Knowledge*, founded in 1803, may be properly regarded as the first interdenominational organization for tract work in America. This was followed by the formation of various local societies, among which were the *New York Religious Tract Society*, organized in 1812, and the *New England Tract Society*, organized at Andover in 1814. The latter society, in 1823, changed its headquarters to Boston, and its name to the *American Tract Society*, and two years later became merged in the *American Tract Society* which was organized in New York City by friends of tract work, who desired to see a society of national scope and influence. Since that time tract societies have multiplied, but the American Tract Society still remains the principal agency for tract distribution in America.

A board of managers, consisting of a president, vice-president, and thirty-six members, are elected annually by this society. This board elects the publishing, distributing, and finance committees. The members of these three committees constitute an executive committee to conduct the business of the society. To promote in the highest degree the objects of the society, the Constitution specifies that the officers and managers shall be elected from different denominations of Christians; that the publishing committee shall contain no two members from the same ecclesiastical connection; and that no tract shall be published to which any member of that committee shall object.

Some idea of the magnitude of the work of this society may be gained from the following statistics. The whole number of distinct publications (not including periodicals) issued by the society from the home office from 1825 to 1903 was 8,498, of which 2,138 have been volumes and 6,360 tracts, etc. These have been published in a score of different languages. The total number of volumes issued during the previous seventy-eight years is 32,743,752; of tracts, 449,554,252; and of periodicals, 264,278,668; making a grand total of 746,576,672 copies of publications printed. Six periodicals are published by the society, viz. the *American Messenger, Apples of Gold, Light and Life, Deutscher Volksfreund, Amerikanischer Botschafter*, and *Manzanas de Oro.* The society has made appropriations amounting to $747,213, by the aid of which 5080 publications have been issued at foreign mission stations in 157 languages and dialects.

The constitution of the Religious Tract Society of London is similar to that of the American Tract Society. Its affairs are conducted by a committee, composed of an equal proportion of members of the Church of England and of Protestant dissenters. During its one hundred and four years the society has printed books and tracts in 250 different languages. In all the society has published over ten thousand books, tracts, etc., and its total distribution amounts to about 3,540,000,000 copies of its publications.

In New York and many other cities there are city mission and tract societies, which find the printed page a valuable auxiliary in reaching the 'submerged tenth.' Many of the evangelical denominations have their own boards of publication or publishing societies, which employ tract literature, especially in aid of their Sunday-school work. In Great Britain, in addition to the Religious Tract Society, there are several other tract societies, such as the *Monthly Tract Society* and the *Stirling Tract Enterprise.* On the Continent of Europe there are perhaps a score of societies which are engaged more or less in the publication and circulation of tract literature. Among the most important of these are the *Paris Tract Society* (*Société des Traites Religieux*), the *Toulouse Religious Book and Tract Society,* the *Geneva Evangelical Society,* the *Italian Evangelical Publication Society of Florence,* and the *German Evangelical Book and Tract Society.* In India, China, Japan, and other heathen lands there are a large number of tract societies which aim to provide Christian literature in the native languages. According to the *Centennial Survey of Foreign Missions,* by James S. Dennis (New York, 1902), there are a total of 159 missionary publishing houses and printing presses in such lands. The annual issues from these amount to 10,800,927 copies. There are also 379 magazines and papers published under missionary auspices, and these have a combined circulation of 250,809 copies.

BIBLIOGRAPHY. The literature on the subject of tract societies consists chiefly of the annual reports, pamphlets, etc., published by the various societies themselves. *The Story of the Religious Tract Society for One Hundred Years,* by Rev. S. G. Green, D.D. (London, 1899), was prepared by an editorial secretary of the Religious Tract Society of London, and is an authoritative history of that society. *The American Tract Society—An Historical Sketch* (New York, 1900), though but a brief pamphlet, presents the salient points concerning the history of the American Tract Society. *The Report of the Ecumenical Conference of Foreign Missions, New York, 1900* (New York and London, 1900), gives some interesting facts with reference to this subject.

TRACY, trȧ'sē', ALEXANDRE DE PRONVILLE, Marquis de (1603-70). A French soldier and administrator. After serving in several wars, he was appointed lieutenant-general of the French possessions in North America on November 19, 1663, and reached Quebec June 30, 1665, accompanied by many young nobles and 200 soldiers. In 1666 with 1,300 men he led an expedition against the Mohawks, burned several of their towns, and forced them to sue for peace. This expedition greatly alarmed Governor Richard Nicolls (q.v.), of New York, who attempted in vain to secure the aid of the New England colonies for an expedition against the French. Soon after this expedition Tracy returned to France.

TRACY, ANTOINE LOUIS CLAUDE DESTUTT, Count de. A French philosopher. See DESTUTT DE TRACY.

TRA'CY, BENJAMIN FRANKLIN (1830—). An American lawyer and Cabinet officer, born at Owego, N. Y. He was educated at Owego Academy, and was admitted to the bar in 1851. In 1853 he was elected on the Whig ticket as district attorney of Tioga County, and in 1856 was reëlected. In 1861 he was elected to the State Assembly on the Union ticket. In 1862 he recruited the 109th and 137th New York Volunteers and became colonel of the former. Failing health compelled him to relinquish his command, but within a year he again entered the army as colonel of the 127th United States regiment of negro troops. Subsequently he commanded the prison camp at Elmira, and at the close of hostilities was brevetted brigadier-general of volunteers. From 1866 to 1873 he was United States District Attorney for the Eastern District of New York, and from 1881 to 1883 was associate judge of the State Court of Appeals. In March, 1889, he entered President Harrison's Cabinet as Secretary of the Navy. In 1893 he resumed his law practice in New York, and in 1897 was the unsuccessful Republican candidate for Mayor of New York City, being defeated by R. A. Van Wyck. In 1899 he was counsel for Venezuela before the Anglo-Venezuelan Boundary Arbitration Commission.

TRADE ASSOCIATIONS. Associations of men engaged in manufacture or trade, for the furtherance or protection of their mutual interests. In England these associations antedate the nineteenth century. In the United States some were founded before 1850; by 1890 they had been formed in most well-established industries; while during the last decade of the century they had spread to almost every subdivision of the industrial world. In general, the trade association may include one or more of three classes of functions, the commercial, the industrial, and the protective. Associations to do the work of business agencies display most clearly the commercial function. The London Association of Guardians for the Protection of Trade was established as far back as 1776. The operation of the earlier societies was confined chiefly to the compilations of registers of bankruptcies, insolvencies, and private settlements with creditors. Societies may undertake investigations into the circumstances connected with a bankruptcy, and perform the general agency business of their members. More recently added features are in connection with credit. Although large commercial concerns furnish general information, there is still room for developing information bureaus within some trades. Many establishments have special credit men, who have formed a national association, with branches in thirty-five chief cities of the United States.

The general industrial functions of trade associations include first, the surveillance of important influences, such as legislation or railway rates, which affect the entire trade. With many associations the tariff question is a weighty and permanent issue, while laws affecting labor, the quality, the method of sale, or the inspection of goods (as in brewing or boiler-making), are constantly watched, advocated, or contested. In the second place, associations may seek to establish agreement in business methods to keep their members informed of new inventions or processes, of market conditions, and so on. A natural result of this activity is the publication of a trade journal, of which the Bulletin of the National Association of Wool Manufacturers (formed in 1864) is a well-known example. Various special functions, also, are often assumed. Thus provision may be made for exhibits at fairs, trade schools may be encouraged, selling agencies established, bureaus of employment maintained, local improvements furthered, or, as in the lumber business, a system of mutual insurance may be attempted. A very important function is the promotion of social intercourse and general good will. It is not always easy to draw a sharp line between the acts of a trade association and those of a trade combination in which the financial management has been centralized. At present the typical forms of protection are: (1) against introduction of so-called unfair methods within the trade; (2) against railroad discrimination in rates; and (3) against labor organizations. Jobbers' and retailers' associations protest against sales direct from manufacturer to consumer, and sometimes establish a boycott against recalcitrant manufacturers. The decreasing importance of the jobber in the distributive system makes the efforts of their associations of particular interest. 'Exclusive agreements' may be made by a middlemen's association with certain manufacturers, in which case no other but the latter's goods will be used. The object of certain associations, in their own words, is "to help the manufacturer decide who are legitimate dealers."

In trades where freight forms an important item of cost, a prime object of the association is likely to be the adjustment of railroad rates. The National Association of Stove Manufacturers and the National Transportation Association, an organization of shippers, are examples. In 1903 the Georgia Sawmill Association took the radical move of disregarding the possibility of an appeal to the Interstate Commerce Commission and themselves asked for an injunction restraining certain Southern railroads from advancing rates on yellow pine. They asked that the Southern Freight Association be declared an illegal combination in restraint of trade. Increased demands of labor organizations, in recent years, have greatly stimulated defensive action by trade associations. In the building trades of New York, the Employers' Association was engaged during 1903 in a bitter war with the unions, while in Chicago employers and employees of the same group of industries apparently passed the stage of fighting, and settled trade matters by agreement between their respective associations, a procedure not always to the advantage of the public.

TRADE, Board of. A department of government in England designated "the lords of the committee of his Majesty's Privy Council appointed for the consideration of all matters relating to trade and foreign plantations." Cromwell in 1655 was the first to establish a permanent committee for matters of trade. Charles II. continued the policy and in 1660 created two separate councils for trade and for foreign plantations, which in 1672 were consolidated into one. In 1786 the present department was established as a permanent committee of the Privy Council. The Board as now constituted consists of a president who is a member of the Cabinet, together with the First Lord of the Treasury, the Chancellor of the Exchequer, and numerous other exofficio members; but, like the Treasury Board, the Board of Trade does not meet, and consists in practice of the president and his staff. It comprises the following departments: (1) The commercial, labor, and statistical department, whose principal function is the collection and dissemination of information concerning matters of trade. Since 1886 it has published the *Board of Trade Journal*. (2) The railway department, established in 1840, with numerous duties of supervision and inspection. (3) The marine department, established in 1850, which has general supervision over merchant shipping and the care of seamen. (4) The harbor department, whose province includes besides lighthouses, harbors, etc., weights and measures, coinage, and other miscellaneous matters. (5) The finance department, which keeps the accounts for the Board and audits for Parliament the reports of the life insurance companies. (6) The fisheries department.

TRADEMARK. A mark, name, emblem, or device adopted by a tradesman or manufacturer and attached to or stamped upon his goods in some manner for the purposes of identification by the public, and protection against the sale of fraudulent imitations. The law of trademarks is of modern development. In 1742 Lord Hardwick declared that he could not protect a trademark adopted by a trader from being used by another. It was not until 1803 that the English courts attempted to prevent the fraudulent use of an adopted trademark. Since that time the law on the subject has developed rapidly. The statute now in force in England is known as the 'Merchandise Marks Act.' It provides for registration, and makes the registry conclusive evidence of title after five years' use of the registered trademark.

The first trademark statute in the United States was passed in 1870. Under the decisions of the United States courts, the office of a trademark is to indicate the origin or ownership of an article on which it is found. Therefore, it follows that a valid trademark must fulfill one of the above essentials either from its own nature or by reason of association with the article itself and the maker's name. A name which is merely descriptive of the qualities or nature of an article, cannot constitute a valid trademark, as its use as such might tend to create a perpetual monopoly in the sale of the article described. For example, the United States courts held that the words 'acid phosphate' could not be protected as a trademark, as they were considered to be descriptive of the essential characteristics of the preparation sold under that name, and as it was a known form of chemical combination, it would prevent others from describing accurately a similar combination.

In general, a geographical name cannot be used as an exclusive trademark. However, a person not doing business in a locality known for a certain product will not be permitted to use the name of that locality as a trademark on similar products handled by him, but not coming from that locality where the name is already in use by a tradesman in the well-known district. A person's own name will not be protected as a trademark as against a person of the same name, who, acting in good faith, desires to use his name on his own goods. A trade name is, therefore, to be distinguished from a trademark, and can only be protected by a court of equity where some one attempts to deceive the public and take another person's trade by adopting his trade name. A close imitation of a trademark may amount to an infringement, especially if there are other circumstances tending to show that there is an intention to deceive the public and take advantage of the business reputation of another.

Any one who handles goods may impress his trademark upon them, and be protected in its use, if he has exercised any peculiar skill or judgment in their selection, care, or alteration. The right to an exclusive trademark may be lost by abandonment, but the evidence of the intention to discontinue using it must be very clear. A trademark is not generally considered to be property in the sense that it can be taken under an execution, but it may be transferred from one person to another, unless it is of such a nature that to allow it to be used on the goods of a person other than the one who originally adopted and used it would tend to deceive the public. The sale of a business, good will, etc., usually includes the trademarks under which goods were sold by the owners. For the law in the United States, see Browne, *Law of Trademarks* (Boston, 1885); for the English law, Sebastian, *Law of Trademarks* (London, 1890); Barclay, *Law of France Relating to Trademarks* (2d ed., London, 1899). See also COPYRIGHT; PATENTS.

TRADE-NAME. A name under which a person or corporation does business and which by user becomes so associated with the good will of the business as to be valuable. A *trade*-name is to be distinguished from a *trade*-mark which is affixed to or impressed on merchandise, and when registered is protected by statute. The wrongful user of an established trade-name will be restrained by a court of equity on the ground that it constitutes fraud and deceit against the public and an unlawful appropriation of something which is so closely allied to the business of another as to be a species of property right. A trade-name may sometimes be registered as a trademark, and this fact is the source of the confusion resulting from the use of these terms as being interchangeable. The statutes of most States prohibit one corporation from adopting the same name as another and the Secretary of State should be consulted before a name is adopted for a new corporation. Consult *Browne, on Trademarks* (2d ed. 1898); also article TRADEMARKS.

TRAD'ESCANT, JOHN (c.1570-c.1637). A traveler, naturalist, and gardener, said to have been born in Holland. He is thought to have made a voyage to Northern Russia in 1618, and in 1620 served against the Algerine pirates. Afterwards he was in the service of the Duke of Buckingham, and after the Duke's assassination seems to have become royal gardener. About this time he established a physic garden and museum at South Lambeth, and was the first Englishman "who made any considerable collection of the subjects of natural history." His son JOHN (1608-62), born at Meapham, Kent, added largely to his father's collection, and in 1637 visited Virginia, where he gathered "all varieties of flowers, plants, shells, etc." In 1656 he published his *Museum Tradescantianum: or a Collection of Rarities, Preserved at South Lambeth, Near London.* Upon his death in 1662 the museum went by the terms of his will to Elias Ashmole, and in 1682 became the nucleus of the Ashmolean Museum at Oxford.

TRADE SCHOOLS. See TECHNICAL EDUCATION.

TRADES UNION CONGRESS. A British federation of trade unions, organized in 1868, which has met annually since that date except in 1871. At the time of its formation the British unions were engaged in an earnest struggle for favorable legislation, and the congress played an important part in securing the legislative victories of 1871-75. (See TRADE UNIONS.) Since that time it has confined itself largely to the tasks of creating a favorable public opinion, voicing the demands of organized labor, providing a place for common meeting, and securing favorable labor legislation. The last function is exercised largely through a permanent Parliamentary committee, the expenses of which are paid by a per capita tax upon the affiliated unions of £1 10s. per 1000 members. The Parliamentary secretary devotes all his time to the work and receives a salary of £250 per annum. The congress itself is thus a deliberative body merely, but in recent years it has started two auxiliary federations—the Labor Representation Committee (q.v.) and the General Federation of Trade Unions. (See TRADE UNIONS, THE GENERAL FEDERATION OF.) At the thirty-fifth congress, held in London in 1902, 198 societies, with 1,400,000 members, were represented. The total income for the year was £2,010.

TRADE UNIONS. "The term 'national trade union,'" says the Federal statute providing for the incorporation of trade unions, "in the meaning of this act shall signify any association of working people having two or more branches in the States or Territories of the United States for the purpose of aiding its members to become more skillful and efficient workers, the promotion of their general intelligence, the elevation of their character, the regulation of their wages and their hours and conditions of labor, the protection of their individual rights in the prosecution of their trade or trades, the raising of funds for the benefit of the sick, disabled, or unemployed members, or the families of deceased members, or for such other object or objects for which working people may lawfully combine, having in view their mutual protection or benefit." No definition less complete than the above is sufficient fully to indicate the complex character of the trade union, since the trade union has always been an insurance association and a social and educational club, as well as "a continuous association of wage-earners for the purpose of maintaining or improving the conditions of their employment," as Beatrice and Sidney Webb define it.

HISTORY. The connection between the modern trade union and the journeymen clubs of the Middle Ages is a matter of dispute. Throughout the later Middle Ages, and with comparative frequency after the fourteenth century, traces are encountered of journeymen clubs—the German *Schenken*, the French *confréries de compagnons*—which maintained a more or less continuous existence, regulated apprenticeship, paid friendly benefits, and engaged in protracted conflicts with employers, characterized by the essential element of the modern strike. Admitting, as Professor Ashley suggests, that the journeymen of these fraternities "were almost all unmarried, that when employed they lived in the master's house, that the masters themselves had usually been journeymen, that the number of masters and journeymen was very much the same," there nevertheless seems to the writer no tenable reason for denying to these associations all the essential attributes of the modern trade union. It is evident, however, that effective and solid trade unionism is intimately dependent upon the existence of a body of workers who will in the natural order of things remain wage-earners throughout their lives. In other words, the trade union follows in general the permanent separation of the employing and wage-earning classes. This separation, speaking generally, was a product of the industrial revolution and the factory system. Trade unions consequently did not become numerous until the later half of the eighteenth century.

In England the history of trade unionism in the eighteenth century is marked by increasing hostility on the part of Parliament toward combinations of laborers. Laws regulating wages, apprenticeship, movement of laborers from parish to parish etc., existed, and the open activity of the trade unions during that century seems to have been largely directed toward the enforcement of those laws, which the employers themselves at time found it convenient to break. Laws against combinations of workingmen in specific trades began to multiply as the doctrine of *laissez faire* secured wider acceptance. These laws culminated in the Combination Acts of 1799 and 1800, by which every form of combination, whether of employer or employees, was rigidly prohibited. In effect, the acts were enforced against the laborers only. For twenty-five years the unions were driven into hiding, but they were by no means extirpated. In 1824 the whole group of combination laws was repealed, but in the following year a reaction set in, and in another statute the law against combination was revived, leaving laborers free to combine, however, for the purpose of fixing the wages or hours of labor of parties to the combination.

The act of 1825 was followed by the rise of labor organizations or general trade unions of a socialistic nature described in the article on LABOR ORGANIZATIONS. During these years, however, the trade union proper was making steady progress within the separate trades, in which identity of interests made unity of organization and policy a comparatively easy task. Toward the middle of the century a reaction against the strike set in, and widespread reforms in the management of the friendly benefit system were inaugurated. The union which applied the new ideas most successfully was the Journeymen Steam Engine and Machine Makers' and Millwrights' Friendly Society, which in 1850 absorbed several other large unions of mechanics and became the Amalgamated Society of Engineers, whose careful and elaborate set of rules for the financial and general administration of the union served, according to Mr. and Mrs. Webb, as the "model for all national societies" founded between 1852 and 1889. The reaction from the socialistic trade unionism of the '30's brought to the front a remarkable group of labor leaders, acute, tactful, industrious, and conservative, who between 1860 and 1875 united in a persistent and energetic campaign for legislative reform. The first victory came in the Master and Servant Act of 1867, which corrected the most glaring defects of the old law on this subject. The union leaders, however, aimed at more sweeping concessions. By the celebrated Trade Union Act of 1871 it was provided that no trade union should be deemed illegal simply because it was in restraint of trade, and unions were given a legal standing carrying with it protection of their funds, without exposing them to the ordinary obligations of an incorporated company. Finally in 1875 the unions secured the passage of a very liberal Employers' and Workmen's Act (replacing the Master and Servant Act of 1867), and a revolutionary Conspiracy and Protection of Property Act, which expressly permitted peaceable picketing, and provided that no combination to do any act in furtherance of a trade dispute between employers and workmen should be indictable as a conspiracy unless such act if committed by one person would be punishable as a crime.

In 1860 a giant stride toward collective bargaining was taken by the formation in the hosiery trade of the first joint conference between employers and employees for the peaceable settlement of trade disputes. The federation of trade unions began; trade councils became common in the cities and in 1868 the first national Trades Union Congress was held at Manchester. Finally the successful legislation of 1871, like that of 1824, was followed by a tremendous expansion of trade unionism and the reappearance of many of the phenomena which had marked the epoch of labor organizations in the '30's, with their ideal of an aggressive, militant organization, free from the incumbrance of friendly benefits, embracing working women and unskilled labor, participating actively in politics, and with tendencies toward socialism.

The most noteworthy event of late years is the formation in 1899 and 1900 respectively of the General Federation of Trade Unions (see TRADE UNIONS, THE GENERAL FEDERATION OF) and the Labor Representation Committee (q.v.). Between 1892 and 1901 inclusive the aggregate membership of British trade unions grew from 1,503,298 to 1,922,780, constituting, according to the latest official estimates, about 20 per cent. of the working classes from which trade unions recruit their membership, or 25 per cent. if we exclude the agricultural classes.

In the United States there is no positive record of a trade union before 1803, the year in which the New York Society of Journeymen Shipwrights was incorporated. In 1806 a union of the House Carpenters of the City of New York was organized, and the first union of the Journeymen Tailors is said to have been organized in the same year. As early as 1817 the New York Typographical Society had been in active existence for some time. and in 1822 the Charitable Society of Shipwrights and Calkers of Boston and Charlestown was formed.

The most important events of the period from 1825 to 1850 are briefly described in the article on Labor Organizations. For a time trade unionism seems to have become involved in the cause of general reform; wide-reaching and ambitious federations were formed which worked at the same time for the abolition of slavery, for woman's rights, land nationalization, and coöperation, as well as the improvement of the conditions of employment. During this period trade unionism proper was undoubtedly making progress in the separate trades, and by 1840 in the principal industrial centres local unions had been organized among the masons, marble-cutters, shoemakers, saddlers, hatters, tailors, printers, bricklayers, roofers, painters, carpenters, and shipworkers.

The fifteen years between 1850 and 1865 may well be described as the *period of nationalization.* Labor leaders had learned that for a time at least the labor movement must go forward cautiously, that participation in politics and broad attempts to reform things in general were dangerous, that labor organizations must be extended, if at all, within trade lines, and not by all-embracing amalgamations. In 1850 the union now known as the International Typographical Union was organized. (See Typographical Union of North America, The International.) This was probably the first American national union, though there is some reason to believe that the Silk and Fur Hat Finishers' National Association was organized as early as 1843. The National Association of Hat Finishers of the United States of America was founded in 1854, the National Protective Association (the Locomotive Engineers) in 1855, the Sons of Vulcan and the National Spinners' Association in 1858.

Since the Civil War local and national unions have been organized on every hand, their government has been perfected, and their administration improved. A large number of vigorous labor journals have appeared; labor parties have been formed and in places have succeeded in electing labor candidates; permanent boards of collective bargaining or arbitration and conciliation have been formed in many trades; boycotting through the union label and labor press has been systematized and developed; favorable legislation has been secured in every State; and, more important than any other result, perhaps, public opinion has been brought to concede the utility and even the necessity of the trade union. The most striking phenomenon of the epoch has been the formation of large federations of unions. Among these larger organizations may be named the National Labor Union (1866), the Knights of Labor (1869), the International Association of Workingmen (1864), the Industrial Brotherhood (1873), the American Federation of Labor (1881), the National Building Trades Council (1897), and the American Labor Union (1898). By far the most important of these is the American Federation of Labor. (See Labor, American Federation of.) The growth and striking success of this organization supply a potent lesson in the requirements and conditions of successful labor organization. Avoiding direct participation in politics, and sedulously refraining from compulsory interference in the immediate affairs of its constituent unions, it confines itself to the prosecution of those aims which all labor organizations have in common, namely, the organization of new unions, the passage of legislation favorable to the working classes, the wider use of the union label, and the support of the labor press.

Statistics of Trade Unions in the United States. These are collected by the Labor Bureaus of a few States, but no complete enumeration for the whole country has ever been made. Estimates of the aggregate membership of American unions vary widely. In January, 1903, President Gompers of the American Federation of Labor estimated that about two and one-half millions of the seventeen million wage-earners in the United States were organized. The estimate is probably too high. The report of the Industrial Commission gives the estimated membership of labor organizations in the United States on July 1, 1901, at 1,400,000. This is probably the most reliable estimate ever made. The increase during 1902 was very great. The unions affiliated with the American Federation alone reported an increase of 283,827 members during the eleven months, November 1, 1901-September 30, 1902. Assuming that the estimate furnished by the Industrial Commission is correct, the aggregate membership of labor organizations in the United States, at the close of 1902, was about 1,650,000. The average membership of the American Federation of Labor alone, during the year ending September 30, 1903, was 1,465,800.

A more satisfactory idea of the growth of trade unions may be gained from the following table, in which the total membership of unions in Great Britain and New York is given, and an estimate of the members represented in the annual convention of the American Federation of Labor.

Number and Membership of Labor Organizations

YEAR	New York State		Represented in conventions of American Federation of Labor		Great Britain	
	Organizations	Membership	Organizations	Membership	Organizations	Membership
1890	....	....	83	199,500	....	....
1891	....	....	52	199,100	....	....
1892	....	....	68	228,400	1,192	1,503,298
1893	....	....	72	245,900	1,240	1,480,291
1894	860	157,197	56	176,300	1,279	1,437,025
1895	927	180,231	75	207,100	1,299	1,408,486
1896	962	170,296	92	273,500	1,314	1,495,476
1897	1,009	168,454	75	265,800	1,306	1,613,753
1898	1,087	171,067	110	279,000	1,277	1,649,461
1899	1,320	209,020	158	350,400	1,270	1,803,897
1900	1,635	245,381	181	550,300	1,252	1,910,614
1901	1,881	276,141	221	789,500	1,236	1,922,780
1902	2,229	329,098	226	1,025,300	....	....

The latter estimate is secured by allowing 100 members for each delegate to the convention. The figures for 1890-95 inclusive are taken from the report of the Industrial Commission and are based upon the actual number of delegates at the conventions. The figures for 1896-1902 are based upon the estimate made by the secretary of the American Federation of the number of delegates *entitled* to sit in the conventions, published in the Proceedings of the 22d Annual Convention of the Federation. To avoid duplication, the members of city centrals and State branches have been excluded. The real membership of the unions affiliated with the Federation is undoubtedly much greater than the paid-up membership indicated in the table, owing to the common custom of paying the per capita tax, on which the representation is based, upon a part only of the actual membership.

Trade Unions and the Law. The development of the law in the United States has been different from that in England. A few early cases are recorded in which trade unions were declared illegal, but as early as 1821 in Pennsylvania and 1842 in Massachusetts a view diametrically opposite to the English law was taken, and since has been consistently maintained by American courts, except in so far as it has been modified in very recent years by the anti-trust acts. Workmen may combine to improve the conditions of their employment and agree not to work for less than a certain amount, or to refuse to work for employers paying less than this amount, without active interference from the legal authorities; and in several important cases the courts have gone to the point of recognizing the legality of the bylaws of unions and even of enforcing them (*Master Stevedores' Association v. Walsh*, 2 Daly, 1; *People v. Musical Mutual Protective Union*, 118 N. Y. 101). Our legislatures have gone even further than the courts in recognizing the legality of the purposes of trade unions. The Federal Government and many of the largest States have enacted statutes providing for the incorporation of trade unions under exceptionally favorable conditions. But only an unappreciable percentage of unions have taken advantage of the incorporation laws, and labor leaders are practically unanimous in opposing it, on the ground that it would subject the unions to an indefinite number of vexatious and costly suits at law. The State legislatures have also conferred several special privileges upon labor organizations. Massachusetts and Kansas, for instance, have exempted labor organizations from the operation of the statutes regulating fraternal beneficiary associations; and about fifteen of our largest States have passed statutes prohibiting employers from discharging workmen for joining labor organizations, and even from making it a condition of employment that they should not belong to such organizations. Finally, at least two States and many local legislative bodies have enacted laws providing, directly or indirectly. that certain public work—usually printing—shall be performed only by union labor. Within recent years the legal status of trade unions has been seriously affected, at least in theory, by the so-called anti-trust acts passed by Congress and many State legislatures, making contracts or combinations in restraint of trade or commerce illegal. The Federal statute, which is concerned, of course, only with inter-State trade and commerce, has been held to apply to a labor organization of draymen and longshoremen (*U. S. v. Workingmen's Amalgamated Council*, 54 F. R., 994); and the same interpretation will probably be given to the State statutes save where they are specifically labor organizations. Little or no attempt has been made to dissolve unions or punish their officers under anti-trust statutes, but where these laws apply the legality of the most reputable unions is seriously threatened.

Trade Unions in Other Countries. While probably the germs of labor organizations in almost every country of Continental Europe may be found in earlier and even in mediæval organizations and movements, they owe their present strength, spirit, and methods chiefly to the socialistic propaganda; most of them have remained in close connection with the Social Democratic parties, and many of them—particularly in France, Belgium, Italy, and the Scandinavian countries—are as much political clubs as trade unions. (See Socialism.) There are, however, a number of strict trade unions on the Continent—particularly among the printers—and this number is continually increasing. As the Continental labor union grows older and more powerful, it manifests a stronger disinclination to be treated as a mere appendage of a political party. The Continental union was late in developing. The year 1864, which marks the formation of the International Workingmen's Association (see Internationale), furnishes a substantially accurate date for the beginning of the trade union movement on the Continent.

The political character of Continental unionism has decreased its efficiency by dividing the forces of labor into several semi-hostile groups. In Germany, for instance, we find the labor organizations divided into three distinct classes: A group of 'peace' unions, known as the *Hirsch-Dunckersche Gewerkvereine*, with 88,279 members (in 1898), assert the essential harmony of interests between employers and employees and depend upon arbitration and friendly benefits rather than strikes for the improvement of the conditions of employment. Clearly distinguished from the former by their aggressive methods in general are the socialistic *Gewerkschaften*, which in turn are divided into two groups over the question of direct participation in politics: the unions federated under the Central Commission (with 493,742 members) advocating a separation of the labor and the socialistic movements, and the local organizations (with 17,500 members approximately) opposed to this separation. The *Christian Unions*, with 161,517 members, constitute a third class distinct from and opposed to the preceding groups by their anti-socialistic principles. In Belgium the labor organizations are practically dominated by the political parties. In France the factional quarrels of the socialists have been carried into the labor organizations, with the consequence that in almost every city the trades are grouped into several hostile unions whose antagonism makes unity of action almost impossible. In Australia, on the other hand, where according to some authorities as many as 75 per cent. of the male workingmen belong to trade unions, and where the unions have secured a large proportion of their victories by political action, socialism has made little headway.

With the view of giving some idea of the beginning and extent of labor organization in the various Continental countries, the following tabular statement has been prepared. It is almost impossible to distinguish the labor organizations from the political clubs and fraternal associations in many countries, so that the figures must be interpreted as rough estimates of the extent of labor organization in the several countries rather than exact statistical measurements.

COUNTRY	Beginning of the modern movement	Approximate membership of labor organizations		Remarks
		Date	Number	
Netherlands	1811	1894	52,818	Freedom of combination was granted in 1811; the movement was, however, weak until very recently.
Belgium	1840	1900	100,000	Constituting from 10% to 11% of the laboring population from which unionists are drawn.
Switzerland	1858	1900	50,000	This estimate is a very loose one.
France	1874	1900	588,832	In addition there were 533,454 persons in agricultural associations and 29,044 members of mixed associations of employers and employees.
Germany	1865	1899	864,350	In addition, about 620,000 members of organizations exercising some of the functions of a trade union. In 1901 the membership of the socialistic trade unions alone was 688,870.
Austria	1867	1901	150,000	119,050 in the general federation of socialistic "Gewerkschaften."
Denmark	1871	1900	96,295	It is reliably estimated that 76 per cent. of the male and 21 per cent. of the female industrial population over 18 years of age belong to trade unions.
Norway	1871	1899	24,000	This estimate is a very loose one.
Sweden	1883	1898	50,000	This estimate is a very loose one.

CLASSIFICATION OF TRADE UNIONS. As was pointed out in the article on LABOR ORGANIZATIONS, the trade union is simply one branch of the great family of labor organizations. The following classification brings out clearly the great diversity of structure which exists both among organizations of laborers and among trade unions themselves:

- LABOR ORGANIZATIONS
  - Continuous
    - Not on the trade principle
      - Political,* e.g. Independent Labor Party.
      - Fraternal,* e.g. Ancient Order of United Workmen.
      - Mixed assemblies, e.g. Knights of Labor.
      - Industrial unions, e.g. United Mine Workers.
      - General amalgamations, e.g. Knights of Labor.
    - On the trade principle
      - Non-federative
        - Sub-locals, e.g. Printers' chapels.
        - Local unions, e.g. "Big Six" of New York.
        - District councils, e.g. of Carpenters and Joiners.
        - National unions, e g. Iron Molders' Union.
        - International unions, e.g. Cigar Makers' International Union of America.
      - Federative
        - Central unions, e.g. Chicago Federation of Labor.
        - State federations, e.g. Massachusetts Federation of Labor.
        - Industrial federations, e.g. National Building Trades Council.
        - General federations, e.g. American Federation of Labor.
  - Temporary
    - Strike.
    - Boycott.

* These are not strictly labor organizations, but are included here because their membership is drawn almost exclusively from the ranks of labor.

The preceding classification emphasizes the difference between amalgamated labor unions and trade unions or federations in which the individuality of each trade is preserved. The 'mixed assembly' is simply the governmental unit of the amalgamated union. It was a permanent feature of the Knights of Labor, but it is also used by the Federation of Labor, and is known as the 'federal union.' It supplies a union for workmen in unorganized trades, or in places where there are not enough workers in one organized trade to start a local union. The industrial union is merely a centralized union, in which are united all the workers of any one industry, irrespective of trade or occupation. The United Mine Workers, for instance, aim to coalesce in the same local union all wage-earners "working in and about the mines except mine manager and top boss." There are also industrial unions which do not aim to unite all classes of workmen in the same locals, but which attempt to unite local unions of the different trades in a single national body. The latter are to be regarded as federations of trade unions, rather than labor organizations. The 'central' or 'central union' is merely another name for the municipal federation of trade unions.

GOVERNMENT. The government of local unions is distinguished by its thoroughgoing democracy. The tenure of office is usually six months and there is a widespread feeling in favor of rotation in office. The most important local officers are the business agent or walking delegate and the chairman of the grievance committee. Only a small proportion of the locals have such officers, but where they do there is a strong tendency to reëlect men who have proved themselves the possessors of the unusual abilities which these positions require. The government of the national union usually comprehends a periodical convention, a permanent executive board, a corps of organizers, a president, several vice-presidents, and a secretary-treasurer. As the referendum is apparently becoming more and more popular in

America, the general membership must be counted in many unions as the ultimate source of legislative power, and, indeed, of the judicial and executive power, as well as in the numerous cases in which the general membership decides appeals, votes strikes and special assessments, etc. In unions which do not employ the referendum system, the supreme executive and judicial powers are vested in the periodical conventions and in the executive boards between conventions, but as these boards are usually composed of unsalaried workmen living in different cities and conducting their deliberations by mail, it frequently—perhaps usually—happens that their powers are virtually exercised by the president, who and the vice-president and secretary-treasurer almost invariably have seats in the executive board.

Problems of Organization. The great difficulties of labor organizations show themselves in bitter disputes between unions. In the first place, there are disputes between dual unions. This is a simple trade war between rival unions which openly claim control of the same trade and the same field. Secondly, jurisdiction disputes are likely to arise. These disputes may be divided into several classes according to the cause and nature of the conflict. (a) Territorial disputes. A typical instance is noted in the 24th Annual Report of the Bureau of Statistics of New Jersey. Here the work on a large building was seriously interrupted for months by a quarrel between the New York and Newark local unions of the International Brotherhood of Electrical Workers, the New York union claiming exclusive right to all work in Newark in accordance with an agreement made with the international union. The dispute was finally settled by an agreement, in accordance with which the Newark union was given "one-half the jobs which a New York contractor may have to dispose of on a building in Newark, the Newarkers to have the New York rate of wages." (b) Demarcation disputes are those arising from conflicting claims to certain work lying midway between two distinct trades. The shipbuilding industries on the Tyne, for instance, were tied up for eighteen months or more at one time by demarcation disputes which hinged largely about the "limit of the size of the iron pipes to be fitted by the engineers and the plumbers respectively, and whether the joiners should or should not be confined to woodwork of one and one-half inches thickness." (c) The third class of disputes consists of those arising between a more extensive and a less extensive union, concerning the autonomy of the latter. Thus the increased division of labor in the printing trade made of the pressmen a separate class, and new inventions produced the stereotyper and electrotyper. It was inevitable that these classes should desire their trade independence, and that the original union should strenuously oppose all secessions likely to decrease its power and prestige. And in fact there has been a long series of conflicts between the old Typographical Union and bodies of discontented pressmen, bookbinders, stereotypers and electrotypers. (d) Industrial organization versus trade autonomy. A similar but far more important source of jurisdiction disputes is the rapidly growing practice of adapting labor organization to industrial organization, and uniting in one union all the trades represented in a single industry. Industrial organization inevitably brings the union adopting it into conflict with the unions of the separate trades represented in the industry. Thus the United Mine Workers have had serious conflicts with the stationary firemen and the blacksmiths, and the brewery workers have been in constant strife with the painters and coopers, the team drivers, etc. This conflict takes its importance from the fact that both methods of organization are characterized by marked advantages as well as defects. In the strike and in all phases of collective bargaining, industrial organization is obviously superior, both for the employer and for the employees. On the other hand, the regulation of the strike and the settleworkers to a larger number of less skilled craftsmen is frequently a source of weakness and always a source of dissatisfaction.

The Ultimate Form of Organization. One of the most persistently advocated remedies for jurisdiction disputes has been that of amalgamation, the form of organization in which all the trades are coalesced in a strong central union. Amalgamation has never proved practicable. United action is plainly necessary, but it must be secured by federation and not by consolidation. Another remedy for the jurisdiction dispute, tried with only partial success, is the 'jurisdiction statement.' The constitution of the National Building Trades Council, for example, provides that "all organizations affiliated with any local Building Trades Council shall plainly and satisfactorily define the class of work they claim, and no trade will be permitted to do the work pertaining to another." Up to the present time, however, the jurisdiction statement has been of but little use in preventing conflicts between unions. The indications are strong that the ultimate structure of union organization will be exceedingly complex; that the unit of government will be the simple trade union of the old type, but that these unions will be combined in a very large number of cross-cutting federations, each distinct and independent, but all of them formed, as it were, of the same material. The simple trade union will probably retain jurisdiction over such questions as industrial education, apprenticeship, and friendly benefits. On the other hand, the regulation of the strike and the settlement of demarcation disputes will in all probability come within the province of industrial federations, which are even now multiplying rapidly. The industrial federations have come to stay. Yet there will undoubtedly be additional federations. The broad, general federation represented at present by the American Federation of Labor will surely persist, devoting itself particularly, as the Federation does, to education of the working classes, the rapid extension of labor organization, the promotion of favorable legislation, the defeat of unfavorable legislation, the wider use of the boycott, and the maintenance of a labor press. It is probable that the time is almost ripe for political action by labor organizations. But past experience teaches unequivocally that almost without exception the entrance of trade unions as such into politics has proved disastrous. Such being the case, it is probable that the trade union will enter politics by means of a distinct political federation. A striking example of this is the Labor Representation Committee (q.v.) of Great Britain.

METHODS AND POLICIES OF TRADE UNIONISM.

Trade Unionism and Monopoly. Probably no social institution in existence represents the movement away from the old economic policy of *laissez-faire* more concretely and forcibly than the trade union. Almost every method or policy adopted by the trade unions is in essence a regulation of competition. The essential function of the trade union is collective bargaining; and the first condition of successful collective bargaining on the part of the trade union is that it shall secure substantial control of the efficient supply of labor. In securing and maintaining such control two policies are adopted: a policy of inclusion and a policy of exclusion. To obtain control of a particular trade in a particular jurisdiction, the utmost effort will be made to bring into the union every effective competitor for the work to be done in that jurisdiction. Once having control, there is the strongest temptation, if not a real necessity, for limiting the supply of craftsmen by regulation of apprenticeship and other means. The great majority of trade unions prosecute the work of organization vigorously and incessantly. In the beginning trade unionism was sporadic and instinctive, and the national union was the product of the amalgamation of two or more self-organized locals. At present organization is deliberate, systematic, and proceeds from the top down; the local is the child rather than the parent of the national. Even the exclusive unions like the Window Glass Workers enter heartily into the work of organizing the great mass of unskilled workers, because with the increasing use of machinery this body constitutes a constant menace to all trades. The organization of wage-earners is the special work of the Federation of Labor. In 1902, for instance, the Federation employed fifteen salaried organizers, who gave their whole time to this work; 39 others who devoted from one to six months of their time to organization; and nearly 1,000 volunteer organizers who were paid for each new union organized by them. The expenditure for organization alone was over $36,000; and new charters were issued to 14 national and international unions, 6 State branches, 127 central unions, and 877 local trade and federal labor unions.

Restriction of Membership. In almost every American union the applicant for admission must be accepted by the local which he desires to enter, and in voting upon applicants a minority of the members—in some important unions as few as three blackballs—are usually sufficient to exclude the candidate. At present, however, in the majority of American unions, the terms of admission are purely nominal.

Entrance to a Trade. Trade union regulations concerning the entrance to a trade fall under four heads: apprenticeship, limitation of boy labor, progression within the trade, and the exclusion of women. The limitation of boy labor will be treated with the limitation of apprenticeship, while the regulation of promotion within a trade is not a question of great practical importance in American unions, except perhaps in the union of the Post Office Clerks, where for obvious reasons the regulation of promotion becomes the main object. The exclusion of women is no longer attempted by American or English unions, the only case to the contrary in the United States known to the writer being that of the Upholsterers' International Union of North America. Nevertheless, only a small proportion of the female bread-winners are organized. In Great Britain, for instance, in 1901, the women and girls constituted only 6.2 per cent. of the members of trade unions and were found in only 144 out of the 1,250 unions, though the census of occupations showed that the female bread-winners were nearly one-third as numerous as the males.

The Regulation of Apprenticeship and Boy Labor. The regulation of apprenticeship was not in origin a trade union policy; it was introduced, adopted, and sanctioned by statute law at a time when the trade union did not exist. Consequently, although the trade unions indorse the regulation of apprenticeship with striking unanimity, and still regard it as an ideal, such regulation is at present enforced only in an insignificant number of trades and seems to be disappearing. The apprentice system is much less prevalent in the United States than in Great Britain; and in the latter country in 1897 Mr. and Mrs. Webb estimated that out of the 1,490,000 members of the trade unions only 90,000 belonged to unions which were actually able to enforce apprentice regulations. The desirability and expediency of the regulation of apprenticeship by trade unions is extremely questionable. An examination of the apprenticeship regulations of the few American labor unions which are able to enforce them plainly shows that the educational motive is decidedly a minor one, while these regulations exercise no perceptible effect in checking child labor under any given set of conditions. On the other hand, the unions which have acquired sufficient power to regulate apprenticeship have evinced a strong disposition to restrict unduly the number of apprentices. A wide examination of the apprenticeship regulations of American unions shows that the average period of apprenticeship is more than three years and the average number of apprentices to journeymen somewhat less than one to ten. Finally—and this fact seems conclusive—the restriction of membership to workmen who have been apprenticed is not necessary to the successful operation of the union. The United Mine Workers, the Locomotive Engineers, the Carpenters and Joiners, and in fact most of the large unions, in practice if not in theory, are completely 'open.'

Monopolistic Alliances Between Trade Unions and Employers' Associations. The evil possibilities of the policy of exclusion are well illustrated in occasional compacts between trade unions and combinations of manufacturers in which the two organizations combine to monopolize a certain industry for the benefit of both. In the Birmingham (England) Metal Trades these 'alliances,' as they are called, were common about 1897-98. The essential feature of the Birmingham alliance was an agreement by which the employers bound themselves to employ none but union men, in return for which the latter agreed to work for no manufacturer who sold his product at prices less than those formally adopted by a 'wages board' composed of an equal number of employers and employees. For every advance in price there was to be a proportionate, though not an equal, advance in wages. Monopolistic alliances of this kind are rare and as a rule not lasting.

Regulation of Wages. The most essential function, as well as the explanation and justification of trade unionism, is the determination of the conditions of employment by collective instead of individual bargaining. The most important condition of employment is the rate of wages, as is well illustrated by the fact that in both England and the United States more than 50 per cent. of the strikes which occur are caused by disputes about wages. The conditions and characteristics of the regulation of wages by trade unions may be briefly summed up under three heads. (1) The standard rate as maintained by American unions is a local rate fixed by the local union. In a few trades working largely by piece, such as the Potters, Glass Blowers, etc., the scale of prices is fixed for the whole country by the national union; and in a few other unions, such as the Brewery Workmen and the United Hatters of North America, a national minimum time rate is prescribed. But in the vast majority of unions the regulation of wages is left wholly to the local union, and no strong demand for uniformity seems to exist. (2) Contrary to general opinion, the majority of trade unions, in trades in which it is possible, favor work by the piece rate system. In England, Mr. and Mrs. Webb have made a careful study of the wage system of every trade union having more than 1,000 members, unskilled laborers and transport workers excepted. Of these, 111 unions, having 1,003,000 members, were examined; forty-nine, with 573,000 members, insisted on piece work; twenty-four, with 140,000 members, willingly recognized piece work; and thirty-eight, with 290,000 members, insisted on time work. A similar investigation in the United States was made by the Industrial Commission. Information was secured concerning 50 important unions in which piece work was possible. Of these unions 28 accepted the piece-work system in some department without active opposition, while 22 unions either forbade or actively discouraged piece work. The reasons for this diversity are clear. In some occupations, such as spinning and weaving, the intensity of the labor is determined by the speed of the machine, or, speaking generally, the employer finds it possible to set the pace for the employee. In such occupations it is evident that the workers will insist upon piece payment to prevent forcing and over-exertion. In other occupations, such as ordinary carpentering or repair work in general, it is impossible to estimate how much skill or time will be required to perform a given 'job' or piece, and here the time rate is the workman's only defense against exploitation. The testimony collected by the Industrial Commission amply proves that the majority of the labor leaders of the United States would abolish the piece-rate system instantly if it were possible. The leaders hold that under the piece-work system the most proficient workmen set the pace and fix the standard rate, thereby depressing the earnings of the less talented but no less industrious or deserving shopmate. In addition the argument is made that the piece-rate system either encourages excessive production, and thus depresses prices, or throws the work into the hands of a few workmen, thus increasing the amount of non-employment, both of which results tend strongly to reduce wages. The feeling is also prevalent that the piece system stimulates employees to over-exert themselves and to work themselves out at an early age.

It must be admitted that the piece system in practice may be, and often is, manipulated to the injury of the general body of wage-earners. It is undoubtedly true that employers are disposed to reduce piece rates as soon as the more efficient workmen in their employ demonstrate an ability to earn an unusually high rate by the system; and furthermore, the testimony seems convincing that in many instances the piece-rate system does lead over-ambitious employees to injure their health in the attempt to earn unusually high rates of pay; but the objection to piece work on the ground that it leads to over-production, and the defense of a uniform wage irrespective of productive power, are on the face of them evils and untenable, if not from the standpoint of the trade union, at least from the standpoint of the general public.

Hours of Labor. In the eyes of the American labor leaders the regulation of the hours of labor is an even more important function of the trade union than the regulation of wages, as the question of the working day is primarily one of health, morals, and the necessary leisure for education, and social and religious duties. In this respect the trade unions have from the beginning placed unusual reliance upon the law. But they have also worked incessantly to reduce the hours of labor by direct negotiations with employers, by strikes, and by boycotts.

The normal day, like the standard wage in the great majority of American unions, is left almost entirely to the separate locals, and even in the few nationals which have a maximum working day for the whole country the locals are left free to secure a shorter working day if possible. But although the locals are accorded a wide discretion in fixing the normal day, the national organizations and leaders constantly urge them to reduce the number of hours, and among the national organizations strong enough to lead in this matter, laws requiring increased rates for overtime, or wholly forbidding overtime except in cases of extreme emergency, are common.

Restriction of Output. The preceding section makes it plain that trade unions do restrict the industrial output openly and systematically. The restriction of the output of individual workers is accomplished in several ways: by adopting a normal day and discouraging or prohibiting overtime; by limiting the daily task or the earnings of piece-workers; by discouraging or prohibiting the grading of time-workers, and thus leveling wages; by forbidding piece work, time work, contract jobs, or the butty system; and in some cases by encouraging the go-easy system of secret loafing, or 'the adulteration of labor.'

A variety of arguments are brought forward in defense of the general policy of the limitation of output. Trade unions claim that this is the only way of preventing over-exertion on the part of workmen, particularly under the piece system; that it tends to prevent unemployment and moderates the destructive competition of the army of the unemployed: and finally that it tends to prevent over-production. There is a large degree of truth in all these contentions. The history of the factory system is one long proof of the truth that, under a régime of freedom of contract in the sale and purchase of labor, wage-earners are driven by the employers and led by the pace of the hardier workmen to impair the health both of themselves and their offspring. It is true also that increased leisure, wisely spent, tends to elevate the standard of life, and that wages are in a measure determined by the standard of life; that collective bargaining presupposes given rules based upon the average efficiency and endurance, thus restraining in its operation the strongest workmen from doing their utmost; that in periods of temporary depression distributive justice sanctions a limitation of the work and income of each, in order that all may have some work and some income.

No judgment upon this subject may, however, be rendered except in concrete cases. When the United Mine Workers demand an eight-hour day in underground mines, the justice of the demand seems unanswerable; when the Window Glass Workers insist on a four months' stop each year, the demand is questionable; but when the Chicago plumbers limit, as they did in 1889, the amount of work in some branches to about half as much as could be performed by an able-bodied workman without undue strain, the demand is *prima facie* inequitable.

The point is even clearer in the limitation of wages as distinct from the limitation of hours. That the Detroit Stove Founders should limit piece earnings per day to $4.50 may seem reasonable as a preventive of over-exertion; but that time-workers, like the stone-cutters, carpenters, and coopers, should oppose the payment of more than the standard rate to exceptionally efficient workers, or that the machinists should oppose a classification of their workmen by the War and Navy Departments, thus forcing all workmen to the dead level of the idlest and most incompetent, seems indefensible.

ATTITUDE TOWARD MACHINERY. Historically, trade unions have opposed the introduction of labor-saving machinery, but, speaking generally, the unions have realized at last that it is impossible effectively to oppose the introduction of labor-saving devices; and among trade union leaders the number of those who fully realize that the machine in the long run is the friend and ally of the wage-earning classes is rapidly increasing. Trade union leaders may be said in general to have learned how to meet successfully the industrial problems caused by the introduction of machinery. Thus, when the printers were confronted with a great decrease in the demand for labor as a result of the invention of the typesetting machine, the Typographical Union met the problem in a rational manner. It insisted that the operators of the machines should be selected from ordinary printers, and that they should be paid as much at least as the wages of the hand printers. For a short time large numbers of printers were thrown out of employment, but in three years, according to the estimate of the president of the Typographical Union, the increased demand for printers, consequent upon the decrease in the cost of printing, afforded work for more than the old supply of printers. The justice of trade union regulation respecting the use of machinery must in each case be decided in accordance with its intent. Trade unions are justified in the attempt, if not clothed with the duty, of lessening the hardships occasioned by the extensive introduction of revolutionary inventions. It is the permanent antagonism to labor-saving machinery which is both hopeless and economically fallacious.

TRADE UNION INSURANCE. Mutual insurance—aid to the traveling journeyman in search of work, assistance in case of sickness, and a collection to defray burial expenses—was perhaps the principal function of the trade union of the eighteenth century, and still constitutes a principal function of trade unionism in foreign countries, particularly in England. In the ten years 1892-1901, for instance, the 100 principal trade unions in England expended £299,310 in working and miscellaneous expenses, £293,552 in dispute or strike pay, and £919,901 in friendly benefits.

Among American unions, however, conditions are entirely different. Of the 96 national unions of which information is at hand, 22 make no provision for any kind of benefits, 32 pay no strike benefits, 48 pay no death or funeral benefits, 74 pay no sick or accident benefits, and 91 pay no unemployment or out of work benefits. Only 2 pay a superannuation benefit, and one of these is a branch of a British union.

While it is evident that the friendly benefit is not essential to the successful conduct of a trade union, it is also true that the leading American labor leaders strongly advise the institution of the benefit system, and in unions maintaining this system it has been of immense service in accumulating large reserve funds, in forcing obedience from members, in preventing them from dropping out when their interest wanes, and in stimulating a more conservative policy in general. The powerful Cigar Makers' International Union, for example, and the railroad brotherhoods, furnish illustrations of the advantages of the insurance system as an auxiliary to trade unionism. (See RAILWAY BROTHERHOODS.) The insurance function, however, is strictly subordinate, except in one or two organizations. The insurance funds are unprotected, and may be expended in strikes, trade wars, or for any purposes which meet the approval of the constituted authorities. After having paid insurance assessments for years, the individual member may be expelled for a trifling infraction of rules, or may see the insurance system abolished and all the funds dissipated in supporting a sympathetic strike. Nevertheless the individual members acquiesce in this condition of affairs, and vehemently oppose any attempt at regulative legislation. The widespread opposition of trade unions to incorporation rests largely upon the belief that it would destroy this unlimited freedom in the use of insurance funds.

COLLECTIVE BARGAINING, ARBITRATION, AND CONCILIATION. Modern political economy recognizes in collective bargaining a legitimate and the most important function of trade unionism. This concerted action, by which employers are prevented from fixing wages at the rate acceptable to the neediest competitor, is the goal and aim of trade unionism. The walking delegate, or business agent, who represents a body of union workmen, advises them what rate of wages to demand, and conducts their negotiations for them, is thus not an ugly incident, but an essential necessity of trade unionism—the very heart of the institution.

In England systematic collective bargaining by recurrent joint conferences was first introduced in the hosiery trade about 1860. At the present time Mr. and Mrs. Webb estimate "that in all skilled trades where men work in concert on the employer's premises 90 per cent. of the workmen find either their rate of wages or their hours of work and often many other details predetermined by a collective bargain in which they personally have taken no part, but in which their interests have been dealt with by representatives of their class." And in the United States the system has been introduced to an extent scarcely realized by the general public. Thousands of local agreements exist in the cities, particularly in the building industry; and in about a dozen trades national agreements exist. The history of trade arbitration and collective bargaining shows that the value of these agreements lies in the conciliatory spirit engendered by conferences in which employees and employers meet on a footing of friendly equality. The arbitrator or umpire, with decisive vote, is relatively unimportant. The reason for this statement lies in the important difference between the adoption of new contracts and the interpretation of existing contracts. The latter function is judicial in nature and may safely be left to authoritative arbiters. On the other hand, the adoption of new principles, or the determination of future conditions, is a matter of competitive struggle, which, except on extraordinary occasions, should not be left to outside parties, however disinterested. Recognizing this truth, trade union leaders generally oppose compulsory arbitration; and even in collective bargaining arbitration seems to be going out of favor both in England and the United States. In the printing (newspaper) and general foundry trades agreements for arbitration exist, but none of the national systems of collective bargaining in the United States contain a provision for arbitration in case the representatives of employers and employees fail to agree.

Collective bargaining is to a degree dependent upon the organization of employers, and it increases in extent and efficiency as employers' organizations increase. Associations of employers are not new, but in the last few years they have become not only more numerous than in the past, but more systematic and more thoroughly managed. (See TRADE ASSOCIATIONS.) Most of the existing manufacturers' associations, like the Stove Founders' National Defense Association and the National Association of Builders, encourage collective bargaining and thus make for industrial peace. A large majority of American unions officially indorse arbitration and conciliation. In Great Britain Mr. and Mrs. Webb think that the opposition to arbitration in the strict sense is steadily growing. In the United States opinion is divided, and it is impossible to say whether opposition is increasing or decreasing. It is, however, indisputable that the employees far more frequently invoke the aid of State boards of arbitration than the employers, and that they are practically undivided in support of collective bargaining on the one hand and in opposition to compulsory arbitration on the other hand.

THE STRIKE. Trade union regulations respecting strikes (see STRIKES AND LOCKOUTS) are so diverse that it is impossible to describe them in a few sentences. Generally speaking, the local union is the active agent in the strike; the national organizations in which a local may be forced to strike against its will number probably less than a dozen, and in only three or four may a local be expelled for striking against the decision of the national officers. The control of the locals is through the purse. Many of the unions maintain protective funds, or war chests, which in the well-managed organizations frequently assume very respectable proportions. If the local desires strike pay and other financial support it must refrain from striking except in accordance with the established regulations of the union. In the better organized unions a procedure of the following nature is imposed upon locals: Before the strike may be considered a local grievance committee, or the local president or business agent, must attempt to settle the grievance amicably with the employer in question. If these negotiations fail, the local may then vote upon the question of striking, and in this vote the ballot is usually secret, while in most unions a two-thirds vote is required to authorize the strike. If the local indorses the strike, the decision must be ratified by the national president or executive board, and at this point, again, most unions require the national president to proceed to the scene immediately and make every effort to adjust the grievance by peaceable negotiation with the employer. Only after the failure of this attempt may the national sanction be conferred upon the strike.

The effect of such regulations can be easily appreciated. The strike of the past was sporadic, passionate, and directed against some abuse which the workers believed intolerable. The strike of the present day is deliberately and systematically conducted; it marks the rising market and periods of prosperity; with many trade unions it has become a settled policy. It is not intended to suggest that trade unions encourage strikes; the general opinion of economic writers is to the contrary. What is meant is that the strike as conducted by the trade union is governed by interest and not by passion; and that "while the most intelligent and conservative labor leaders freely recognize the expensiveness of strikes and desire to supplant them as far as possible with peaceable methods of negotiation, they almost uniformly maintain that workingmen gain in the long run far more than they lose by the general policy of striking." For the statistics of strikes, see STRIKES AND LOCKOUTS.

THE BOYCOTT. The American union has done with the boycott what it has done with the strike: made it less violent, but more deliberate and systematic. The old form of boycott—the fiery crusade for the social and commercial ostracism of the offending employer—is still met with occasionally, but the favorite method at present is to place the recalcitrant employer on an unfair list and spread the ban through the medium of the labor press. The initiative is largely taken by complaint of the local union to the national executive board that some employer is violating union rules. The national officers usually offer the employer a hearing at which to disprove the charges, or offer proof of intention to discontinue the objectionable practice, and if such proof is not supplied the offender is placed on the list of merchants or manufacturers with whom loyal trade unionists are encouraged to have no business dealings either as purchasers of commodities or sellers of labor. A majority of American unions use this system to a greater or lesser extent. The Federation of Labor gives national scope to the more important boycotts by indorsing them and including the offenders' names in the column of the *American Federationist.* Between 75 and 100 firms and companies were under boycott by the Federation in January, 1903. It is clear that if the 1,465,800 or more members of the Federation strictly observed every official boycott the latter would become a formidable weapon against manufacturers and sellers of commodities in general use among the laboring classes. The observance, however, is so lax that the boycott is not effective except in a few industries, such as the brewing industry, and in some union strongholds, such as Chicago, Milwaukee, and the larger cities generally.

Boycotts proper, however, have been generally held unlawful in American courts, though a few recent equivocal decisions are held by some to point the other way. American trade unionists, however, are practically unanimous in upholding the right to boycott. Their argument rests upon the absolute and complete legality of the act of discontinuing business relations. Finally, trade unions exert what is often called 'a legal boycott' through the familiar union label, which has played such an important part in the building up of the Cigarmakers', Garment workers,' and Hatters' unions in America, and the use of which is now spreading, not only among American unions, but among those of England, Germany, Austria, and Australia. See UNION LABEL.

BIBLIOGRAPHY. For the history of trade unionism in England, consult Webb, *History of Trade Unionism* (2d ed., London, 1896), containing an exhaustive bibliography; for the United States, Ely, *The Labor Movement in America* (New York, 1886); for statistics in England, see *Annual Reports* by the Chief Labor Correspondent of the Board of Trade on Trade Unions; for statistics in the United States, 17th volume of the *Report of the Industrial Commission* (Washington, 1901); for legal aspects, Stimson, *Hand-Book to the Labor Law of the United States.* This is brought up to date in the fifth volume of the *Report of the Industrial Commission.* For the organization, functions, and policies of trade unions, see Webb, *Industrial Democracy* (London, 1902); for organization, functions, and policies of American trade unions, 17th and 19th volumes of the *Report of the Industrial Commission.* For materials and sources, England, *Report of the Royal Commission on Labor;* in particular, vols. ii., iii., and v.; United States, *Report of the Industrial Commission;* in particular, vols. v., vii., xii., xiv., xvi.

Most of the labor and statistical bureaus of the separate States now publish statistical and other material upon trade unions. Much of this information is fragmentary and untrustworthy, but the reader is especially referred to the *Reports of the Massachusetts Bureau of Statistics of Labor* and the *Annual Reports of the New York Bureau of Labor Statistics.* A notable source of current information is the bi-monthly bulletin of the Bureau of Labor. Almost all of the trade unions now publish monthly journals, among which the *American Federationist,* the *Typographical Journal,* and the *Locomotive Firemen's Magazine* are especially noteworthy.

TRADE UNIONS, THE GENERAL FEDERATION OF. The central labor organization of Great Britain. It was organized July 1, 1899, under the auspices of the British Trades Union Congress for the purposes of upholding "the rights of combination of labor," promoting industrial peace, and establishing a fund for mutual assistance and support. The Federation is "open to every *bona-fide* trade union in Great Britain," but the unit of membership is the trade union and "no branches or individuals are allowed to join." It is governed by a general council of delegates which meets annually, and between these sessions by a management committee of fifteen. Appeals may be taken from the decisions of both the council and the committee to the general membership. The Federation is "non-political and non-legislative," leaving to the Labor Representation Committee (q.v.) the campaign for the election of labor representatives to Parliament, and to the Parliament committee of the Trades Union Congress the agitation for favorable labor laws. The Federation pays, in strikes authorized by the general council or the management committee, two grades of strike benefits: five shillings a week per member "on the higher scale," and half this amount "on the lower scale." Unions on the higher scale contribute sixpence a member per quarter, and unions on the lower scale threepence a member per quarter, on ninety per cent. of the total membership, exclusive of superannuated members. In cases of emergency the management committee is authorized to increase the regular dues 100 per cent. The entrance fee is one penny per member upon ninety per cent. of the total membership, but in addition it is provided that "Any society desirous of joining the Federation shall pay ten per cent. of the average worth per member of the class or scale the union or society is joining, in addition to their entrance fee, but any society not in existence at the time of adoption of this scheme shall be allowed to join on payment of five per cent. of the average worth per member of the Federation at the time of joining." No union is entitled to benefits until it has belonged to the Federation for twelve months. The Federation started with 343,000 members. During the fiscal year ending June 30, 1902, the total income was £29,962 and the total expenditures £9,957, of which £8,338 was for strike benefits. At that date the reserve or defense fund amounted to £76,969 and the membership to 419,606.

TRADE WINDS. See WIND.

TRADING STAMPS. Slips of engraved or printed paper usually in the form of gummed stamps, given by merchants to purchasers of goods, and which may be presented to some person or corporation in exchange for articles of value. The trading stamp companies usually agree to distribute books containing the names of their subscribers among the residents of the city and surrounding country. The scheme amounts to an advertisement and various forms of it are in operation in many States. The statutes of a number of States prohibit these 'gift enterprises' as being a form of lottery. In New York such a statute was held unconstitutional on the ground that there was no element of chance in the scheme, and that the prohibition was an interference with legitimate trade. The United States court took a contrary view in passing on an act of Congress prohibiting gift enterprises in the District of Columbia. The court held that the statute was a valid exercise of the police power, on the ground that the trading stamp scheme by which the enterprise was conducted was a burden on both the merchants and purchasers of their goods. The assumption is that a merchant who buys the trading stamps from some corporation introducing them will make up the amount he is thus compelled to pay either in the price of his goods or their quality, and thus in the end the public are deceived into thinking that they are obtaining something for nothing. An additional objection to the scheme advanced by the court was that the trading stamp companies profited by the fact that many persons did not present their stamps for the premiums offered. The decisions of the various States are not uniform on this question, the two views above presented illustrating the diversity of opinion. Where there is an element of chance as to the value of the article which a certain number of trading stamps may draw, the general view is that the scheme is akin to lottery, and illegal. See LOTTERY.

TRADUCIANISM (from Lat. *traducianus*, from *tradux*, vine-branch for propagation, from *traducere*, to lead along, train, propagate, from *trans*, across, through + *ducere*, to lead). One of the theories adopted for the purpose of explaining the production of the soul in the procreation of human species. It is ascribed to Tertullian (q.v.) as its first author, and is elaborately explained and defended by him in his book *On the Soul*, written after he had lapsed into the Montanist heresy. In opposition to others who had held the theory of preëxistence of souls, of which preëxisting souls one is divinely infused, or, by some natural affinity, is attracted into each fœtus as soon as it has been formed by generation in the procreation of man, Tertullian taught that souls are propagated by souls as bodies by bodies, and by the same or a simultaneous process. In another place he describes this origin of soul from soul as generation, and even of a class analogous to corporeal generation; and this more gross and material exposition of the theory of traducianism is sometimes called *generationism;* which, however, is commonly looked upon as a totally distinct theory. A third hypothesis to explain the origin of the soul is that of creationism (q.v.).

TRAETTA, trä-ĕt′tȧ, TOMMASO (1727-79). An Italian composer, born at Bitonto. He studied at the Conservatorio di Loreto, Naples (1738-48), and in 1751 produced his first opera, *Farnace*, in Naples. From 1765 to 1768 he was a director of a conservatory in Venice, and resigned to become Court composer to Catharine II. at Saint Petersburg. His most important operas were *Germondo* (1776) and *Ippolito ed Aricia* (1759), which gained for its composer a life pension from the King of Spain. His works were characterized by theatrical effectiveness and harmonic vigor. Consult Capruzzi, *Traetta e la musica* (Naples, 1878).

TRAFALGAR, trä′fȧl-gär′, *or, more commonly in England*, trȧ-făl′gẽr, CAPE. A low promontory on the south coast of Spain, about 29 miles northwest of Tarifa (q.v.), at the western entrance to the Strait of Gibraltar. It is memorable for the great naval victory obtained off its shores by the British fleet under Nelson over the combined fleets of France and Spain on October 21, 1805. The allies had thirty-three ships, commanded by the French vice-admiral, Villeneuve, while Nelson had twenty-seven. The British fleet was arranged in two columns. The first under Collingwood fell upon the rear of the allied fleet, commanded by the Spanish vice-admiral, Gravina. After a terrible contest, in which Nelson himself lost his life, the two British columns completely disorganized the hostile line. Eighteen ships were captured, and Napoleon's naval power was gone forever. For the important influence this victory had on the course of the Napoleonic wars, see NELSON, HORATIO; NAPOLEON I. Consult Mahan, *Influence of Sea Power on the French Revolution* (Boston, 1892).

TRAFALGAR SQUARE. A London square named in commemoration of the battle of Trafalgar and containing the imposing granite column in memory of Nelson, two fountains, and statues of Havelock, Napier, Gordon, and George IV. About it are the buildings of the National Gallery, National Portrait Gallery, Royal Humane Society, Royal College of Physicians, and other public buildings.

TRAF′TON, MARK (1810-1901). A Methodist Episcopal minister, born in Bangor, Me. He joined the Maine Conference 1831, but held most of his charges in the New England and Providence Conferences. In 1852, while serving his third term as pastor at Westfield, he was elected to represent his district in the Thirty-fourth Congress. He was a poet of no mean order. He published *A Plea for Infant Baptism and Against Exclusive Immersion* (1846); *Rambles in Europe* (1852); *The Safe Investment* (1856); *Baptism, Subjects and Modes* (1870); *Scenes in My Life* (1877).

TRAGACANTH. See GUM.

TRAGEDY. See DRAMA.

TRAGIC POET, HOUSE OF THE. One of the most attractive houses of Pompeii, made famous as the home of Glaucus in Bulwer's *Last Days of Pompeii*. The name was assigned through misconception of a painting discovered at the time of the excavation. It had two stories, and was richly decorated with paintings, among them the two best-known Pompeian paintings, "The Nuptials of Zeus and Hera" and "The Sending Away of Briseis," both preserved in the Naples Museum, together with the noted mosaic of a dog with the motto "Cave Canem," originally in the floor of the vestibule.

TRAGOPAN (Neo-Lat., from Gk. τραγός, *tragos*, goat + Πάν, *Pan*, Pan), or HORNED PHEASANT. One of the crested pheasants of the genus Ceriornis, which have naked cheeks, a horn-like caruncle projecting backward from behind each eye, and a loose wattle, capable of being inflated, hanging beneath the bill. Five species are known, all found in India and China.

TRAILL, trāl, Catherine Parr. A sister of Agnes Strickland (q.v.).

TRAILL, Henry Duff (1842-1900). An English journalist and author, born at Blackheath, near London. He was educated at the Merchant Taylors' School, London, and at Saint John's College, Oxford. In 1869 he was called to the bar at the Inner Temple, but he soon gave up law for journalism. He edited the *Observer* from 1889 to 1891, and was the projector and first editor of *Literature* (established 1897). Traill did much miscellaneous work of good quality. For the "English Men of Letters" series he wrote *Sterne* (1882) and *Coleridge* (1884); for "English Worthies," *Shaftesbury* (1886); for "English Statesmen," *William III.* (1888); and for "English Men of Action," *Strafford* (1889). Other biographies by him are *Lord Salisbury* (1891), *Sir John Franklin* (1896), and *Lord Cromer* (1897). In politics and history are *Central Government* (1881); the exhaustive *Social England* (1892-96), of which he was editor; *From Cairo to the Soudan Frontier* (1896); and *England, Egypt, and the Soudan* (posthumous, 1900). For prose literature may be cited *The New Lucian* (1884) and *The New Fiction and Other Essays* (1897). Political verse contributed to various periodicals was collected under the titles, *Recaptured Rhymes* (1882) and *Saturday Songs* (from *The Saturday Review*, 1890).

TRAIN, George Francis (1829-1904). An American author, born in Boston, Mass. After engaging in the mercantile business in Boston and Australia, he went to England in 1860, and undertook to form street-railway companies in Birkenhead and London, but his plans were obstructed by legal opposition. His publications include: *An American Merchant in Europe, Asia, and Australia* (1851); *Young America Abroad* (1857); *Irish Independency* (1865); and *Championship of Women* (1868). He also published an autobiography entitled *My Life in Many States and in Foreign Lands* (1902).

TRAIN BANDS. Early English militia raised by commissions of musters, and organized and drilled as military bodies. On the abolition of the fyrd in 1604, James I. organized in its place the *train bands* to the number of nearly 200,000 men. As an organization the train bands were neither militia nor volunteers, but partook of the nature of both, and in point of efficiency lacked both discipline and drill. During the Civil War they sided almost to a unit with the Parliamentarians, and rendered very effective service. After the Restoration, the command and control of the army was definitely assigned to the King; before this time the question had been in doubt. See Armies, section on *Great Britain;* Militia.

TRAINING. See Physical Training.

TRA'JAN (Marcus Ulpius Traianus) (a.d. 51-117). A Roman Emperor (a.d. 98-117). He was born at Italica, near Seville, in Spain. He was descended from a family which was probably of Roman origin, and was early trained to arms, becoming a leader in the Parthian and German campaigns, during the reigns of Titus and Domitian. He was rewarded for his services by promotion to the offices of prætor (a.d. 85) and consul (a.d. 91), and was adopted (a.d. 97) by Nerva (q.v.) as his colleague and successor. Trajan became sole ruler in January of the following year, and celebrated the event of his accession by largesses to the soldiers, and to Roman citizens and their children. He also made provision out of the Imperial treasury for the maintenance of the children of poor freemen in Rome and other Italian towns. In a.d. 101 Trajan set out on his first campaign against the Dacians, who had exacted tribute from Rome since Domitian's time. The struggle was long and destructive, but the Romans at last gained a decisive superiority, and in a subsequent campaign (104 to 105) completely subdued their opponents, whose country thenceforth became the Roman province of Dacia, and was secured by partial colonization. This conquest, the first since the death of Augustus, was celebrated, on Trajan's return to Rome, by a triumph, and by games on a most extensive scale, which continued for four months. The Column of Trajan was erected to commemorate this victory. In 106 Trajan again went to the east. Landing in Syria, he marched northward, receiving on his way the submission of numerous princes, and conquered Armenia, which he made a province. The record of the events of the next seven years of Trajan's reign is extremely defective, the few notices in Dion Cassius and others being insufficient for the construction of a consecutive narrative. In 115 he again set out from Syria, directing his march this time against the Parthian Empire. He took Ctesiphon almost without a struggle, and, descending the Tigris, subdued the tribes on both banks, being the first and only Roman general who navigated the Persian Gulf. On his return he found that Mesopotamia, North Syria, and Arabia required to be subdued again. This being done, and Parthia again conquered, Trajan, sinking under a combination of dropsy and paralysis, attempted to reach Italy, but died at Selinus, in Cilicia.

Though most of Trajan's reign was spent in the gratification of his warlike ambition, the internal administration was far from neglected; the administration of justice was vigorous and impartial; that of finance was equally acceptable; informers (*delatores*) were severely punished, and peculating governors of provinces rigorously prosecuted. The improvement and beautifying of Rome was carried on; the Empire was traversed in all directions by new military routes, canals and bridges were constructed, new towns built, the Via Appia was restored, the Pontine Marshes partially drained, the magnificent 'Forum Traiani' erected, and the harbor of Centum Cellæ (Civita Vecchia) constructed. During Trajan's reign a persecution of the Christians, of a mild character, took place.

TRAJAN, Arch of. (1) An arch at Benevento, Italy, somewhat resembling the arch of Titus at Rome, erected in a.d. 114 to commemorate the completion by Trajan of a new road to Brundisium. It is of white marble with one archway 27 feet high, the whole structure being 50 feet in height. The reliefs represent the triumphs of Trajan over the Dacians. The arch is one of the finest and best preserved specimens of the Roman arch. (2) A triumphal arch, in good preservation, at Ancona, Italy, built by the Roman senate in a.d. 112. It commemorates the building of new quays by Trajan. The single archway is 29 by 46 feet in dimension.

TRAJAN, Baths of. Baths built by Trajan on portions of the remains of the Golden House of Nero in Rome. The scanty ruins are situated on the Oppian, where some remains may be seen in the Villa Field. They adjoin the Baths of Titus (q.v.), with which they were confused until 1895, on the northeast. The materials of the magnificent edifice were used in limekilns and in constructing other buildings.

TRAJAN, Forum of. An immense group of public buildings in ancient Rome, filling the space between the Capitoline and Quirinal Hills. It was named after its principal builder, the Emperor Trajan, and included the forum proper. entered by the famous Arch of Trajan and containing his equestrian statue in bronze; the Basilica Ulpia; the celebrated Column of Trajan, in the midst of a cloistered court, where were also located the two Ulpian Libraries, one Greek, the other Latin; and the Temple of Trajan, built by Hadrian. See Forum.

TRAJAN'S COLUMN. A celebrated column at Rome, which was reared in A.D. 114, ostensibly by the Roman senate and people, in honor of the Emperor Trajan. The pedestal is covered with bas-reliefs of trophies of Dacian arms, and a very remarkable series of bas-reliefs, forming a spiral round the shaft, exhibits a continuous history of the military achievements of Trajan in his Dacian wars. These are in excellent preservation, and, independently of their beauty as works of art, they are invaluable as records of ancient costume, military operations, and history. A spiral staircase in the interior of the column leads to its summit. The height of the column proper, including base, shaft, and capital, but excluding the lofty pedestal (18 feet), is just 100 Roman feet (29.57 meters). It still stands erect in all its ancient beauty amid the ruins of Trajan's forum. The summit was crowned by a colossal statue of the Emperor, which was incongruously replaced (by Pope Sixtus V., in 1588) by one of Saint Peter. The ashes of Trajan, who died in the East, were said to have been deposited under this column in a golden vase, but no traces of such a burial have been found. Consult: Fröhner, *La colonne Trajane* (Paris, 1872-74); Cichorius, *Die Reliefs der Trajanssäule* (Berlin, 1896 et seq.); Reinach, *La colonne Trajane au musée de Saint-Germain* (Paris, 1896); Petersen, *Trajans dakische Kriege* (Leipzig, 1901).

TRAJAN'S WALL. A line of fortifications stretching across the Dobrudja from Czernavoda, where the Danube bends northward, to a point of the Black Sea coast near Kustendje. It consists of a double, and in some places a triple line of ramparts of earth, from 8¾ to 11 feet in height on the average (though occasionally it attains an altitude of 19½ feet), bounded along its north side by a valley, which, being generally marshy, serves admirably the purpose of a ditch. The construction of this rampart is attributed to Trajan, the general of the Emperor Valens, who in A.D. 377 endeavored by this means to check the advance of the Visigoths. In 1854 Trajan's wall became an important line of defense on the invasion of the Dobrudja by the Russians, and the invaders were twice defeated in their attempts to pass it—at Kostelli (April 10th) and Czernavoda (April 20th to 22d).

TRAJECTORY (from Lat. *trajicere*, *transjicere*, to throw across, from *trans*, across, through, + *jacere*, to throw; connected with Gk. *ἰάπτειν*, *iaptein*, to throw). In mathematics, any plane curve which cuts at a constant angle a series of plane curves of the same species having a common origin. If the constant angle is a right angle, the surve is called an *orthogonal* trajectory of the system. The question of such a curve was proposed by Johann Bernoulli (1691) in his *Acta Eruditorum*, and Newton (1716) laid the foundation for the theory of trajectories. For the history of the trajectory, consult Terquem, in the *Nouvelles annales de mathématiques* (1845, p. 292). For the various classes, consult Brocard, *Notes de bibliographie des courbes géométriques* (Bar-le-Duc, 1897, p. 277; partie complémentaire, 1899, p. 181).

TRAJECTORY (in gunnery). See Ballistics.

TRALEE'. A seaport of Ireland, the chief town of County Kerry, on the Lee, one mile from its mouth, and 207 miles west-southwest of Dublin (Map: Ireland, B 4). The town is well built and dates from the twelfth century. Population, about 9000.

TRALLES, trăl'lēz. An ancient city of Lydia, in Asia Minor, or the Eudon River, a northern branch of the Malander. Its origin was ascribed to Argive and Thracian settlers. It was a thriving commercial centre. Under the Seleucidæ it was known as Seleucia and Antiochia.

TRAM. See Silk.

TRAMP. The American equivalent of the English 'sturdy beggar' and 'vagrant.' His first statutory appearance was in 1876, in New Jersey, and he was soon recognized legally in 21 States. He is commonly defined as an able-bodied man without visible means of support, wandering aimlessly, begging, and refusing work, camping and kindling fires on highways and private property, and terrorizing women and children. What really distinguishes him from the prosaic vagrant of other countries is his extensive use of the railways—stealing rides, or, in his argot, 'jumping trains.' The number of tramps in the United States cannot be accurately given. The closest estimate is one based upon the results of a statistical inquiry made in 1890-91, covering 1349 tramps in 14 cities, and the semi-annual lodging-house census of the Massachusetts Board of Charity. This showed 45,845 tramps in the United States. The highest mark was reached in 1895, when Massachusetts showed a mean daily tramp population of 791, as against 451.4 in 1890, implying a total for the State of 2832, as against 1616 before, and of 79,427 for the United States. The mean has fallen, with but two slight intermissions, since, and in 1902-03 was 369.6, suggesting 1323 for Massachusetts and 38,636 for the United States. This estimate assumes much, but may be accepted as a fair approximation. The average cost of the tramp to the community is about $4.40 a week, independent of his possible depredations; and although 83.5 per cent. of tramps say their health is good, 10 per cent. of them admit having had a dangerous contagious disease.

There are no national repressive laws. Those of the various States have been characterized by a severity born of panic, a not uncommon penalty being twelve months' imprisonment, and in two States sale at public auction for a designated period. Contrary to the common impression, the tramp generally has learned and frequently practiced a trade or profession—57.4 per cent. of the 1349 mentioned above. The proportion of 'professionals,' or those who never work, is extremely small, their real weakness being chronic tendency to intermittency in work. This is fostered by their habits and marital condition, 63 per cent. of them being admitted drunkards, and 93 per cent. unmarried; and again by the conditions of industrial activity, the drunkard being employed only when he is indispensable and discharged, along with the unmarried man, when business slackens, witness the great rise in tramp population after 1873 and the fall after 1901. The statistics seem to show that the surest way of correction lies in prevention.

In England the ancient penalties against what we call tramping were very severe. In the reign of Edward VI. the punishment was branding on the breast with a V and two years' slavery. In 1572 it was whipping for the first offense, boring the ear with a hot iron for the second, and death for the third. A fine of ten times the dole was imposed on the person helping the vagrant. The vagrant may now be lodged in the casual ward of the Union (almshouse), where he must break stone or pick tow in payment.

In Germany the most drastic modern measure against the prime vice of tramping, open mendicancy, was that taken in Bavaria in 1790-95, under Count Rumford, where in four years 10,000 vagabonds were arrested. It proved effective. The number of tramps in Germany is unknown, but is sometimes set at 100,000. The tramp there is the lineal descendant of the old artisan wandering abroad to complete his knowledge of his craft. Beginning in 1854, when Professor Perthes, of Bonn, founded a cheap tavern for them, where no drink stronger than beer could be had, the number of these home refuges, *Herbergen zur Heimat*, increased in 1901-02 to 462, a gain of 72 from 1892 to 1902, with an aggregate of paying guests for the year of 1,931,575 and of non-paying guests or those rendering an equivalent in work of 759,057. For 108,505 of these situations were found. In more or less direct communication with the *Herbergen*, in 240 instances under the same roof, is, on one hand, a great network of local establishments, *Verpflegungstationen*, where lodging and a meal is furnished in exchange for work, generally woodchopping; or, if there is no separate building, an order is given for cheap entertainment at a local tavern.

On the other hand is a chain of labor colonies, *Arbeiterkolonien*, the first of which was established in 1882 at Wilhelmsdorf, in Westphalia, by Pastor von Bodelschwingh. There are now 33 colonies, with a thirty-fourth allied branch, for Germans, in East London. It is noticeable that 26 of them were established between 1882 and 1892, a decade of especial industrial depression. The thirty-three colonies have accommodations ranging from 35 to 275, with a total of 3865, for men only, and with 3055 occupants (October 31, 1902), and an aggregate attendance from the beginning of 138,392. These work at their trades or otherwise until permanent places are found for them, or they resume their travels. Four of them are under Roman Catholic, one under Evangelical control; the rest are non-denominational. The English branch has room for 83 persons and has had 630 inmates since its establishment in 1900. The efficiency of the German system, which depends on private initiative, has been much contested even in its own home. It seems to be, however, an earnest and intelligent attempt to do a difficult task that cannot safely be neglected.

The French have experimented, under Paris municipal control, along the lines of the labor colony, at La Chalmelle, in the Department of Marne.

Bibliography. Josiah Flynt, *Tramping with Tramps* (New York, 1899); Wyckoff, *The Workers* (New York, 1897-98); McCook, "A Tramp Census and Its Revelations," in the *Forum* (August, 1893); id., "The Tramp Problem," in *Proceedings of the Conference of Charities and Corrections* (1895), and *Lend a Hand* (September, 1895); id., "Tramps," a lecture, in the Boston *Herald* (1895); id., "Pauperism and Whisky," in *Journal of the Social Science Association* (1894); id., "Leaves from a Tramp's Diary," in *The Independent* (1901-02).

TRANCE (OF., Fr. *transe*, extreme fear, Sp., Port. *trance*, crisis, hour of death, from Lat. *transitus*, passage over, from *transire*, to pass over, cross, from *trans*, across, through + *ire*, to go). A general term in psychology denoting various forms of modified consciousness. The nature of the abnormal nervous conditions that constitute the physiological causes of trance is not clear. The psychological symptoms vary from seeming inanimation to a waking condition, though a manifestly abnormal one, of exaggerated suggestibility in respect to some dominating idea. In general there is more or less insensibility to environment and to ordinary stimuli. What may be termed the waking trance is also characterized by extraordinary concentration or automatic mental action, while the automatic functions of the body are little interrupted. The thoughts of the subject are ordinarily fixed on one kind of idea, frequently religion. In trance-sleep, except in its protractedness and the lessened sensibility to external stimuli, there appears to be little abnormal. In trance-coma these symptoms are more intense and respiration and circulation are feebler. In death-trance, except sometimes the inner dream-life, all animation ceases, including the action of heart and lungs. The thought, or dream, of trance is likely to be more sequential and coherent in character than that of normal sleep. Various pathological and psychopathic conditions are often called trance, such as deep and unusually protracted sleep, lethargy, suspended animation, the hypnotic state, and altered personality. Consult: Charcot, *Leçons sur les maladies du système nerveux* (1883); Mantegazza, *Estasi umane* (1887); Preston, *Hysteria and Allied Conditions* (1897); and for an account of the so-called trance medium Mrs. Piper, *Proceedings of the Society for Physical Research*, xii.-xv.

TRANI, trä'nē. A seaport in the Province of Bari delle Puglie, Italy, 27 miles by rail northwest of Bari (Map: Italy, L 6). Its ancient walls have given place to spacious boulevards. The twelfth-century cathedral has a very high tower and magnificent bronze doors. The Santa Maria Immaculata is a beautiful church. The Gothic palace (the seat of a priests' seminary) and the old castle (now a prison) are both interesting. Excellent building stone is quarried. Trani first came into notice when it submitted to the Normans in 1073. During the Crusades it carried on a heavy trade with the Levant. Population (commune), in 1881, 25,647; in 1901, 31,800.

TRANSBAIKALIA, träns′bī-kä′lē-å. A territory of Eastern Siberia, bounded by the Territory of Yakutsk on the north, the Territory of Amur and Manchuria on the east, Mongolia on the south, and Lake Baikal and Irkutsk on the west (Map: Asia, L 3). Area, 236,800 square miles. The region is divided by the Yablonoi Mountains, a part of the Stanovoi (q.v.) chain, into two parts, of which the western has the character of an elevated plateau intersected by a deep valley that extends from Lake Baikal to the Uda River and is used by the chief highways as well as by the Trans-Siberian Railway. The portion east of the Yablonoi chain is lower than the western part, and is traversed in the southeast by the Nertchinsk Mountains. The region is watered by the Argun and Shilka, which unite to form the Amur, the Vitim, a tributary of the Lena, and the Selenga (q.v.), a tributary of Lake Baikal. Of the numerous lakes the principal is Lake Baikal (q.v.). The climate is continental and very severe, the temperature being occasionally as low as —58°. Transbaikalia is one of the most highly mineralized regions of Siberia. Gold is found especially in the Nertchinsk Mountains, where there are also rich deposits of silver and lead. Coal is found near the southeastern shore of Lake Baikal, and iron in many parts. The mining industry, however, is of little importance, and only the gold output (3882 kilograms in 1897) is of any importance. The mines are owned to a large extent by the State and worked by convict labor, the centre of the mining industries being the Nertchinsk (q.v.) region. Agriculture is confined chiefly to the south, where the natural conditions are more favorable. Stock-raising is extensively carried on, and hunting is still of considerable importance. The chief manufactures are leather, spirits, and flour. The transit trade with Mongolia through Kiakhta (q.v.) is large. Population, in 1897, 664,071, of whom the Cossacks numbered about one-third. The aborigines, mostly Buryats and some Tunguses, have still in the main preserved their clan organization, although many of them have been assimilated with the Russians. Capital, Tchita (q.v.).

TRANSCAS′PIA. A Russian territory in Western Asia, bounded by the Territory of Ural on the north, Khiva and Bokhara on the east, Afghanistan and Persia on the south, and the Caspian Sea on the west (Map: Asia, Central, G 2). Area, estimated at from 214,000 to 220,000 square miles. In its general features the region resembles Turkestan, of which it may be considered a western continuation. The larger part of the north consists of elevated table lands with some mountains in the peninsula of Manghishlak in the northwest, and a deep depression near the Khivan frontier in the east. The central part is lower and is practically a desert with shifting sands and dried-up river courses. The southern part is traversed by a mountain chain which separates the sandy deserts of Turkestan from the highlands of Northern Persia, and from its structure and direction appears to be a continuation of the Caucasus system. This region is watered by the Atrek, which flows along the southern boundary to the Caspian and by the Tejend and the Murghab. The whole region is scantily watered. Irrigation is practiced. The coast is indented by a number of deep inlets, of which that of Kara Bugas is noted for its extreme salinity. The climate is hot and dry, and the precipitation extremely meagre. The region contains rich mineral deposits, of which salt, naphtha, ozocerite, and gypsum are mined to some extent. Agriculture is developing in the southern part, which is more favorably situated with regard to irrigation. The principal products are wheat, sorghum, rice, and barley. Cotton is also successfully cultivated. The natives have extensive herds of sheep and other stock, and export skins and wool. A number of household industries, such as rug-weaving and the production of various articles of felt, are more or less developed. The chief medium of transportation is the Transcaspian Railway, which traverses the southern part of the territory. Population, in 1897, 372,193, of whom the Turcomans constituted about two-thirds. Capital, Askhabad (q.v.).

TRANS′CAUCA′SIA. The southern part of the Caucasus (q.v.), comprising the governments of Tiflis, Baku, Yelizavetpol, Erivan, and Kutais and the territories of Daghestan and Kars. Area, about 92,400 square miles. Population, in 1897, 5,461,911.

TRANSCENDENTAL, TRANSCENDENT (from *transcendent*, from Lat. *transcendens*, pres. part. of Lat. *transcendere*, to surpass, from *trans*, across, through + *scandere*, to climb, Skt. *skand*, to spring, ascend). Words employed by various schoolmen, in particular Duns Scotus, to describe the conceptions that, by their universality, rise above or transcend the ten Aristotelian categories. (See CATEGORY.) Thus, according to Scotus, *ens*, or being, because it is predicable of substance and accident alike, of God as well as of the world, is raised above these by including or comprehending them.

Between the hitherto convertible terms transcendental and transcendent Kant drew a distinction, of considerable importance in understanding his own system. By the word 'transcendental' he designates the various forms, categories, or ideas assumed to be constitutive or regulative elements of human experience; although they are manifested only in experience, they are not products of experience. Among such transcendental elements are space and time, causality, and substantiality. The knowledge that these elements are not of empirical origin is called transcendental knowledge. The word 'transcendent' Kant reserves for those objects that lie in the world of things in themselves, entirely inaccessible to experience, and for any pretended knowledge of such objects.

TRANSCENDENTALISM. A term applied in philosophy to Kant's system and to those like it in maintaining that there can be knowledge of transcendental elements. On account of the literary reputation of Emerson and of his colleagues in the Transcendental Club (organized in 1836), and in the Brook Farm (q.v.), the terms Transcendentalism and Transcendental School are now frequently used by English-speaking peoples to designate the views of these thinkers. The so-called Transcendental Movement in New England was mainly confined to that region, and especially to Massachusetts, and, in point of time, to the decades from 1830 to 1850. In its origin it dates much further back, and in its effects it can scarcely be said to be entirely extinct to-day. In character it was partly philosophical, thus connecting with German and French thought; partly economic, thus connecting with French and English schemes of social reform; partly literary, thus connecting with the poetry of such dissimilar characters as Wordsworth and Shelley, and with the gospel of Carlyle; partly theological in a loose sense, thus connecting with Unitarianism; but on the whole, as Emerson averred, primarily spiritual, thus connecting with and finally coalescing in contemporary movements for regeneration of every kind. Putting the matter another way, we may perhaps say that New England Transcendentalism was in the main a result of a revolt from the formalism both of Unitarianism and of Calvinism, which coalesced with a loose system of intuitional philosophy borrowed from Germany, and with the romantic revolt from classicism in literature, as well as with a contemporaneous American movement for securing the benefits of foreign culture (illustrated in Irving and Longfellow among non-Transcendentalist authors), and which finally more or less merged in the great anti-slavery agitation. But any effort to sum up in a single sentence the elements of such a movement for social and individual regeneration must be both clumsy and misleading, and it will be necessary to dwell briefly on each element.

Transcendentalism in New England was involved in the Great Awakening of a century before, for both were spiritual manifestations, the earlier of which did much to shake the hold of rigid Calvinism and to introduce the religious emotionality and liberalism that were later to culminate in men like William Ellery Channing (q.v.) and Theodore Parker (q.v.). Within twenty years after the Awakening, Arminianism and Arianism, through the agency of the Deists and other British writers, had made many converts, especially in eastern Massachusetts. Jonathan Mayhew (q.v.) is typical of these early liberals or Unitarians. The followers of Jonathan Edwards struggled valiantly against the innovators, and held most of New England for orthodoxy, but by 1785 there was a distinctively Unitarian church (King's Chapel) in Boston, even if thirty years were to elapse before this name could be definitely fastened on the seceders from Calvinism. This change of faith was not effected without heart-burning and a development of religious unrest among New Englanders, which made the acceptance of new philosophical ideas, new literary standards, and new social theories all the easier when the time was ripe. The appointment of Unitarian professors at Harvard, resulting in the founding of Andover (q.v.) and the preaching of such men as the younger Buckminster (q.v.) and Channing, undoubtedly prepared the way for Emerson (q.v.) and Alcott (q.v.), for Ripley (q.v.) and Parker.

But although by 1825 Unitarianism had won a decisive victory in Boston and its environs, it was not destined to maintain its ascendency for anything like so long a period as its foe, Calvinism, had done. It, too, showed a tendency to formalism, both in thought and in taste, and impressionable souls soon broke away into new paths of philosophy, theology, and literature. Some little knowledge of Kant and his successors, of Schleiermacher, and of Goethe, had been obtained by a few persons prior to 1830. Before 1840 the labors of George Ripley, F. H. Hedge (q.v.), and other translators had considerably increased this knowledge; in consequence, the influence of German thought upon New England Transcendentalism cannot be ignored, although it is easily exaggerated. French thought, as illustrated by Cousin, and more by Fourier, was less influential, but that there was a decided taste for foreign literature which gave an impetus to the contemporaneous movement for a greater and freer spiritual life seems to be clearly established. This meant dissatisfaction with eighteenth -century standards and with the colonial character of American literature, and thus involved the founding of *The Dial* (q.v.). Nor in this connection should we forget the interest displayed by some Transcendentalists in the Oriental Scriptures, in Neo-Platonism, and in more or less occult literature. But behind the revolt from formal Unitarianism and the craving for new forms of philosophy and literature that characterized many young persons in New England between 1830 and 1840, there was the general uplift of the world's spirit that showed itself in revolutions and in other ways, and there was also on the part of aspiring souls a contempt for the vulgarity and selfishness of American political and business life during the Jacksonian epoch. It is no wonder that New England, which was old and homogeneous enough to produce thinkers and writers, and not merely men of action and affairs, was nevertheless unable to develop orderly schools of thought and literature, and seemed for a time given over to extremists and faddists of all sorts.

If the Transcendental movement was ever organized, this did not take place until 1836 (September 19th), when Emerson, Hedge, Alcott, and others formed the so-called Hedge or Transcendental Club. Little came of this organization until *The Dial* was started in 1840, and Brook Farm (q.v.) founded in 1841. Neither enterprise was fully successful, but both were very influential upon literature and thought, though not greatly upon action. Under Margaret Fuller (q.v.) and Emerson *The Dial* was a hospitable receptacle for the verses of the Transcendentalist poets—C. P. Cranch (q.v.), the younger W. E. Channing (q.v.), and others, whose merits are slowly being recognized—and for many of the best papers of the two editors, and of Thoreau (q.v.). It did not create or recreate American literature, but it undoubtedly stimulated important writers. Brook Farm was laughed at by the hard-headed, and not effectively supported by many of the leading Transcendentalists themselves, but it set up a beneficial ideal of "plain living and high thinking," it furnished Hawthorne material for his *Blithedale Romance*, and it doubtless leavened the utilitarian spirit of the country and the age.

No writer upon New England Transcendentalism has failed to remark upon the exceedingly elusive character of the movement. It is difficult to disengage its elements, to delimit it in point of time, to say what it really accomplished, to determine what it became. If it had been fully organized the case would have been different for the student, yet the results would probably have been less fortunate, both to the Transcendentalists themselves and to the American people at large. Not being hampered by organization, by formulas, by the apparatus of propagandism, the Transcendentalists were better able to serve a more specific cause of greater moment—that of Abolition. They were also enabled to follow the bent of individual genius after having experienced, as Wordsworth had before them, the stimulating effects of having lived in a visionary period, when it was bliss merely to be alive, and when to be young was very heaven. Emerson became the favorite moralist of his countrymen, and an important poet; Alcott gave full vent to his eccentricity, and ended as the patron saint of the Concord Philosophers; Margaret Fuller had a brilliant and only too short career as a critic and woman of letters; Ripley by his reviews in *The Tribune* and his services with C. A. Dana (q.v.) as an encyclopædist showed that a Brook Farmer was capable of valuable, if homely, work in the cause of letters and science; Thoreau revealed nature to his countrymen, and became a high priest of individualism, as well as a writer of truly classic prose; Theodore Parker died just before the beginning of the crusade of which he was perhaps the greatest preacher. Last, but not least, thousands of men and women throughout New England were inspired by Transcendentalism to devote themselves to every form of philanthropy, including educational and temperance reform, to acquire a varied and genuine culture, and to become public-spirited citizens. The era of the Transcendentalists was in many respects an American Renaissance, the effects of which were not confined to this country, but were spread, chiefly through the writings of Emerson, Thoreau, and Channing, to England and to some extent to the Continent of Europe. That their ideas were vague and often transcended reason, not to say common sense, that their literary work was largely amateurish, that their extravagances gave much occasion to legitimate ridicule, that their so-called movement was the forerunner of religious and social manias of all sorts, can scarcely be gainsaid; but it is equally idle to deny the loftiness of their aims and the importance of their works.

Consult the various lives of Emerson, Ripley, Channing, J. F. Clarke, Parker, Margaret Fuller, Alcott, Thoreau, etc. Also Cooke, *Unitarianism in America* (Boston, 1903); id., *The Poets of Transcendentalism* (ib., 1903); Frothingham, *Transcendentalism in New England* (New York, 1876); Swift, *Brook Farm* (ib., 1900); T. W. Higginson, *Old Cambridge* (ib., 1900).

TRANSCRIPTION (Lat. *transcriptio*, from *transcribere*, to transcribe, from *trans*, across, through + *scribere*, to write). In music, an arrangement of a composition for instruments or voices other than those employed by the composer, which really are not transcriptions, but paraphrases. See PARAPHRASE.

TRANSEPT (from Lat. *trans*, across, through + *septum*, *sæptum*, inclosure, partition; connected with *sæpes*, hedge). The projecting wings at right angles with the nave and aisles, forming the smaller arms of the cross, in the ground plan of churches. In some of the largest early basilicas it was placed at the very top, helping to form a T-plan. In such churches the great arch opening from the nave into the transept was called the triumphal arch. When the strictly cruciform plan was introduced for churches in the early Middle Ages (Carolingian period) the transept became quite common, and in the Gothic age almost universal. It shows sometimes in plan, when it projects beyond the line of the side aisles; sometimes only in elevation, when, though not projecting, it is marked by its vault and roof, which intersect the lower roof of the aisles on a level with that of the nave. The intersection is often called the crossing, and was usually surmounted by a spire, tower, or dome, to mark it. The crossing was also usually marked by much heavier piers.

While single transepts were the rule, there were two kinds of double transepts used in England and Germany. The double English transept was on the scheme of the archbishop's or Passion cross, with both arms toward the choir end; the double German transept was connected with the double choir, one at each end of the church. The ends of the transepts in Gothic churches were often treated as façades only second in importance to the main front, with their large rose or wheel windows and their elaborate portals. Those of the Notre Dame in Paris, of Chartres, and Amiens are particularly beautiful.

TRANSFIGURATION (Lat. *transfiguratio*, from *transfigurare*, to transfigure, from *trans*, across, through + *figurare*, to form, from *figura*, shape, form) OF CHRIST. The temporary revelation of the glory of Jesus during His earthly ministry, recorded in Matt. xvii. 1-8, and parallel passages. The festival commemorating it can be traced back to the fifth century, but was established on August 6th as a solemn feast for the whole Roman Catholic Church in 1457, as a thanksgiving for the victory over the Turks near Belgrade. It was retained as a black-letter festival by the Church of England, and restored as a greater feast by the American Episcopal Church at the revision of the Prayer-Book in 1892.

TRANSFORMATION. See MARBLE FAUN.

TRANSFORMER. In electrical engineering, an apparatus for transforming or converting an electric current. Machines for converting alternating currents to direct currents and vice versa are described under DYNAMO-ELECTRIC MACHINERY. Devices for obtaining pulsating currents of high potential from pulsating currents of low potential are described under INDUCTION COILS. The present article treats only of devices used to transform alternating currents into other alternating currents differing in magnitude and potential.

A transformer may be specified as two electric circuits, such as two independent coils of insulated wire, inclosing a common magnetic circuit. This will be the case in some degree if the coils are anywhere near each other, but not placed at right angles and so that the plane of one coil passes through the centre of the other. If an electric current is passed through one of the coils, magnetic lines of force (see MAGNETISM) will be created, some of which will thread through the second coil. If the coils are placed contiguous to each other nearly all of the lines of force created by the first coil will thread through the second coil, and if iron is introduced in the magnetic circuit the number of these lines, or the intensity of the magnetic field, will be much greater with a given current in the first coil than if air or other non-magnetic matter only were present. (See MAGNETISM.) A device constituted in this manner of an iron magnetic circuit interlinked with two electric circuits becomes, when one of the electric circuits is supplied with alternating current, an alternating current transformer.

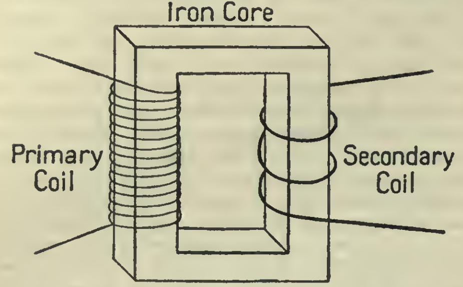


FIG. 1. DIAGRAM OF ESSENTIAL PARTS OF A TRANSFORMER

Starting with no current in either coil, let us consider what happens if we apply an electromotive force to the extremities of the first or primary coil. A current will commence to flow, but will not attain at once to the full magnitude due to the electromotive force applied and the resistance of the circuit. This is because the passage of the current creates a magnetic field, the growth of which in turn creates a counter electromotive force opposed in direction, as the name signifies, to the impressed electromotive force. (See ELECTRICITY.) At the same time that the counter electromotive force is produced in the first coil, an induced electromotive force will be created in the second coil, having the same direction as the counter electromotive force in the first coil, or contrary to the electromotive force impressed upon the first coil. Supposing that the second coil is so connected that it forms a closed circuit, an electric current will be set up in it which will be opposite in direction to the current in the first coil.

It should be noted that an electromotive force is induced in the second coil only so long as the number of lines of magnetic force is changing. If the first coil is supplied from a source of alternating current, this will be continually, since the impressed electromotive force from such a source will increase incessantly from zero to a maximum in one direction, pass back through the zero value to a maximum in the opposite direction, and then fall to zero again. It will be seen that the current in the primary coil will follow a similar cycle of changes, as will also the flux of lines of magnetic force and the induced electromotive force and current in the secondary coil.

It may be assumed that in an ideal transformer all the lines of force created by the first coil pass through the second coil, and further, that there are no losses of energy due to the resistance of the two coils, to eddy currents induced in the windings or in the iron core, or to other causes. In accordance with the first assumption that all lines of magnetic force thread through both coils, the electromotive force induced by variations of the magnetic flux will be the same in every turn of either coil, or, in other words, the total electromotive force induced in each coil will be proportional to the number of turns in that coil. If, say, the primary consists of 100 turns of wire and the secondary coil of 10 turns of wire, and if, further, the primary coil be connected with a source of supply of alternating current having a potential difference of 1000 volts, the potential difference at the extremities of the secondary coil would be 100 volts. Now, while it is seen that the voltages produced are in direct proportion to the number of turns in the respective coils, it will be found that the currents produced bear an inverse ratio. This may be explained as follows:

Assuming the primary coil to be without resistance and also, for the time being, that the secondary circuit is open so that no current can flow, the current in the first coil will be limited entirely by the back electromotive force, and, under the conditions assumed of a highly permeable magnetic circuit, this would almost equal the applied electromotive force and little current would flow. However, a current of sufficient magnitude to create the magnetic field producing the counter electromotive force referred to must flow. This magnetizing current and the magnetic flux it produces will be varying most rapidly when the impressed electromotive force is maximum, since then the counter electromotive force must be greatest, and again, it must reach its maxima, that is, its limits, when the impressed electromotive force is zero. In other words, the magnetizing current is not in phase with the impressed electromotive force, but lags behind, and if the matter is considered in detail it will be found that this current takes energy from the circuit during two parts of the cycle and returns it during two others. Energy is absorbed while the magnetic field is being built up and returned to the supply circuit as the field collapses. If at any time much disparity should begin between the impressed electromotive force and the counter electromotive force, the current and magnetic field would commence immediately to vary rapidly, which would tend to bring the two electromotive forces again into approximate balance. Further, the intensity of this magnetizing current depends only upon the susceptibility of the magnetic circuit, the magnitude of the electromotive force impressed upon the primary coil, and the frequency with which the impressed electromotive force is reversed. Since the counter electromotive force depends on the rate at which the lines of force are created or die out within the coil, if the frequency is great, the magnetic flux, and therefore the magnetizing current, will not need to reach as high values for a given applied electromotive force as if the frequency were low.

It has just been pointed out that in the ideal transformer without resistance or other losses the counter electromotive force prevents any flow of current in the primary in phase with the impressed electromotive force. If, however, the secondary circuit be closed so that current flows therein, this condition no longer continues. The secondary current flows in a direction contrary to the primary impressed electromotive force and alternates simultaneously with it, and so tends to neutralize the magnetizing effect of any current which may flow in phase with the primary electromotive force. It may be here stated that the magnetizing effect of either coil is proportional to the size of its current multiplied by its number of turns. Furthermore, since the secondary coil is required to neutralize exactly the magnetizing effect of the primary current in phase with the applied electromotive force, the secondary current multiplied by the secondary turns must equal the primary current multiplied by the primary turns, that is, the currents will be inversely proportional to the number of turns in the respective coils.

In the example given above, if the terminals of the secondary coil, having a potential difference of 100 volts, are connected by an electrical circuit having a resistance of one ohm, 100 amperes of current will flow, the coil itself, of course, being assumed to have no resistance. The magnetizing effect of this current of 100 amperes flowing through 10 turns of wire will be 1000 ampere turns. Since the primary has 100 turns, the current required to produce the same number of ampere turns will be 10 amperes. By supplying 10 amperes at 1000 volts to the primary we could take 100 amperes at 100 volts from secondary. In other words, the output of energy (volts × amperes) equals the input.

The actual transformer differs from the ideal transformer just described in the following respects. In the first place, the coils have electrical resistance, and some electromotive force will be consumed in causing current to flow through this resistance. The result of this is that the entire potential difference called for by the ratio of the numbers of turns on the coils does not appear at the secondary terminals and that some electrical energy is converted into heat. It is obviated, as much as possible, by increasing the size and conductivity and decreasing the length of the primary and secondary conductors. In the second place, all the lines of magnetic force created by the primary coil do not pass through the secondary, and vice versa. The result of this again is that the potential difference at the terminals of the secondary coil is not equal to that called for by the ratio of transformation. This effect is reduced to a minimum by a proper distribution of the coils with respect to each other. In the third place, energy is absorbed by the iron core in consequence of the magnetic changes constantly taking place within it. This loss of energy takes two forms, one of which is represented by electric currents (called eddy or Foucault currents) induced in the iron itself. This is prevented, as far as possible, by dividing the iron into laminæ at right angles to the direction of flow of these currents. The second loss of energy in the core is due to the fact that the magnetism of the iron lags behind the magnetizing force, that is, when the magnetizing force is increasing the flux is not as great for a given value of the force as it is for the same value of the force when the force is decreasing. (See MAGNETISM.) This effect, called hysteresis (q.v.), is avoided, as far as possible by choosing the proper grade of iron. The practical effects of these deviations from the ideal transformer are: the first two cause a drop in the potential at the terminals of the secondary coil; this drop increases with the load and the part of it due to the resistance of the conductors represents loss of electric energy which appears as heat; the eddy currents and hysteresis in the iron core represent transformation of electric energy into heat.

The first transformers were constructed by Michael Faraday in England in 1831 and at nearly the same time by Joseph Henry in the United States. Faraday discovered that when the current in a coil was varied a current was induced in a nearby coil of wire, although both were stationary and did not touch. For a long time the only application of this discovery was in the making of induction coils (q.v.), Ruhmkorff coils, and other similar small apparatus. With the introduction of alternating currents into electrical engineering, however, the transformer found a wide field of application. For instance, the amount of energy wasted in heat by a current traversing a circuit is proportional to the square of the current multiplied by the resistance of the conductor. The energy transmitted is proportional to the product of the current and the electromotive force. That is, if we have a high enough electromotive force we can transmit a given amount of energy with a very small current, and so with relatively small conductors.

This feature becomes of great importance, since it permits small and less costly conductors, when we wish to transmit energy over a great distance, as for instance from a waterfall to a distant city. But while a high voltage is desirable for transmission, it is dangerous and difficult to control, both in the machinery in which the electrical current is generated and in the apparatus in which it is utilized. By means of transformers, however, the current may at the generating station be 'stepped up' for the trans-

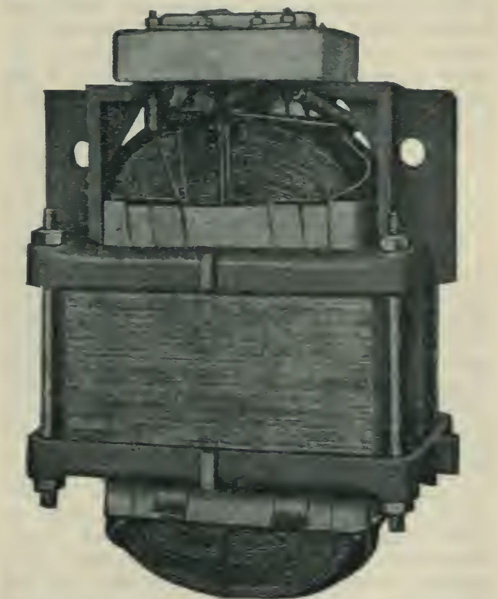


FIG. 2. SHELL TYPE TRANSFORMER, WESTINGHOUSE PATTERN.

mission line and again at the receiving end 'stepped down' to a lower potential for distribution. As an example, the water from the melting snows on the mountains of California is used in water-wheels to drive dynamos generating electric current at a pressure of a few thousand volts or less. This is 'stepped up' by transformers to about 60,000 volts and is transmitted through small overhead conductors nearly 200 miles to San Francisco, where it is 'stepped down' to perhaps 100 volts for ordinary incandescent lighting. See TRANSMISSION OF POWER.

The device which we have outlined is modified in many ways to meet the requirements of various uses, and transformers for the same purposes are built in different forms by different manufacturers. In methods of construction nearly all standard commercial transformers may be put in one of the two classes, shell type and core type. In the shell type of transformer, part of the iron of the magnetic circuit passes around the outside and more or less envelops the primary and secondary windings. In the core type the windings almost completely cover the iron core. Very efficient apparatus is constructed in both forms, each of which has been adopted, respectively by one of the two great electrical manufacturing concerns of the United States.

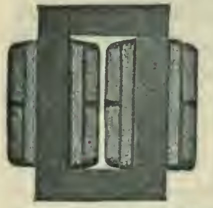


FIG. 3. CORE TYPE TRANSFORMER, GENERAL ELECTRIC CO. PATTERN.

If a transformer is supplied with a constant average alternating electromotive force and is expected to deliver a constant electromotive force from its terminals, as we have assumed in our explanation, it is spoken of as a *constant potential transformer*. To this class the great majority of transformers in commercial use belong. If the transformer is supplied with a constant current and is expected to deliver a constant current, although the voltages may vary, it is known as a *series* or *constant current transformer*. If the secondary of a transformer is inserted in series in one of the distribution lines running from a power station and used to regulate the voltage in that line it is known as a *booster* or *induction regulator*.

Of special transformers for special purposes there are many. *Polyphase transformers* consist of a number of pairs of windings, one for each phase of the electrical circuit, arranged upon a common magnetic circuit. Transformers delivering constant current at a varying potential when supplied with a varying current at a constant potential are used for series arc lighting from constant potential supply mains. This apparently paradoxical result is obtained by so arranging the primary and secondary coils that the magnetic leakage, that is, the lines of force passing through one coil but not through the other, varies with the voltage required in the secondary. This can easily be obtained if the secondary coil is made movable and so arranged that it can swing away from the primary coil, which it will readily do if the current within it increases the least, since the currents of the primary and secondary coils repel each other by virtue of the fact that they flow in opposite directions. Another special form of transformer having a limited application is the *auto-transformer*, in which the primary and secondary coils are united into one. To explain this type we may suppose a coil of 200 turns of wire to be wound on an iron core with a tap taken off at the one hundredth coil. If an alternating electromotive force of 100 volts is applied to 100 turns, sufficient alternating magnetic flux will be set up to produce a counter electromotive force of 100 volts in these 100 coils; but this will also give rise to a similar electromotive force in the remaining 100 coils, so that between the extremities of the 200 coils we will have a potential difference of nearly 200 volts. This type of transformer has many special uses. It is employed, for example, to obtain the low voltages required for starting induction motors, for balancing alternating current, multi-wire distribution circuits, etc.

The capacity of a transformer is limited only by the accumulation of heat in the windings and core. For this reason transformers are often immersed in oil baths, naturally or artificially cooled, or else supplied with a blast of air from a fan.

BIBLIOGRAPHY. Fleming, *The Alternating Current Transformer* (3d ed., London, 1901); Kapp, *The Electric Transmission of Energy and Its Transformation* (London, 1895); id., *Transformers for Single and Multiphase Currents* (ib., 1896); Steinmetz, *Theory and Calculation of Alternating Current Phenomena* (3d ed., New York, 1900); Jackson, *Alternating Currents and Alternating Current Machinery* (New York, 1900); and especially the *Proceedings* of the American and British Institutes of Electrical Engineers, and the current electrical magazines and periodicals.

TRANSFUSION OF BLOOD (Lat. *transfusio*, from *transfundere*, to pour from one to the other, from *trans*, across, through + *fundere*, to pour). The injection into one person of blood taken from another, either directly, from vein to vein, or after it has been defibrinated. The operation has been regarded as legitimate in obstetric surgery since the year 1824, when Dr. Blundell published his well-known work, entitled *Physiological and Pathological Researches*. The operation had, however, been vaguely known to the medical profession for the last four centuries; and there are obscure allusions in the Roman poets, which would seem to indicate that it was practiced as early as the Augustan age. The older operation of transfusion of blood has now given way to the operation of infusion into the veins or subcutaneous tissues of a hot saline solution of a temperature of 100° to 120° F. This solution contains sodium chloride in the proportion in which it is found in solution in normal physiological tissues (about 0.6 per cent.). The amount injected varies usually from one to two pints. It is one of the most useful agents at the surgeon's command in the treatment of shock and the acute anæmia resulting from sudden loss of blood. Consult: Jenning, *Transfusion: Its History, etc.* (London, 1883); Zachrisson, *Experimenteller studier, etc.* (Upsala, 1902); Wallace, "Intra-venous Saline Injections in Shock and Hemorrhage," in *Medical Review* (Pittsburg, Pa., 1896).

TRANS-ISTHMIAN CANAL. The projects for a trans-isthmian canal have included two principal routes, the Nicaragua and the Panama, though there also has been a discussion of a number of secondary routes the principal of which are the Tehuantepec, the San Blas, and the Caledonia Bay. All of these routes have been investigated by engineers and some of them have received continued study for many years. The most thorough and comprehensive study of recent years was that made by the Isthmian Canal Commission in 1899-1900, and not only were the two main routes discussed but also other possible projects as mentioned below. The political questions involved have largely been confined to the Nicaragua and Panama schemes and as these propositions have attracted such widespread attention in the past and as each possesses certain unique features both engineering and otherwise, they will be found treated under their respective heads (see NICARAGUA CANAL and PANAMA CANAL), while below will be given a summary of the features of other proposed routes.

TEHUANTEPEC ROUTE. The well-known geographic conditions at Tehuantepec and between the Nicaragua and Panama Canal routes made it unnecessary to explore those parts of the American isthmus for other possible locations for an interoceanic canal, and the commission mentioned limited its investigations to what is generally known as the Darien country, extending from Panama to the Atrato River.

For about 80 miles the width of the isthmus in this region does not exceed 40 miles, except at one of two headlands which project beyond the general line of the coast. The narrowest point is at San Blas, where the distance from Mandinga Harbor to the shore of Panama Bay is only 31 miles, two miles less than from the head of the bay at Limon, at Colon, to the mouth of the Bernadino. On the eastern side of Panama Bay, about 100 miles from Panama, an estuary known as San Miguel Bay extends into the interior to within 33 miles of Caledonia Bay, on the Atlantic side. This bay of San Miguel, on the Pacific, and San Blas and Caledonia bays, on the Atlantic side, afford excellent harbors and canal approaches. Between Panama and San Blas the ridge of the Cordilleras crosses from the Pacific to the Atlantic side and continues there to the mouth of the Atrato River.

As the existence of practicable and feasible routes in this section depended upon the height and continuity of the divide, its crest was examined all along the line, with as much care and accuracy as was practicable under the conditions which existed, for the discovery of gaps and depressions, so as to ascertain whether any were sufficiently low for canal purposes, and measurements were made of those which promised the most favorable results.

The ridge was traced continuously on the ground from the head of the river Carti, a little east of Mandinga Harbor, in San Blas Bay, to the head waters of the Chagres, and thence down the river to the Panama Railroad a total distance of 24½ miles; also near Caledonia Bay from the Carreto summit, to the Sassardi summit, a distance of 27½ miles. The lowest elevation in the former section was 956 feet, in the latter 683 feet. Between these two sections from San Blas Bay to Caledonia Bay, a distance of 81 miles in an air line, and from Caledonia Bay southward to the Atrato River, the examination was made from the sea, and the elevations of the higher peaks, as well as the gaps and their distances was determined. The result showed that there was no probability of any suitable depression within these limits.

In addition to these investigations, a survey was made from San Miguel Bay, on the Pacific side, up the Chucunaque and Chucurti (Sucubti) rivers, which was almost though not quite connected with the work done near Caledonia Bay. After the results of the general exploration were determined, the examination of other possible routes was limited to those sections where the isthmus was narrowest, where the coast lines offered good harbors, and the indications along the divide were the most promising. These conditions were found near San Blas Bay and Caledonia Bay. East of San Miguel Bay the isthmus widens, and no route can be expected there less than a hundred miles in length.

SAN BLAS ROUTE. The San Blas route extends from the bay of that name to the mouth of the Bayano, on the Pacific; it has been advocated as the shortest line between the two oceans, which is true. The most complete plan developed involves a tunnel at least seven miles long. While not necessarily impracticable, such a tunnel would be very objectionable and would render the line inferior either to the Panama or the Nicaragua location.

CALEDONIA BAY ROUTE. The distance from Caledonia Bay to tide water on the Savana River is about 30 miles in a straight line. Studies have been made of three lines across the divide, all of them striking the same point on the Savana River, near the mouth of the Lara, the approach on the Atlantic side being through the three valleys of the Caledonia, the Aglaseniqua, and the Sassardi. The distance from Caledonia Bay to the mouth of the Lara varies from 32 miles by the Sassardi route to 36 by the Caledonia route. The Sassardi route has not, however, been explored through its whole length, and it is possible that an actual survey would make it as long as the Caledonia route. Each line would require a tunnel. If the Sassardi route were taken, the length of this tunnel, assuming an open cut to be used to the depth of 400 feet, would be about 1.6 miles. On either of the other two the tunnel would be about two miles longer, while the approaches on the south side would be much heavier.

These surveys indicate that the Sassardi route is probably the best of the three for a sea-level canal. The indication cannot be regarded as conclusive, because a thorough survey and development of the sub-surface material might show insuperable difficulties, which would be more likely to exist in the tunnel than elsewhere. The cost of a canal upon this line would be excessive and the tunnel more objectionable to navigation than the locks on the other routes.

Caledonia Bay is virtually tideless. San Miguel Bay has a tidal range of 20 feet or more. This heavy tide causes currents in the Savana River of sufficient force to be a serious menace to navigation, and it would be necessary to build a tide lock near the mouth of the Savana. The distance from the mouth of the Lara to the tide-lock site is about 14 miles, the upper portion of which is in a narrow river which would require enlargement for a canal. This makes the total length of canal navigation from Caledonia Bay to the tide lock about 50 miles.

The result of all these examinations showed that there was no probability of the existence of any practicable canal location between Panama and the mouth of the Atrato River, except by the adoption of a tunnel line, and there seemed to be no reason for further field work except in the interest of geography. See Report of Nicaragua Canal Commission, 1897-99 (Baltimore, 1899) and the bibliography under Nicaragua Canal and Panama Canal, which articles should be read in this connection.

TRANSIT INSTRUMENT (Lat. *transitus*, passage over). An astronomical instrument consisting principally of a telescope fixed to a horizontal east-and-west axis, and revolving in the plane of the meridian. It is employed, as its name denotes, in the observation of the meridian transits of the heavenly bodies, i.e. in noting the exact instants when they reach the meridian of the observatory. The axis, which is the most important part of the instrument, and thus demands the utmost care in its construction, consists of a hollow sphere or cube, to opposite sides of which are tightly fastened the bases of two cones in whose apices the pivots are screwed; the sphere or cube is pieced for the admission of the telescope, which is firmly fastened at right angles to the axis. One of the pivots is hollowed so that a stream of light can be directed from a lantern half way along the interior of the axis, and through an aperture in the side, into the telescope tube, where, being received by a small reflector, set at 45° to the axis and telescope tube, it is directed to the eyepiece, rendering visible a series of fine spider-threads stretched across the field of view. The pivots must be carefully turned to a perfectly cylindrical form, and fitted into the instrument, so that they are accurately in line. One extremity of the axis carries one and sometimes two small graduated circles, each supplied with index, clamping screws, and vernier; these circles are capable of indicating angular measures to within 1′ or 2′. There are three adjustments necessary before a transit instrument can be used: the axis must be horizontal; the sight line of the telescope, as marked by the spider-threads, must be at right angles to the axis of motion; and the latter must be placed so as to point accurately east and west. On the perfection of the first two of these adjustments depends whether the telescope sweeps over a great circle of the sphere, and the third is necessary to insure that this great circle shall be the meridian of the place of observation. These adjustments can never be made quite perfect, and the usual mode is to investigate the amount of error in each, and allow for it by a calculated correction applied to the observed time of the star's crossing the meridian. To note accurately this observed time by the astronomical clock is, as we have said, the essential part of a transit observation. It is best done by means of a chronograph (q.v.), an instrument with which an automatic record of the observed time can be made by means of an electric signal sent out directly from the observer's hand. The transit used by engineers will be found described and illustrated under Engineering Instruments.

TRANSIT OF VENUS. The passing of Venus across the sun's disk, seen when the planet is exactly in line with the sun and the earth. The two planets, Mercury and Venus, whose orbits lie between the sun and the earth's orbit, can at times pass between us and the sun. We can then see them in the telescope, appearing as black dots projected on the luminous solar surface. If the exact instant of time be observed when the planet first touches the solar disk, and again when it finally leaves it, we can use the observations to calculate the solar parallax and the distance from the earth to the sun. Transits of Venus are especially well suited for this purpose, and they have been very elaborately observed in the past, especially in the years 1874 and 1882. Unfortunately, experience has proved that it is impossible to observe the required instants of time with sufficient precision; and other methods of measuring the sun's distance are now preferred by astronomers. (See Parallax; Eros.) The next transit of Venus will occur June 8, 2004. Transits of Mercury will happen on the following dates in the twentieth century:

November 12, 1907.
November 6, 1914.
May 7, 1924.
November 8, 1927.
May 10, 1937.
November 12, 1940.
November 13, 1953.
November 6, 1960.
May 9, 1970.
November 9, 1973.
November 12, 1986.
November 14, 1999.

It will be noticed that transits of Mercury occur much more frequently than those of Venus; but, as we have said, they are not well adapted for solar parallax observations, and are indeed of quite minor importance astronomically.

TRANSKEI (trăns-kī′) **TERRITORY.** A dependency of Cape Colony, between the Great Kei River and Tembuland. Area, 2552 square miles; population, in 1891, 153,563, the region thus being the most densely populated part of Cape Colony. The territory is administered by a chief magistrate and is subject to the 'Native Territories Penal Code.'

TRANS′LEITHA′NIA. A name applied to the eastern division of the Austro-Hungarian monarchy on account of its position east of the Leitha River, which forms a part of the boundary line between the two divisions of the monarchy. See Cisleithania.

TRANSMIGRATION. See Metempsychosis.

TRANSMISSION OF POWER BY ELECTRICITY. The electrical transmission of energy in considerable quantities from the point of generation to one or more distant points of delivery. This excludes telegraphy and telephony (qq.v.), where energy is transmitted over a wire, but in small quantities.

Energy is transmitted in order to utilize a cheap source of energy supply, and the total cost of generation and transmission to the point of use must be less than would be the cost of generation at the point of use, otherwise such transmission would not be profitable. Therefore, transmission plants are usually supplied by water power or by cheap coal, and the electricity is derived from generators. (See Dynamo-Electric Machinery.) The cost of the transmission depends upon the distance and upon the permissible electrical pressure, or voltage, of the transmission line. The weight of copper required to transmit any amount of energy for any distance at any particular efficiency is directly proportional to the square of the distance, and inversely proportional to the square of the voltage. If the distance be doubled, with the same voltage, the weight of copper will be four times as great; if the voltage be doubled, with the same distance, the weight of copper will be one-quarter as great; if the loss be doubled, the weight of copper, for the same distance and same voltage, will be halved.

This is the fundamental fact in the transmission of energy by electricity; great distances can be economically overcome by the use of high voltages only. This explains the practical elimination of the direct current as a means of transmission; direct-current generators cannot be built in large sizes for more than 1500 volts, on account of trouble at the commutator; to connect a large number of such generators in series involves great difficulties in the use of the energy at the receiving end; the motors must also be connected in series and be insulated to stand the maximum voltage; this limits their use to places where skilled supervision can be exercised. There are a few instances of the use of direct-current transmission in Europe, but in the United States there is none.

The maximum permissible voltage then limits the distance of transmission. What, in turn, limits the maximum voltage? Transformers (q.v.) can be built to operate satisfactorily at 75,000 volts; insulators are now built for use at 60,000 volts and for a test pressure of 120,000 volts; the insulator is at present the weak point of the transmission system, yet it is probable that improvements in insulators can be made at reasonable cost to permit their use up to 75,000 volts. There is, however, another limitation due to the material loss of energy between two wires suspended in air, when the voltage between them exceeds a certain value; this loss is comparatively small up to about 50,000 volts, but increases very rapidly above that point; it can be diminished by increasing the distance apart of the wires, but great increase on a single pole is impracticable, hence it would become necessary to build separate pole lines for the several wires; this added cost may easily be greater than the value of the energy saved by such construction, and a lower voltage may be more economical. The practical limit to the voltage is fixed by the excessive cost of the insulation of transformers and line, rather than by the dielectric loss, and at present 75,000 volts is probably the maximum.

The transmission of energy can be made with as good economy in copper by the single-phase as by the three-phase system (see DYNAMO-ELECTRIC MACHINERY), for the same stress on the insulator, and requires only two wires against three for the three-phase system; but this advantage is more than offset by the fact that there is no good and simple motor that can be used, under ordinary conditions, with the single-phase system; the polyphase system, on the other hand, has come into general use on account of the induction motor, which is self-starting and of extreme simplicity in construction and operation; its commercial introduction gave the first great impetus to the transmission of energy by electricity. Compared with the two-phase system, the three-phase has the advantage of requiring only three wires as against four, and 25 per cent. less copper, hence it is practically the only system used for transmission. Copper wire is generally used, although aluminum has some advantages; the wires are always bare, and are supported by porcelain or glass insulators fixed to cross-arms on poles, which, in the United States, are generally of wood.

The items of the cost of a 10,000 kilowatt transmission plant for 150 miles, at 75,000 volts, with a 10 per cent. loss are: Copper, $20; pole line, $15; transforming stations, $10—a total of $45 per kilowatt. The cost of a water-power plant, excluding the transmission, may vary from $75 to $200 per kilowatt—the cost of the transmission system is then from 18 per cent. to 38 per cent. of the total cost. The annual charges for interest, depreciation, and maintenance of this line will be $6 per kilowatt. Hence there must be at least this difference in the cost of generation at the two points to make the transmission pay. At 37,500 volts, the copper would cost $80—making the total $105 per kilowatt for the transmission; the annual charges would then be $10 per kilowatt. Accurate statistics are not available, and the line of demarcation between a transmission plant and an alternating-current central station is difficult to draw. There are, however, about 200 water-driven electric plants in America, aggregating approximately 600,000 kilowatts, with single stations up to 75,000 kilowatts capacity, and with single generators up to 7500 kilowatts capacity. The maximum distance in daily service is 220 miles; the maximum voltage 60,000; the frequency varies from 25 to 60 cycles, with an increasing tendency to the lower value.

The efficiency of a transmission system is largely determined by the amount of copper, which is in turn determined by economical considerations; it usually falls between 80 and 90 per cent., and is about as high at half load as at full load. The increasing prominence of the steam turbine and the gas engine will probably retard the development of transmission plants in the immediate future, but, looking further, it is inevitable that their importance and value will increase as the coal supply diminishes in quantity and increases in cost.

The best practice in the transmission of energy by electricity is found on the Pacific Coast, and the plants of the Standard and Bay Counties Company, in California, are typical. This company supplies Oakland, San Francisco, Stockton, and a large number of smaller places with electric energy for all purposes. It operates two main power houses at Colgate and at Electra; it also has the Yuba and the Nevada power houses. It has more than 650 miles of pole line and some 800 miles of three-phase circuit, nearly all of aluminum cable; it uses voltages up to 60,000, and operates to a distance of 220 miles, from Colgate to Stockton. The poles are of Oregon cedar or sawn California redwood, of an average height of 40 feet, and carrying either one of two three-phase circuits, the wires being supported on porcelain or glass insulators. The capacity of these power plants exceeds 25,000 kilowatts. For detailed descriptions of modern transmission plants, reference should be made to the files of the electrical engineering journals and the *Proceedings of the American Institute of Electrical*

Engineers. See DYNAMO-ELECTRIC MACHINERY; TRANSFORMER.

TRANS-MISSISSIPPI EXPOSITION. An exposition held in Omaha, Neb., from June 1 to October 31, 1898. The site covered about 200 acres, a mile to the north of the city. The main buildings, which contained the exhibits devoted to Agriculture, Fine Arts, Machinery and Electricity, Manufactures, Mines and Mining, and the United States Government, were grouped around a grand court which extended through the middle of the grounds and surrounded the lagoon or canal which terminated at its west end into a three-lobed lake 400 feet across, at the extreme west end of which was an electric fountain. The grounds were also skillfully improved by the presence of trees, shrubs, and flowering plants until the arid prairie became so changed as to gain the name of Magic City. The buildings were covered with white staff, adorned with intricate carving and classical statuary, resulting in the production of an artistic effect of remarkable beauty. Of special interest among the amusement features was the ethnological gathering of 500 Indians, representing 25 tribes. The total attendance was 2,613,508, and the total receipts $1,924,077.

TRANSPADANE REPUBLIC. A republic formed by Napoleon in 1796 on the south side of the Po, and in 1797 united with the Cispadane Republic, on the north side, to form the Cisalpine Republic (q.v.).

TRANSPIRATION (from Lat. *trans,* across, through + *spirare,* to breathe). The evaporation of water from the aerial surfaces of plants. The term is used instead of evaporation, first, because the evaporation is modified by the action of the living organisms; and second, because the development of heat within this organism prevents the complete stoppage of evaporation when the plant is surrounded with a saturated atmosphere. In most land plants, transpiration from the epidermal cells is inconsiderable because such become nearly waterproof by cutinization of the outer walls. The cells bordering the interior air chambers (see AERATION) are saturated with water, and from them it evaporates readily into the air occupying these spaces, whence it finds its way by diffusion through the stomata (q.v.). The rate of transpiration will be determined by the relative humidity of the outer air, temperature, wind, light, etc. Transpiration is *unavoidable,* because gases must be absorbed from the air (see ABSORPTION); it is *necessary,* at least to some plants, for cooling; and it is *advantageous* for the movement of dissolved salts. See CONDUCTION.

Since excessive loss of water is one of the greatest dangers to which plants are subject, plants growing in dry regions show a great variety of adaptations to reduce the rate of transpiration and to conserve the moisture which reaches them. (See XEROPHYTES.) The amount of water transpired varies greatly on account of variation in external conditions and internal structure. A few examples of transpiration under normal conditions will illustrate. In 12 hours on a hot, dry day a sunflower 3.5 feet high, having a leaf area of 5316 square inches, lost 30 ounces of water. The loss of water from 100 square centimeters of leaf surface in 24 hours for the pea was 2.51 grams, for the hop 4.3 grams, for the hemp 9.3 grams. Estimates as to the loss of water during the growing season by the plants of wheat grown on one hectare (about 2.5 acres) equal 1,179,920 liters; and by oats 2,277,760 liters. If all this water could be caught and condensed on the same area it would reach in the first case a depth of nearly 118 millimeters (4⅝ inches), and in the second 228 millimeters (9 inches). A beech tree having 200,000 leaves was estimated to lose between 300 and 400 liters (about 2 barrels) on a hot day.

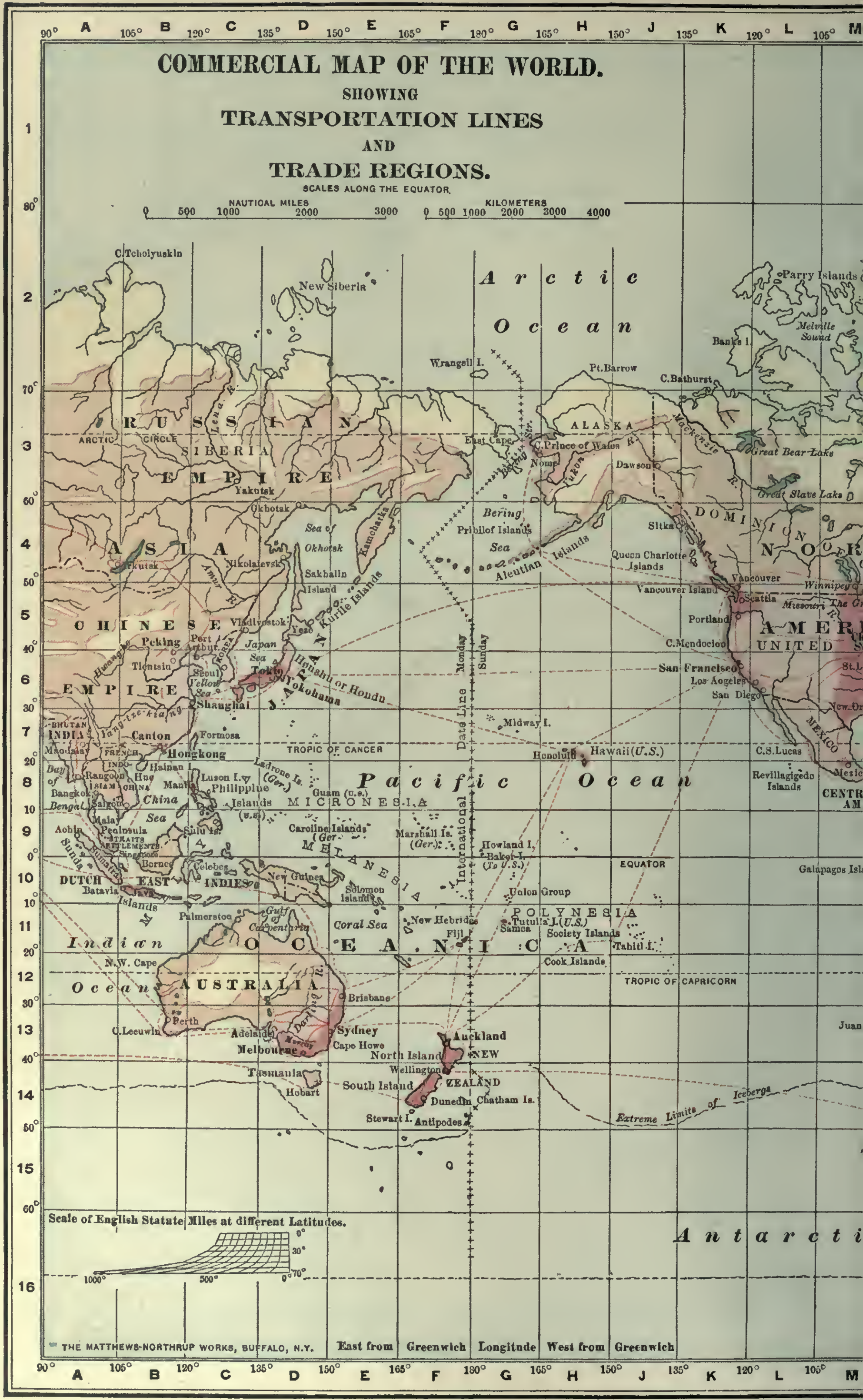
TRANSPIRATION OF GASES. See EFFUSION.

TRANSPORTATION (in law). See ADMIRALTY; COMMERCE; CARRIER, COMMON; MARITIME LAW; PUBLIC CALLINGS; HIGHWAY, etc.

TRANSPORTATION. The carrying of persons and goods from place to place. The part which transportation plays in the practical life of a community depends most directly upon the complexity of its economic system. Wherever the division of labor and the localization of industry have reached a high degree of development transportation necessarily attains a correspondingly high development. The rise of industry on a great scale and the creation of efficient means of transportation mutually condition each other.

More than a thousand years before our era Phœnician ships were trading in the Mediterranean, and later along the shores of the same sea the Greek cities built up their colonial and trade system. Rome was relatively late in developing maritime traffic, but by the time of the Empire an extensive commercial system had arisen, bringing to Rome the raw produce of Sicily and North Africa, and extending westward even beyond Gibraltar. Ancient land transport was comparatively insignificant. The Greek roads were chiefly to sacred places, such as Delphi, and their economic importance was small. The Roman roads were established for military rather than economic reasons, but they were vastly more extensive. Centring at Rome, they not only stretched through Italy, but (under the Empire) to Constantinople and Asia Minor, along parts of the north coast of Africa, westward to Spain, over the Alps to Gaul, and through Britain. Excellent as these roads often were, their method of construction was wastefully expensive from the modern standpoint.

The return to a more primitive economy in the early Middle Ages meant that for a time transportation should cease to play any important part in the economic life of Europe. The salient points in the story of its gradual revival are the stimulus given by the Crusades to trade with the East, the consequent growth of the Italian cities, and, in the twelfth century, the formation of the great trade league (Hansa) of the North European towns. Although the rise of towns and the establishment of fairs made a certain amount of land or river transport necessary, it was slow, insecure, and costly, and, at least on the Continent, was subject to burdensome and arbitrary tolls. The destruction of the Eastern caravan routes through the Turkish and Mongol invasions gave especial importance to the discovery of an ocean route to the Indies made by Portuguese navigators at the end of the fifteenth



COMMERCIAL MAP OF THE WORLD.

SHOWING

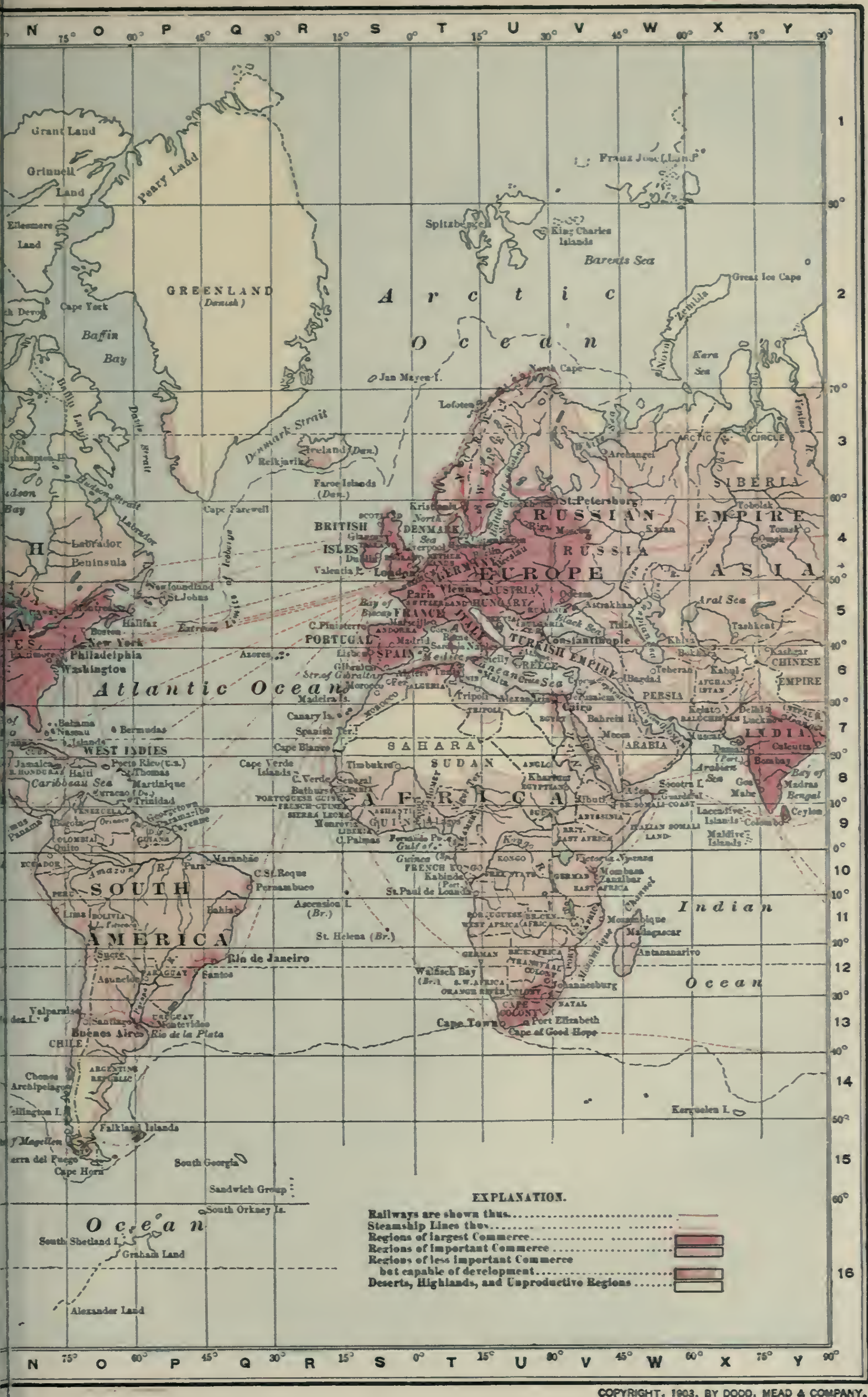
TRANSPORTATION LINES

AND

TRADE REGIONS.

SCALES ALONG THE EQUATOR.

THE MATTHEWS-NORTHRUP WORKS, BUFFALO, N.Y.



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century. The introduction of the compass made trans-oceanic voyages readily possible. The discovery of America made them profitable, and helped to shift the centre of trade from the Mediterranean to the Atlantic, from the Italian cities to the Portuguese, the Spanish, and the Dutch. The growth of colonial empires, based essentially on transportation, marks a most important era in the world's economic history. more adequate means of transport, which only the railroad and the steamship could supply. Through them, in the nineteenth century, international industry has been made possible.

The following table, from the *Report* of the United States Commissioner of Navigation (1902), shows the Merchant Marines of the World, according to Lloyd's Register (1902-03). Only vessels of over 100 tons are included.

COUNTRY	Sail		Steam		Total	
	Number	Net tons	Number	Gross tons	Number	Tonnage
BRITISH:						
United Kingdom	1,685	1,533,480	7,358	12,897,592	9,043	14,431,072
Colonies	1,004	360,962	994	754,863	1,998	1,115,825
Total	2,689	1,894,442	8,352	13,652,455	11,041	15,546,897
UNITED STATES:						
Sea	2,155	1,247,125	776	1,095,788	2,931	2,342,913
Lake	59	135,863	318	858,380	377	994,243
Total	2,214	1,382,988	1,094	1,954,168	3,308	3,337,156
Germany	500	502,230	1,365	2,636,338	1,865	3,138,568
Norway	1,345	766,003	905	866,754	2,250	1,632,757
France	601	415,029	690	1,104,893	1,291	1,519,922
Italy	862	467,241	361	691,841	1,223	1,159,082
Russia	751	244,232	544	556,102	1,295	800,334
Spain	150	48,364	464	736,209	614	784,573
Japan	998	135,351	535	555,230	1,533	690,581
Sweden	789	225,468	719	464,705	1,508	690,173
Holland	109	57,873	320	555,047	429	612,920
Austria-Hungary	42	26,784	259	529,319	301	556,103
Denmark	411	98,483	366	440,010	777	538,493
World's total, including above with all other countries	12,472	6,577,776	17,156	25,859,987	29,628	32,437,763

Land transport lagged far behind that on the sea. With the growth of centralized nations a political motive arose for the improvement of roads and of internal trade. Under Louis XIV. (1643-1715), during the Ministry of Colbert, the French roads were greatly bettered, and many of the local tolls were put aside. In England little effective action was taken by the central Government, and, despite many 'Turnpike Acts' (granting rights to levy tolls in return for maintaining roads) the English highways remained poor throughout the eighteenth century, till the efficient road-making methods of McAdam (1756-1836) and Telford made possible the great improvements of the nineteenth. In the United States, as in England, private or local activity has been chiefly relied on for road-making. Private turnpikes were constructed in colonial times, and during the 'internal improvement' era, after 1800, Federal roads were built. Road-building has been recently carried on systematically in many parts of the United States.

The slowness and costliness of land transportation, even in the eighteenth century, made it impossible to convey ordinary goods any long distance. An era of canal-building, which began in England soon after 1750, met in part the increasing need of the growing industrial centres for communication with one another and with the sea. The same movement appears in the United States in the first quarter of the next century. With the rise of the factory system following 1760, with the application of steam power to mining and manufactures, and the possibilities of machine production on a large scale, came an imperative need for more rapid and

It appears from these figures that steamships now comprise 58 per cent. of the world's vessels (not reckoning China, Turkey, etc.) and 80 per cent. of their tonnage, although for some nations the percentages are much higher. The preponderance of British ships is most notable in steamships. In 1801 there was in the United Kingdom a total net tonnage of 1,786,000; in 1850 the figure was 3,565,000; in 1880, 6,575,000; in 1901, 9,608,000. The percentage of net steam tonnage was 4.7 in 1850, 41.4 in 1880, and 79.2 in 1901. German shipping has grown still more rapidly in recent years. The sailing tonnage has decreased from 1,223,000 in 1885 to 667,207 in 1901, but the (net) steam tonnage has risen from 520,186 in 1885 to 1,057,525 in 1895, and 1,548,667 in 1901.

Before the introduction of iron ships American builders were greatly favored by the cheapness of native timber, and for this and other reasons American shipping was dominant in the world's carrying trade. The tonnage engaged in foreign traffic was 667,000 in 1800; and, though somewhat set back by the War of 1812, it rose to 1,439,000 in 1850 and 2,497,000 in 1861. This was its maximum. The coasting trade has continued to rise from 1,177,000 in 1840 to 2,645,000 in 1860 and 4,859,000 in 1902, including vessels of all sizes. But foreign shipping had fallen to 1,314,000 in 1880, and in 1902 was but 873,000 tons. While in 1860 63 per cent. of the imports and exports of the United States was carried in American vessels, in 1870 the percentage was only 33.1; in 1880, 22.9; in 1890, 16.7; and in 1902, 12.1.

The growth of railway mileage since 1830 is shown in the following table, compiled from the

Journal de la Société de Statistique de Paris (1901-02):

GROWTH OF RAILWAY MILEAGE SINCE 1830

YEAR	United States	Great Britain and Ireland	France	Germany	Russia	The world
1830	23	57	24	....	....	121
1840	2,818	838	303	360	17	4,792
1850	9,021	6,624	1,870	3,761	311	23,980
1860	30,626	10,437	5,865	7,285	989	67,055
1870	52,922	15,151	11,019	12,253	6,982	128,407
1880	93,262	17,929	16,109	21,057	14,617	230,515
1890	166,654	20,334	24,030	26,638	19,225	377,746
1900	194,334	21,932	26,611	31,933	29,892	491,236

The railway equipment, traffic, etc., of certain principal countries is shown in this table:

	United States, 1891	United States, 1901	United Kingdom, 1901	Germany, 1900	France, 1900
EQUIPMENT					
Number of locomotives	32,139	39,584	20,461	19,069	10,775
Number of locomotives, per 100 miles of line	20	20.2	94	60	41
Number of passenger cars	27,949	35,969	45,948	38,434	29,049
Number of passenger cars, per 100 miles	17	18.4	211	123	112
Number of freight cars	* 947,300	1,439,328	706,982	412,744	284,601
Number of freight cars, per 100 miles	587	749	3260	1310	1100
PASSENGERS					
Number carried during year	531,183,998	† 607,278,121	1,172,395,900	842,092,000	453,193
Number carried one mile, in millions	12,844	17,354	....	12,427	7,802
Number carried, per mile of line	79,642	89,721	....	400,960	297,400
FREIGHT					
Tons carried during year	675,608,323	1,089,226,440	413,623,025	367,180,000	('99) 138,600,000
Tons carried one mile, in millions	81,074	147,077	....	23,463	(1899) 10,819
Tons carried per mile of line	502,705	760,414	....	757,040	(1899) 412,722
REVENUE					
Gross earnings from operation, million dols.	1,096.7	1,588.5	518.9	483	295.4
Gross earnings from operation per mile of line, dollars	6,800	8,123	23,457	15,580	12,442
Revenue per passenger per mile, cents	2.142	2.013	....	1st Cl. 1.83 2d Cl. 1.10 3d Cl. 0.638 4thCl. 0.464	(1899) .709
Revenue per ton of freight per mile, cents	0.895	0.750	....	‡ 1.318	1.49
TRAFFIC DISTANCES					
Average journey per passenger, miles	24.18	28.58	....	(1899) 14.3	(1899) 18.1
Average haul per ton of freight, miles	....	251.98	....	(1899) 63.5	(1899) 77.7
Train miles, passenger trains, in millions	307.9	385.1	(1899) 216.4	(1899) 140.9	(1899) 106.1
Train miles, all other trains, in millions	446.2	491.9	(1899) 179.5	(1899) 145.5	(1899) 105.5

* Excluding 51,987 fast freight line cars. † Excluding season-ticket holders. ‡ Excluding express goods.

(Compiled for the United States from Interstate Commerce Commission Reports. For foreign countries, from various sources, chiefly the *Archiv fur Eisenbahnwesen*, 1902.)

For further statistics and general discussion of this subject, see RAILWAYS and STEAM NAVIGATION.

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TRANSPORTATION, PENAL. Banishment from society in the form of exile, ostracism, or outlawry. The practice is well known among uncivilized peoples, and existed among the ancient nations and in mediæval Europe. In England, under a statute of Elizabeth (1597), 'dangerous rogues' might be banished by justices in quarter sessions, but no system of transportation can be said to have arisen till the time of Charles II., when justices were empowered to send certain offenders to America instead of inflicting the death penalty. In 1717 transportation was authorized as a substitute for other punishments than hanging, and the contract system, by which individuals agreed to transport convicts in return for their labor during the period of sentence, was established. The business was profitable at first, but became less and less so, until a payment had to be made for each criminal transported. Protests from America were frequent, but were unavailing. After 1776 a twofold system was developed. To meet the immediate need, hulks stationed in the Thames (later at Portsmouth and other places) were arranged to receive convicts; and though this was begun merely as a temporary expedient, it endured as a legalized system for over three-quarters of a century. Involving as it did the crowding of prisoners under extremely bad sanitary and moral conditions, the hulk system was severely criticised by several Parliamentary committees, but it was abolished only gradually, as penitentiaries were constructed.

Within a decade after 1776 another settlement for criminals had been found in Australia. In 1787 the first lot of convicts left for New South Wales. In 1804 they began to be sent to Tasmania. The number transported was at first small. The annual average up to 1816 was less than 500, but it rose to 3000 during the twenties and thirties. The spirit and practice of the system were essentially penal, not reformatory, and conditions of life in a colony where the majority of persons were convicts were almost inevitably bad. The report of the Parliamentary committee of 1838 condemned the system at almost all points, and a few years later (1842) a 'probation system' was planned by which prisoners were classified and might pass through various stages toward pardon or freedom. The essential difficulty of the scheme was to find work in the colonies for ticket-of-leave men or 'probationers,' while the matter was further complicated by an increasing objection of the colonists to the importation of convicts. Transportation to New South Wales ceased after 1849, and to Tasmania after 1852. Thenceforth Western Australia was the only outlet, and though the probation system, improved in 1847, worked there successfully, the colony was quite unable to provide for all English convicts. With the development of the system of penal servitude (1853-63) transportation declined, and the last shipment of criminals to Western Australia was in 1867.

In France penal transportation was established by a law of 1854. Guiana was at first utilized as a place to send criminals, but its climate proved quite unsuitable, and except for negro convicts it has been abandoned as a penal settlement since 1867. Mention might be made, however, of the notable exception of Captain Alfred Dreyfus (q.v.). In 1864 convicts were sent to New Caledonia, where conditions have been much more favorable; but, though the system still continues in use, it is not regarded with much favor. Russia is the only other modern nation which has practiced transportation on a large scale. Siberia was made a place of settlement in the seventeenth century, and after the discovery of the mines the system grew apace. Between 1807 and 1899 it was estimated that 865,000 persons had been transported to Siberia. Since 1869 the island of Saghalien (q.v.) has been used largely as a penal colony. In 1896 it contained 15,000 convicts and exiles, and less than 3,000 free settlers. The horrors of Siberian exile which Krapotkin, Dostoyevsky, and others have told to the Western world, have been considerably mitigated in recent years. Convict labor does not prove of permanent economic advantage, and in Siberia, as elsewhere, it has been found impossible to colonize a country with convicts. In 1900, following the investigation of a commission of 1899, the Prussian penal system was radically reformed. Imprisonment is to take the place of exile for all except political and religious offenders. No further attempt is to be made to settle convicts as colonists, but all those exiled will remain imprisoned during their sentences. Consult: Du Cane, *Punishment and Prevention of Crime* (London, 1885); Wines, *Punishment and Reformation* (ib., 1895); Holtzendorff, *Die Deportation als Strafmittel* (Leipzig, 1859); Krapotkin, *In Russian Prisons* (London, 1887); Kennan, *Siberia and the Exile System* (New York, 1891); De Windt, *The New Siberia* (London, 1896).

TRANSPOSING INSTRUMENTS (from *transpose*, OF., Fr. *transposer*, from Lat. *transponere*, to transpose, from *trans*, across, through + *ponere*, to place). Those musical instruments whose natural scale is always expressed in C major irrespective of the actual pitch. Such instruments are the horns, trumpets, cornets, tubas, clarinets, and cor anglais. The C major scale when played upon the B flat clarinet is identical in pitch with the B flat major scale. In order to play the real C major this instrument must play the scale written as D. In a composition in the key of F major the signature of the strings and all non-transposing instruments will, of course, be one flat; whereas the B flat clarinets must be written in the key of G. See MUSICAL INSTRUMENTS.

TRANSPOSITION (Lat. *transpositio*, from *transponere*, to transpose). In music, the performance of a composition in a key other than the one in which it was written by the composer. Vocal works are most frequently transposed, as when a tenor wishes to sing a work originally written for low voice. Transposition occurs also often in transcription. Singers have no difficulty in transposing a song into any key, but the transposition at sight upon any instrument, especially the organ or pianoforte, is difficult. See SCORE.

TRANSUBSTANTIATION (ML. *transubstantiatio*, *transsubstantiatio*, change of substance, from *transubstantiare*, *transsubstantiare*, to change to another substance, from Lat. *trans*, across, through + *substantia*, substance, essence, material, from *substare*, to stand under, be present, from *sub*, under + *stare*, to stand). A word used by Roman Catholic theologians to designate the change which they believe to take place in the Eucharistic elements of bread and wine, in virtue of the consecration. The term was first officially adopted by the Church at the Lateran Council of 1215, and the doctrine involved by it explicitly defined as an article of faith by the Council of Trent: "The whole substance of the bread is changed into the body of Christ, and the whole substance of the wine into His Blood, the species alone remaining."

The definition of the manner of Christ's presence is really rather a philosophical than a theological one, resting as it does upon the Aristotelian system of philosophy adopted by the mediæval theologians. It is based upon the belief in the existence in everything of an essential distinctive principle not cognizable by the senses called 'substance;' the 'species' or 'accidents' of the thing are qualities which are perceived by the senses—color, taste, smell, solidity, etc. In transubstantiation, accordingly, the *accidents* remain unchanged, while the underlying *substances* of bread and wine cease to exist, their places being taken by the *substance* of the body and blood of Christ. The objections to the doctrine have been chiefly drawn from the philosophical difficulties which are involved in it; and the defenders of it have therefore added to the proofs which they profess to draw from the Scripture and tradition a general demonstration that the doctrine, although mysterious, does not involve any philosophical repugnance or impossibility. Leibnitz (q.v.), although a Protestant, has not only entered at great length, and in several portions of his works, into this philosophical discussion, but professes to prove, by strict philosophical principles—by the consideration of the properties of matter, of substance, of space, extension, and the like—that the essential principle of the body "may exist in many places at the same time, nay, under far-distant and distinct species."

Consult, for an excellent English treatment of both philosophical and theological aspects of the question, Dalgairns, *The Holy Communion* (Dublin, 1861); and see LORD'S SUPPER; SUBSTANCE.

TRANSVAAL, trăns-väl′, or TRANSVAAL COLONY; formerly SOUTH AFRICAN REPUBLIC. A British possession in South Africa. It is situated between latitudes 22° and 28° S., and longitudes 25° and 32° E., and is bounded on the north by Matabeleland, on the east by Portuguese East Africa and Swaziland, on the south by Natal and the Orange River Colony, and on the west by Bechuanaland and the Bechuanaland Protectorate. There were transferred to Natal, in January, 1903, 7000 square miles of area, including the districts of Vrijheid, Utrecht, and a section of the Wakkerstroom district, with a total population of nearly 60,000, 8000 being whites. The area of the Transvaal is about 104,000 square miles.

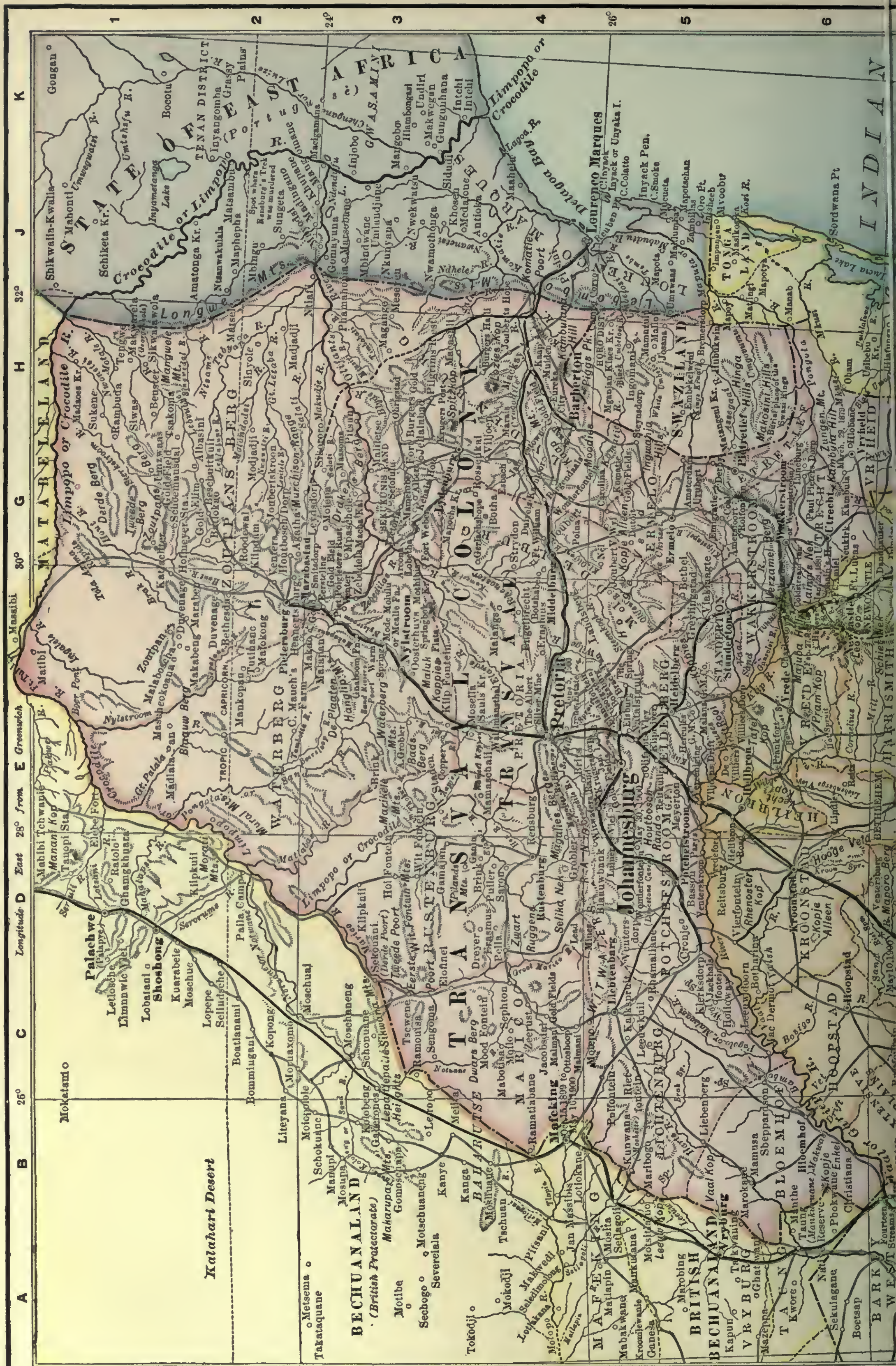
The interior of the Transvaal is a plateau lying on an average about 6000 feet above sea level. In the east this plateau is terminated by the northern Drakensberge, with the highest point (Mauch Mountain) reaching nearly 9000 feet. On the eastern border are the Lebombo Mountains. Across the interior plateau stretches from east to west the far-famed Witwatersrand, with Johannesburg and the rich gold fields, which separates the Limpopo and the Vaal basins. Just north of the Witwatersrand and in general parallel with it extend the Magalies Mountains. Pretoria lies at the eastern outlet of the narrow valley thus formed. In the centre of the extensive Drakensberge system, which occupies the whole eastern third of the colony, is Barberton with its gold fields. The Transvaal is well watered. It is drained mainly by the Limpopo River, which forms the boundary on the northwest and north, and the Vaal River, which forms most of the southern boundary. The Olifant River, the principal affluent of the Limpopo, has nearly its entire course within the Transvaal. The Barberton region is drained by the Komati, which flows into the Indian Ocean. None of the rivers of the Transvaal, however, are navigable.

The climate west of the Drakensberge and south of the Magalies range is subtropical, with a European character. The mean annual temperature is 67° F. January is the warmest, July the coldest month. There are winter frosts. The northern and eastern sections of the Transvaal are more tropical, especially the valley of the Limpopo. December, January, and February witness the heaviest rainfall. The west is the driest. The climate of the interior uplands is noted for its healthfulness. Among the distinctive trees are the thorny acacias and the eucalyptus. The range of plants is very large, including the European grains and many of the valuable tropical species. The northeastern section is the least fruitful. The lions and elephants have been driven into the north and northeast parts. The flocks and herds of the Boers were very large before the war of 1899-1902, and horses were also bred, though to a much less extent.

Granite and slate are in general the basic formations, upon which rests the so-called 'Cape Formation,' above which are found quartzite and coal-bearing layers. The Transvaal is exceptionally rich in varieties of mineral wealth, such as copper, iron, coal (in different sections), lead, silver (north of Pretoria), diamonds (in the Pretoria district, and in the southwest corner in the direction of Kimberley), and notably gold. Gold was first discovered in 1867, and is now found abundantly in numerous districts. The rich gold fields of the Witwatersrand—'The Rand'—(of which Johannesburg is the mining centre), and those of Barberton, have made the Transvaal particularly famous. Around them developed the history of the colony. The value of the gold taken out from 1884 to 1898 was $350,000,000. The mining operations after 1899 were seriously interfered with by the war and for more than a year ceased altogether. In eleven months in 1902 1,500,000 ounces were obtained. In that year nearly 50,000 natives were employed in the mines. In 1898 diamonds were taken out to the value of $200,000. There has been no output of copper and silver in later years. Coal was a noteworthy item before the recent war, and was mined to the amount of $3,000,000 in 1898.

The country is well adapted to agriculture and stock-raising, though its possibilities are as yet meagrely developed. The acreage in farms is estimated at less than 600,000. After the war of 1899-1902 three-fourths of the burghers soon returned to their lands. The Government made loans to aid them in raising the crops, and land was rented on shares under favorable conditions to the more indigent. Syndicates of farmers borrowed money in a large lump sum, massing all their assets together as security. The proceeds were to be used for only a given number of families. The number of live stock in the colony is unknown. The manufacturing interests are in their infancy. There are 11 factories for machinery, 9 for tobacco, 19 for mineral waters and ices, and 3 for explosives, several printing works, and numerous saw mills.

The imports for 1901 were valued at £3,670,365. The figures for 1902 evidently quadrupled this sum. The main articles are clothing, provisions, metals, and manufactures of metals. The largest amount comes through Cape Colony, though almost as much enters through Natal. Comparatively little comes via Delagoa Bay. The figures for exports are not given. The principal articles shipped out are gold, hides, cattle, wool, ivory, and ostrich feathers. The colony has railway communication with the important sister colonies and with Portuguese East Africa. The mileage is about 700.


Longitude East 28° from Greenwich
A
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30°
32°
Kalahari Desert
BECHUANALAND
(British Protectorate)
BRITISH BECHUANALAND
MATABELELAND
STATE OF EAST AFRICA
(Portuguese)
TRANSVAAL COLONY
WATERBERG
ZOUTPANSBERG
SWAZILAND
TONGA LAND
Limpopo or Crocodile R.
Crocodile or Limpopo
Delagoa Bay
Lourenço Marques
Pretoria
Johannesburg
Mafeking
Pietersburg
Barberton
Palachwe
Shoshong
Kanye
Vryburg
Heidelberg
Standerton
Kroonstad
Hoopstad
Bloemhof
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Ermelo
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Vryheid
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Harrismith
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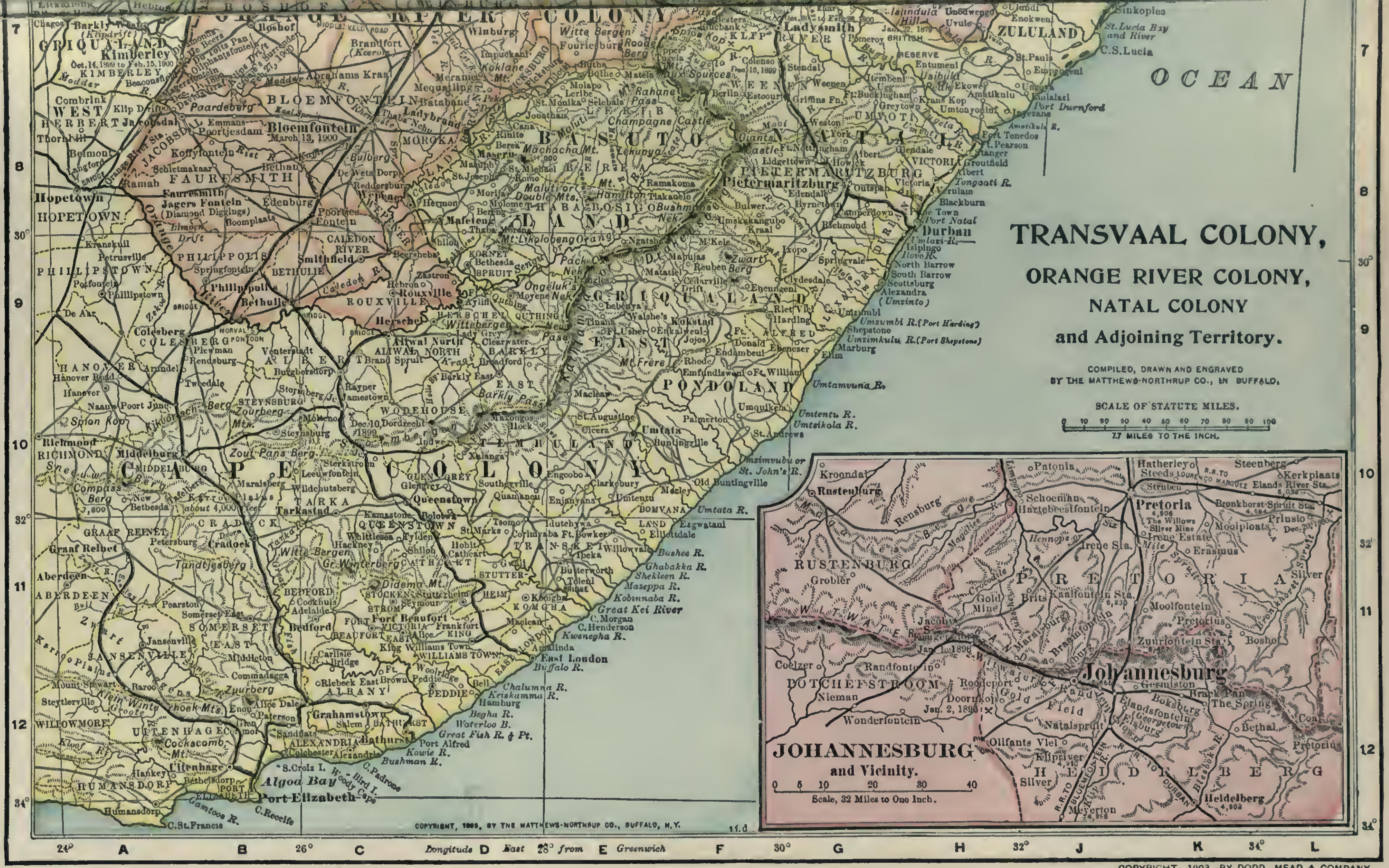

TRANSVAAL COLONY,
ORANGE RIVER COLONY,
NATAL COLONY
and Adjoining Territory.

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The colony was annexed to Great Britain September 1, 1900. Hostilities with the Boers definitively ceased in May, 1902. Certain privileges were allowed the Boer population, such as the use of Dutch in the courts and public schools where desired. Civil government was to replace the military régime as soon as practicable. The colony is administered by a Governor, Lieutenant-Governor, and an Executive Council. There are 20 districts. The capital is Pretoria (q.v.). Johannesburg, the principal city, is, however, to some extent an administrative centre. For the fiscal year 1901-02 the civil revenues and expenditures each were upward of $7,000,000. For the following fiscal year the estimated revenue increased to nearly $20,000,000, derived from customs chiefly. Mines and railways also contributed. For this last-named year the expenditures were put at $18,500,000, of which one-third was devoted to the South African constabulary, though most of this last-named amount would be recovered by the Transvaal from the Orange River Colony and the British Government. The total sum voted by the Imperial Government for the Transvaal and Orange River colonies in 1901 and 1902 was $40,000,000, including $500,000 for the South African constabulary and $4,000,000 for railways. The Boer public debt at the close of 1898 was $13,000,000, and against this was to be reckoned the value of the State lands, then not so valuable as now since gold has been found on them. The debt occasioned by the war is figured at $150,000,000. A total loan was to be floated of $175,000,000, to be guaranteed by Great Britain and based on the assets of the Transvaal and Orange River colonies. Productive public works will be undertaken. The seven banks in the Transvaal have a combined capital of £7,000,000. The weights and measures are those of Cape Colony. English currency and coins minted at Pretoria circulate. As to the military control, the colony is divided into five districts. The British commander-in-chief for all South Africa is stationed at Pretoria. There is a constabulary. A volunteer force is also to be formed for the colony.

The population in 1896 was 1,094,156, of whom 245,397 were whites and 748,759 natives. The religious population is estimated as follows: in the Dutch churches, 63,000; in other Protestant churches, 53,000; Jews, 10,000; and Roman Catholics, 5000.

History. The Transvaal was one of the two States founded by the Boers after the 'great trek,' or emigration, from Cape Colony. These Boers were descendants of the colonists who had come into South Africa under the Dutch control. They were a hardy, vigorous, bigoted race, holding the natives in slavery and hence not getting along well with their savage neighbors. The dislike of the English which naturally arose after the latter took possession of Cape Colony in 1806 culminated in 1833 when the emancipation law was passed. Some years later a considerable number of the Boers went north with their families, flocks, and household goods, and at first founded a colony in Natal. This was broken up by the British Government in 1843 (see Natal) and the Boers, going westward, founded the Orange Free State. (See Orange River Colony.) In 1848 this also was taken under British control (remaining thus, however, only for a few years), and the more irreconcilable of the Boers 'trekked' once more, across the Vaal, and founded the South African Republic, commonly known as the Transvaal. By the Sand River Convention, concluded in 1852, Great Britain recognized the independence of "the emigrant Boers living north of the Vaal River" and boundaries were duly established. The new State was for some years allowed to take its own course and the only interference with its increasing prosperity came from the struggles with the natives, between whom and the Boers there was bitter enmity. In 1877 some discontented burghers suggested to the British Government that the Transvaal should be taken under its protection. Mistaking the appeal of a faction for national sentiment, the British commissioner, Sir Theophilus Shepstone, declared the Republic British crown territory, and annexation was persisted in by the British Government, in spite of repeated appeals. In 1880 the people revolted against the British régime. On December 13th a mass meeting was held at Heidelberg and the restoration of the independent Republic was declared. A brief campaign, in which the Boers developed remarkable fighting powers, according to methods especially adapted to the country, followed this act. The Boer victories of Laing's Nek and Ingogo were followed by the battle of Majuba Hill (February 27, 1881), which resulted in the worst defeat sustained by British arms in many years. On August 8, 1881, peace was concluded by the convention of Pretoria, in which self-government was restored to the Transvaal burghers, subject to the suzerainty of the British Crown. This latter reservation gave Great Britain the right to maintain a British resident in the country and to march her armies across the territory in time of war and also the control of external relations. The convention of London, signed February 27, 1884, omitted the suzerainty clause and the Boers claimed that thereby Great Britain gave up all control over their affairs. The British Government, on the contrary, maintained that the convention of London was supplementary to that of Pretoria, and that the latter was in force except where directly contravened by the former. In the years 1881-93 several events occurred which reacted upon the relations of Great Britain and the South African Republic. The first of these was the formation in Cape Colony of the Afrikander Bund, with a platform calling for a union of European races in South Africa on a basis of South African nationality and independence. This movement increased the dislike of the British Government to the development of any strong, independent power in the neighborhood of the British South African possessions. The advance of the English into Mashonaland and Matabeleland, which the Boers had coveted and which hemmed them in, was to them an added irritation; and the climax was reached in the aggressive attitude of the British South Africa Company, which held rights of exploitation and administration in the new British territories.

The discovery of gold in the Transvaal in 1884 opened a new and troubled era. Hitherto the country had been agricultural and rural, with a homogeneous population. Now there was a sudden influx of mining men, promoters, and adventurers of all nations. In the Witwatersrand was founded the populous mining city of Johannesburg, inhabited very largely by these Uitlanders, or outlanders. The Boers felt that the primitive life they had wished to preserve was invaded, circumscribed, and likely to be overwhelmed. They therefore sought to restrict the privileges of citizenship, in order to retain the political control in their own hands. This led to constant friction and to attempts to secure British intervention. It is impossible in the limits of this article to discuss the many points of difference which brought to a head the troubles between Great Britain and the Republic. In the autumn of 1895 a plan was arranged between the leaders of the British South Africa Company —Cecil Rhodes (q.v.), his colleague, Mr. Beit, and Dr. Jameson (q.v.), administrator of Rhodesia—on the one hand, and several leaders of the Uitlanders —Lionel Phillips, Charles Leonard, and John Hays Hammond representing them—on the other, for an armed raid into the Transvaal from Rhodesia, for the purpose of bringing about by a display of force the reforms desired. Dr. Jameson made it understood finally that he should act in behalf of the British supremacy. The Johannesburg committee did not apparently intend to overthrow the Government, and when this was known sought to stay action while they issued a manifesto calling for the desired reforms. Jameson, disregarding their warning, entered the Transvaal December 29th with 600 men. He was defeated, surrounded, and obliged to surrender (January 2, 1896). The Transvaal Government turned the prisoners over to the British Government for trial. They were convicted in England and received light sentences. Four of the Johannesburg leaders were condemned to death by the Transvaal courts, but this was commuted to a heavy fine. The raid caused a great excitement and assumed international importance. It brought the agitation and the bitter feeling between the two countries to an acute stage. The controversy, concealing under diplomatic phraseology much irritation on both sides, continued for some time longer. Mr. Chamberlain, the English Colonial Secretary, seemed determined to force the position of the Republic, and President Kruger was obstinate in his refusal to yield any important point. In the autumn of 1899, when war seemed imminent, the Orange Free State decided to make common cause with the South African Republic. On October 9th an ultimatum which made peace and continued negotiation impossible was presented to the British agent at Pretoria and Mr. Chamberlain summarily closed the correspondence. For the subsequent history of the Transvaal, see SOUTH AFRICAN WAR.

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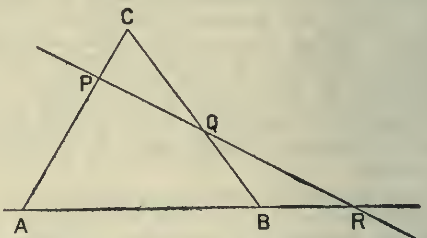
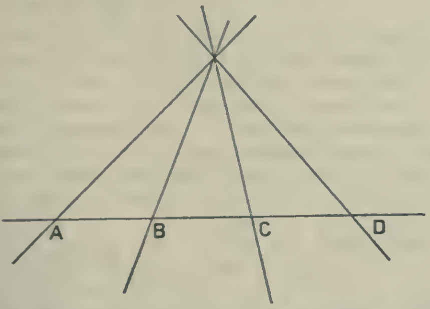
TRANSVERSAL (ML. *transversalis*, from Lat. *transversus*, *traversus*, *transverse*, p. p. of *transvertere*, to cross, transverse, from *trans*, across, through + *vertere*, to turn). In geometry, a term commonly applied to a line cutting a pencil of parallels. In modern geometry the term is extended to mean any straight line cutting the other lines of a figure. Thus any line intersecting the three lines forming a triangle ABC in P, Q, R, is a transversal of the triangle. The theory of tranversal is one of the most important in modern geometry. It has its origin in a theorem attributed to Ptolemy (q.v.), but which is found in the *Spherics* of Menelaus (q.v.), and which has been thought to go back to Hipparchus (q.v.). This states that a straight line drawn arbitrarily in the plane of a triangle determines on the lines of its sides six segments such that the product of three not having a common extremity equals the product of the other three. Pappus (q.v.) in his *Collections* approaches the theory from another standpoint and shows that if a pencil of four lines be cut by a transversal in the points A, B, C, D, the ratio $\frac{AC}{AD} = \frac{BC}{BD}$ is constant for any position of the transversal. Pappus also showed that if a transversal cuts the sides and diagonals of a complete quadrilateral, the six segments determined on this



transversal are such that the product of three not having a common extremity will equal the product of the other three; that each diagonal is cut harmonically by the other two; and that when a hexagon has three of its vertices collinear, and the other three also collinear, the intersections of the opposite sides are collinear also—a special case of Pascal's theorem on a hexagon inscribed in a conic. Desargues (q.v.) in his *Essai pour les coniques* generalized the theorem of Pappus with respect to the quadrilateral. He showed that if a transversal cuts a conic and a quadrilateral inscribed therein, the product of the segments between either point of the conic and two opposite sides of the quadrilateral will have to the product of the segments between this point and the other two opposite sides, the same ratio as between the corresponding products when the other point of the conic is taken. The theory was extended by Pascal, who was a friend of Desargues, and later by Newton, Cotes, and Maclaurin. In more recent times Carnot and Poncelet have been among the foremost to elaborate the theory. To Carnot is due the introduction of negative lines in the theory of transversals, and the treatment of the subject as related to modern geometry. See CONCURRENCE AND COLLINEARITY, Ceva's and Menelaus's theorems being important examples of the theory of transversals.



TRAN'SYLVA'NIA (Hung. *Erdély*, from *erdö*, forest, the name corresponding to the Latin, *Transilvania*, beyond the forest; Ger. *Siebenbürgen*). A former grand duchy and crownland of Austria, since 1867 an integral part of the lands of the Hungarian crown. It occupies the southeastern corner of the Hungarian Kingdom, and is bounded by Rumania on the east and south. Area, 21,518 square miles (Map: Hungary, H 3). It is inclosed on the east and south by the great range of the Carpathian Mountains, which bends round at a right angle, the part extending east and west being known as the Transylvanian Alps. The interior is crossed by numerous spurs of the border chains, and has an elevated surface. Some of the valleys are remarkably fertile. The chief river, the Maros, an affluent of the Theiss, crosses the country from northeast to southwest. The southern part is traversed by the Aluta, an affluent of the Danube, which breaks through the Transylvanian Alps in the Red Tower Pass, while the northern part is drained by the Szamos, an affluent of the Theiss. Transylvania has a number of small mountain lakes and is rich in mineral springs. The region is famous for its scenery, and the mixture of nationalities, with the various costumes, adds greatly to its picturesqueness. The climate is generally mild in the interior, especially along the rivers, while in the mountain regions the winters are long and severe. In spite of its mountainous surface, Transylvania has a very productive soil. The chief crops are wheat, barley, rye, oats, flax, tobacco, and some industrial plants. Fruits and especially grapes are cultivated extensively. Stock-breeding is favored by the abundance of meadow land, and is carried on on a large scale. The local breed of horses is superior and many are exported. Wool is an important product. The mineral products in 1900 included 2260 kilograms of gold, 2574 kilograms of silver, and nearly 1,000,000 tons of coal. The total value of the mineral output was over $7,000,000, of which salt alone amounted to over $2,000,000. Wild game still abounds in the mountains and large forests, including bears, wolves, foxes, and boars. Transylvania is well provided with transportation facilities. The population was 2,251,216 in 1890 and 2,456,838 in 1900. About 56 per cent. of the inhabitants are Wallachs (Rumans), about 33 per cent. Magyars (Hungarians) and Szeklers (close kin to the Magyars), and about 9 per cent. Germans. The Germans represent mainly descendants of colonists brought into the country from the region of the Lower Rhine by King Gejza II. of Hungary about the middle of the twelfth century. They dwell mainly in the southern part of the country, the district inhabited by them being known as Saxon Land. Their chief town is Hermannstadt. The great bulk of the inhabitants of Transylvania belong to the peasant class. The nobility and gentry are Magyars. Of the population 30 per cent. are Greek Orthodox, 28 per cent. Greek Catholic, 24 per cent. Protestant, 13 per cent. Roman Catholic, 2½ per cent. Unitarians (Transylvania having become the cradle of modern Unitarianism in the sixteenth century), and 2 per cent. Jewish.

HISTORY. The largest cities of Transylvania are Klausenburg, which possesses a university, Krandstadt, Hermannstadt, and Maros-Vásárhely. Transylvania formed part of the Roman province of Dacia. When the great migration of nations took place it was for a time occupied by Germanic peoples. They were followed by the Avars, after whom came the Petchenegs. In the eleventh century the country was brought under the sway of the Magyars. The advent of German colonists in the twelfth century improved the condition of the country. It was probably not long after this that the immigration of Wallachs set in from the region now called Rumania. Under the Hungarian kings Transylvania was ruled by voivodes. In 1526, after the battle of Mohács, in which Louis II. of Hungary was overwhelmed by Solyman the Magnificent, the national party among the Hungarians chose Zohn Zápolya, Voivode of Transylvania, King. He had a rival in Ferdinand I. of Hapsburg. Part of Hungary remained in possession of John Zápolya, who was upheld by the Turks. Transylvania was severed from the Kingdom of Hungary, the royal crown remaining in the possession of the Hapsburgs. From 1571 to 1576 the country had an able prince in Stephen Báthory, who in 1575 was elected King of Poland. Other princes of the Báthory (q.v.) family followed. At the beginning of the seventeenth century Transylvania was for a short time in the power of Austria, but in 1604 a great rising of the Protestants in the country and in Hungary took place under the head of Stephen Bocskay (q.v.), who was elected Prince of Transylvania in 1605, and in 1606 forced the Hapsburgs to recognize the liberties of the Hungarian Protestants. In the Thirty Years' War two princes of Transylvania, Bethlen Gábor (q.v.) and George Rákóczy (q.v.), figured among the champions of the Protestant cause. When Leopold I. of Austria, after the overthrow of the Turks at Vienna (1683), had made himself master of the heart of Hungary, he proceeded to secure possession of Transylvania. Prince Michael I. Apafi (q.v.) had to acknowledge the Austrian ruler as overlord of Transylvania, which was united with Hungary, and his son, Michael II., was forced to renounce his title for a money consideration. In the Peace of Karlovitz, in 1699, the Turkish Sultan recognized the sovereignty of Austria over the country. The Diploma of Leopold I., in 1691, had guaranteed to Transylvania its ancient privileges and customs. It was erected into a grand principality in 1765. In the Hungarian Revolution of 1848-49 Transylvania was the scene of terrible massacres of the Magyars by the Wallachs and of the victories and final defeat of General Bem (q.v.). In 1849 Transylvania was separated from Hungary, and made an Austrian crownland. In 1867 it was again united with Hungary.

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TRAP. A name commonly applied to dark fine-grained rocks such as diabase, basalt, and diorite, the components of which cannot be readily distinguished.

TRAPA (Neo-Lat., abbreviation of ML. *calcitrapa*, caltrop, from Lat. *calx*, heel + ML. *trappa*, snare, from OHG. *trappa*, *trapa*, AS. *træppe*, *treppe*, Eng. *trap;* so called from the four spines of some species, which thus resemble caltrops). A small genus of aquatic plants of the natural order Haloragiaceæ. *Trapa natans*, the water caltrops, is found in ditches and ponds in Southern Europe, and is grown in ponds in Holland. The floating leaves are rhomboidal, toothed, and smooth; those under water are cut into capillary segments. The fruit has four spines; the large, almond-like kernels are edible either raw or roasted, or in soups, and taste somewhat like chestnuts, hence the French name marron d'eau (water chestnut). Nuts of *Trapa bispinosa*, the Singhara nut, being starchy, are widely used as food in Cashmere, where they are made into cakes, etc. *Trapa bicornis*, by some botanists considered to be a form of *Trapa natans*, is much cultivated in China, for its edible fruit. Some botanists reduce all the species to one, with possibly several varieties.

CHINESE BUFFALO NUT (*Trapa bicornis*).

TRAPANI, trä'pä-nė. The capital of the Province of Trapani, Sicily, situated on a peninsula, on the northwest coast, 45 miles west by south of Palermo (Map: Italy, G 9). There are several fine churches with noteworthy sculptures and paintings, and palaces architecturally interesting. The lyceum has a picture gallery and a natural history collection. The special industries are connected with the working of coral, shell-cameos, marble, and alabaster. There are also ship-building yards, salt-works, fisheries, and an export trade in wine, fruits, olive oil, etc. The fine harbor, which is defended by a fort, is the scene of much commercial activity. Near the city is the ancient Annunziata pilgrimage church, with the famous statue of the Madonna of Trapani. Trapani, the ancient Drepanum and seaport of Eryx (q.v.), was fortified by the Carthaginians in the third century B.C. Here in B.C. 249 they defeated the Romans in a great naval battle. Eight years later, however, Trapani became a Roman colony. It was a royal residence in the Middle Ages. Population (commune), in 1881, 38,231; in 1901, 59,452.

TRAP-DOOR SPIDER. Any one of the large hairy tropical spiders belonging to the family Theraphosidæ, which make long tubes in the earth, lining them with silk and furnishing them at the entrance with a bevel-edged, hinged, accurately fitting trap-door made of alternate layers of earth and silk. The upper surface is covered with earth or gravel so as to completely disguise the entrance. The spider hides in the nest when not seeking its prey, and with some species a branch to the tunnel is built with a separate door.

The digging of the burrow, which is always on high sloping ground, is a very laborious task. The earth is loosened with the mandibles, and is carried away piece by piece supported by the mandibles and maxillæ. One observed by Moggridge took an hour to dig a hollow as large as half a walnut. A species common in the Southwestern United States (*Ctenitza Californica*) digs holes nearly an inch in diameter, and sometimes a foot in length. When the spider is on guard, holding the door down from inside by means of its mandibles and feet, it is impossible to raise the trap-door without tearing it. Experimenters at San Diego, California, removed the trap-doors of sixty nests, unhinging them at night. Without exception the spider had by morning completed a new door. Continued removal, however, resulted in a falling off in the quality of the successive doors owing to the failure of the spider's supply of silk. The fifth door made, by a single spider, was composed almost entirely of mud with hardly enough web to coat and hinge it. When the trap-doors were fastened down a side branch with a new door was always made over night with an opening near the original mouth.

The nests are generally built in pairs, but it is not known whether they are occupied by different sexes. The young hatch in the mother's burrow, and live there for a few weeks; then they leave the nest and begin small tubes of their own. The food of these spiders consists largely of ants and other crawling wingless insects. They have been known to eat earthworms and large caterpillars. The trap-door spiders of Southern Europe make thin covers which rest loosely on the top of the hole, but they are covered with leaves or something of the sort in order to disguise them.

Consult: Moggridge, *Harvesting Ants and Trap-Door Spiders* (London, 1873); Emmerton, *The Structure and Habits of Spiders* (Salem, 1878); McCook, *American Spiders and Their Spinning Work*, vol. iii. (Philadelphia, 1893).

TRAPEZIUM. A quadrilateral of which no two sides are parallel. See QUADRILATERAL.

TRAPEZOID (Gk. τραπεζοειδής, *trapezoeidēs*, shaped like a trapezium, from τραπέζιον, *trapezion*, trapezium, table, from τράπεζα, *trapeza*, table, from τέτρα-, *tetra-*, four + πούς, *pous*, foot + εἶδος, *eidos*, form). A quadrilateral two of whose sides are parallel. The parallel sides are called the *bases*. The area of a trapezoid is given by the formula $A = \frac{1}{2}(b + b')a$, where b and b' are the bases and a the altitude. See QUADRILATERAL.

TRAPP, JOHN (1601-69). A Puritan clergyman. He was born at Croome d'Abetot; graduated B.A. at Oxford (1622); was usher (1622-24), then headmaster of the free school at Stratford-on-Avon (1624-26); vicar of Weston-on-Avon, two miles from Stratford (1636-46); rector of Welford (1646-60); then went back to Weston, where he died. His fame rests upon his commentaries on the books of the Old and New Testaments, which furnish a specimen of Puritan Bible study at its best, and are often both witty and wise. They were issued in a collected edition in 1662 et seq., and reissued as *Commentary on the Old and New Testaments* (1865-68). Consult Spurgeon, *Commenting and Commentaries* (London, 1876).

TRAPPING (from *trap*, AS. *træppe, treppe*, OHG. *trappa, trapa*, trap, snare; connected with Ger. *Treppe*, flight of stairs, ladder, Goth. *trimpan*, MHG. *trumpfen, trampeln*, Ger. *trampeln*, Eng. *trample, tramp*). In its strict meaning, the taking of animals and birds by means other than the arrow, spear, or gun. The methods used in trapping may be divided roughly into four classes: (1) 'The pit,' 'the inclosure,' and 'the heavy deadfall,' for the largest animals, such as the bear and the lion, and 'the lighter deadfall' and 'snap trap' for smaller yet dangerous beasts such as wolves, foxes, and beavers. (2) The 'box trap,' the 'switch-up,' and various 'snap traps' and 'snares' for the lesser kinds of quadrupeds. (3) 'Nets' of various kinds with or without decoys and birdlime for birds. (4) Nets and baskets for fish.

'The pit' is a hole in the earth, lightly covered, and completely inconspicuous. It is placed where the game is likely to go voluntarily, or where it may be drawn, either by judicious beating or the employment of an enticing bait. The covering breaks through and the quarry is caught in the pit. The kind of animal so caught varies with the country; for instance, the Arabs trap lions in pits. 'The inclosure' is a space round which in Africa the heavy creeping vines from tree to tree have been woven together into rough hurdles, and in Asia the bamboo is similarly employed.

The 'heavy deadfall' is a pen about three feet wide, four feet deep, and five feet high, made of logs driven into the soil. Four heavy corner posts hold transverse logs, and the fall log. The principle of the trap is that when the bait is disturbed, say by a bear, a heavy log will fall upon the animal's back and crush its body against the lower log fixed across the front of the pen. In order to reach the bait the bear must enter the trap at least half way. A slight forward pull releases the lower end of the bait stick and causes the 'fall log' to drop. Sometimes the 'fall log' is a heavy slab set up on bait sticks. The 'box trap' is practically the deadfall, but instead of the log falling on the captive, the box lid falls down on the box's sides and end, and incloses the catch unhurt. Its advantage is that it can be placed anywhere, even in a tree. For 'the switch-up' a runway of the animal sought for is selected, and on either side of it, about six inches apart, a notched stick is driven projecting about eight inches above ground, with a cross piece resting on the notches. A spring sapling about five feet long is then driven into the ground near by and its springy head bent over the cross piece and fastened to it, after which a noose of brass wire is hung on it. The rabbit or other small animal hopping along the runway runs his head in the sliding noose, this grips his neck, and in his struggles he releases the cross piece, which lets the sapling spring back and up to its vertical position, and the captive is lifted off its feet and strangled. The steel spring trap is used universally for every kind of quadruped, from the bear to the rat. It is made of two jaws of toothed steel, which when open lie flat on the ground harmless, but when trod on or the bait in the centre of it disturbed, springs up and catches the unwary intruder in a grip from which there is no escape. Its use is avoided by the more merciful trapper, because it does not always kill, like the deadfall, and does not merely confine, like the box trap.

Fish are trapped in a variety of ways. Gill nets are spread from stake to stake across the channels or swims of the fish when they come up from the sea, like shad, into the estuaries in the spring to spawn. Their heads are caught in the mesh of the net where their fins will not go through, and from which they cannot go back. Other nets are set to catch fish migrating down from the fresh waters to the sea, like salmon and trout. Similar ones are sometimes set under the ice, near holes cut into it, toward which the fish will invariably come to breathe. Then there is the 'cast net,' a circular net with lead weights around its bottom edge, which when thrown and spread, by a twirl of the arm, into shallow water where a shoal of fish are, sinks rapidly at the full extent of the circle, and when drawn in by the caster pulls all the fish within its area up with it on to land. Baskets are set for some fish, such as eels, into which they can crawl, but out of which they cannot return. Snares, too, or snigs, as they are sometimes called, are used to capture fish in shallow water, notably pike. They are simply wire nooses at the end of a rod which the snarer quietly slips over the head of the fish and tightens with a snatch. The Chinese have an ingenious way of trapping fish. They attach a board along the side of a boat so that it descends into the water at a very slight angle. They paint this white and cover it with a shining iridescent varnish. Then, on a moonlight night, they propel the boat toward the shoal of fish, and the fish, mistaking the radiance of the board for that of the elements, swim up the shallow board, which is flush at the top with the gunwale, and over into the boat.

TRAPPISTINE. A liqueur made at the Trappist abbey of Grace-Dieu, France. See LIQUEUR.

TRAPPISTS. A branch of the Cistercian Order, following the reforms introduced in 1664 by Jean le Bouthillier de Rancé (q.v.). They take their common name from the Monastery of La Trappe in Normandy, of which Rancé was abbot when he began his reforms. They are classed among the most austere of Roman Catholic religious Orders, and their very strictness and separation from the world has brought and still brings them many members who have held distinguished positions in secular life, but wish to leave it. The day in a Trappist monastery begins with matins in the church at 2 A. M., followed by a half hour's meditation, and mass or study occupies the time until ten minutes to six. Then follows prime, and from 7.30 to 9 manual labor or instruction. At 9.45, terce, high mass, sext, and examination of conscience. Dinner is at 11, except on fast-days, when it is an hour later. The hour after it is occupied by study in winter, but a nap is conceded in summer. Work or teaching come again from 2 to 4; vespers and meditation at 5, at 6 compline, at 7 supper, and bed at 8. The dinner consists of a small quantity of soup and vegetables with a pound of bread and a little fruit and one glass of beer. The supper is of a similar nature, and those who need it are allowed a little milk, coffee, or broth on rising. The fasting season lasts from Holy Cross Day (September 14th) until Easter. The Trappist sleeps in his habit, removing only his shoes. Only the superiors have separate rooms; each of the others has simply a curtained alcove in a large dormitory. Perpetual silence is the most characteristic restriction imposed on the Trappist monk. It is absolute, unless he has the care of guests, or needs to speak to his superiors; any other necessary communications are made by signs. When sick, he is nursed in the infirmary; dying, he is carried into the church that he may receive the last rites in the presence of his brethren. The dead are buried in their habits, without coffins. Novices are received after two years' probation, and three years later may be professed. Besides the choir-brothers, who are or mean to be priests, and the lay brothers, oblates are also received—persons who for some reason do not wish to take the vows, but conform strictly to the rule during their residence in the monastery.

The earlier houses of the Order were nearly all in France; their expulsion from that country at the time of the Revolution and under the Third Republic has caused them to plant numerous monasteries in other countries. According to official statistics, in 1897 they had 3472 members, in 54 monasteries. They have one house in England, two in Ireland, two in Canada, and two in the United States—at Gethsemane, Ky., and near Dubuque, Iowa. They do not as a rule undertake the cure of souls, but conduct a few mission stations in South Africa, the Congo State, Japan, China, etc. Consult: Gaillardin, *Les Trappistes* (Paris, 1844); *La Trappe par un Trappiste de Sept-Fons* (ib., 1870); Pfannenschmidt, *Geschichte der Trappisten* (Paderborn, 1873). For the ordinary reader, the most vivid and accurate account of life in a Trappist monastery is to be found in Huysmans's *En Route* (Eng. trans. by C. Kegan Paul, London, 1896).

TRAP-ROCKS (Ger. *Trapp*, from Swed. *trapp*, trap-rock, from *trappa*, Ger. *Treppe*, stair; so called because often developed in step-like masses). A very general term, little employed in scientific language, but commonly used to designate dense and generally fine-grained igneous rocks of black or dark-green color. The term is almost synonymous with basalt (q.v.) or diabase (q.v.), but might include, as well, gabbro, norite, peridotite, pyroxenite, etc. When altered such rocks assume a green color from the hornblende, chlorite, epidote, or other secondary minerals developed in them, and they are then known as greenstone. Both greenstone and trap include a wide range of rock families, which by reason of their fine texture and altered condition are difficult to determine without careful and generally microscopic study.

TRAQUAIR, trăk'wâr, RAMSAY HEATLEY (1840—). A British naturalist, born at Rhynd, Perthshire. He graduated at Edinburgh University, and in 1873 was made keeper of natural history collections in the Edinburgh Museum of Science and Art. From 1883 till 1887, and again from 1896 till 1900, he was Swiney lecturer on geology in the British Museum. His publications include: *Structure and Affinities of the Palæoniscidæ* (Pal. Soc., 1877); *Structure and Affinities of the Platysomidæ* (*Trans. Roy. Soc. Ed.* 1879); and *Report on Fossil Fishes Collected by the Geological Survey of Scotland in the Silurian Rocks of the South of Scotland* (*Trans. Roy. Soc. Ed.* 1900).

TRASIMENO, trä'sê-mā'nô, LAGO (Lat. *Trasimenus Lacus*), or LAGO DI PERUGIA. A lake in Italy, lying between Cortona and Perugia. It is about 10 miles in length by 8 in breadth; the greatest depth is not above 30 feet. The lake has no apparent outlet, and the margins are flat and overgrown with reeds. It is surrounded on all sides by hills, those on the north side, extending from Cortona to the lake, being known as the Gualandro Hills—the *montes Cortonenses* of Livy. They are covered at the present day with oaks, vineyards, and olive plantations. The lake is memorable chiefly for the great victory obtained by Hannibal in B.C. 217 during the Second Punic War, over the Romans, under Flaminius.

TRASS. See TRACHYTE.

TRASTEVERE, träs-tā′ve-re. A district of Rome about the Janiculum, which was annexed to the city by Augustus as the *Regio Transtiberina*. In Imperial times it was the abode of street peddlers, and during the Middle Ages was frequented by foreigners. It is now almost entirely inhabited by the working classes. Many valuable antiquities have been recovered in the district, among them the Apoxyomenos (q.v.) of Lysippus.

TRAU, trou. A town of Dalmatia, Austria, on the Adriatic, 12 miles west of Spalato (Map: Austria, E 5). It is interesting for its remains of Venetian domination, including a thirteenth-century cathedral. Population of the commune, in 1900, 17,064.

TRAUBE, trou′be, LUDWIG (1818-76). A German clinician, born at Ratibor, Silesia. He studied at the universities of Breslau and Berlin. In 1849 he became assistant of Schönlein in Berlin, and for many years was connected with the Charité Hospital there. In 1857 he was made professor at the Friedrich-Wilhelm Institute, and in 1872 he became professor at the University of Berlin. Traube was especially noted for his experiments on animals for the purpose of demonstrating pathological conditions. The practice of auscultation and percussion was greatly promoted by him, and he also made important studies regarding diseases of the heart, kidneys, and lungs. He published: *Beiträge zur experimentellen Pathologie* (1846); *Ueber den Zusammenhang von Herz- und Nierenkrankheiten* (1856); *Gesammelte Beiträge zur Pathologie und Physiologie* (1871).

TRAUMATROPISM (from Gk. τραῦμα, *trauma*, wound + τροπή, *tropē*, a turning, from τρέπειν, *trepein*, to turn). The sensitiveness of plant parts to wounding, by reason of which they change their growth so as to curve away from the side wounded. This sensitiveness is especially manifested by roots; in which, however, severe wounding may produce a purely mechanical effect, overpowering the true irritable reaction, which is only manifest in response to slighter wounds. See GROWTH.

TRAUN, troun. A river of Austria. It rises on the Gross-Hochkasten in Northwestern Styria and, entering Upper Austria, traverses the Hallstättersee and the Traunsee (q.v.) and flows into the Danube a few miles below Linz. It is celebrated for its trout. Near the village of Roitham it forms a notable waterfall. Length, about 110 miles.

TRAUNSEE, troun′zā, or **GMUNDENERSEE**, gmụn′den-ẽr-zā. The largest lake of Austria after the Attersee (Map: Austria-Hungary, C 3). It lies in Upper Austria, at an altitude of 1376 feet, between Ebensee and Gmunden in the Traun Valley, and is eight miles long and 626 feet deep. It is a picturesque lake and, after the Walchensee and some of the Italian lakes, the deepest in the Eastern Alps.

TRAUTENAU, trou′te-nou. A frontier town of Bohemia, situated 74 miles northeast of Prague, on the Aupa, a tributary of the Elbe (Map: Austria, D 1). It is the centre of the linen industry of the Riesengebirge, and has in addition paper mills. Here occurred two engagements between the Prussians and Austrians, June 27 and 28, 1866. Population, in 1890, 14,777.

TRAUTWINE, trout′wīn, JOHN CRESSON (1810-83). An American civil engineer, born in Philadelphia, Pa. In 1828 he began the study of his profession in the office of William Strickland, then the principal architect and civil engineer of Philadelphia. He assisted Strickland in the construction of the United States Mint at Philadelphia, was a civil engineer on the Columbia Railway in 1831, became principal assistant engineer of the Philadelphia, Wilmington and Baltimore Railway in 1835, and an engineer of the Philadelphia and Trenton Railway in 1836. In 1836-42 he was chief engineer of the Hiawassee Railway, connecting Georgia and Tennessee. With G. M. Totten he constructed the waterway known as the Canal del Dique, between the Bay of Cartagena and the Magdalena River, and executed (1850) the surveys for the Panama Railway. Other surveys made by him include those for the Lackawanna and Lanesborough Railway (1856), and those for an interoceanic railway route across Honduras (1857). He also planned a system of docks for the city of Montreal.

TRAVAILLEURS DE LA MER, trȧ′vī′yẽr′ de lȧ mâr (Fr., Toilers of the Sea). A novel by Victor Hugo (1866), containing wonderful and sympathetic descriptions of the sea. The theme of the story is the desperate devotion of Gilliat for Deruchette, leading to his suicide.

TRAV′ANCORE′. A native State of British India, lying territorially within the Province of Madras (Map: India, C 7). It occupies the western part of the extreme southern end of the Indian peninsula, and stretches from Cape Comorin northward along the coast to Cochin. Area, 7091 square miles. The coast, which is low and sandy, is lined with lagoons receiving numerous small streams. The land rises gradually to the crest of the Anamalay Mountains, which extend along the eastern boundary with an average altitude of 4000 to 5000 feet, rising in their highest peaks to over 8500 feet. The climate is hot on the coast; the rainfall is heavy, and the mountain slopes are covered with forests of valuable woods, such as teak and ivory.

Rice, the sago palm, and vegetables are among the principal products. Pepper, coffee, tea, cocoanut products, and timber are the chief articles exported. Travancore is one of the most progressive of the native States of India. Its chiefs for a long period have been highly qualified by character and education for their positions, government has been well administered, and a higher degree of prosperity has prevailed than has been common in India. The chieftaincy descends in the female line. The ruling family belongs to the Hindu race. A tribute of 810,162 rupees is paid annually to the British in consideration of the protection which they afford. In 1897-98, 64 per cent. of the boys and 19 per cent. of the girls of school age were in attendance at schools. The total population increased from 2,557,736 in 1891 to 2,951,038 in 1901. The large majority of the population, 2,035,615, were Hindus. There were 190,566 Mohammedans and 28,183 Animistics. In few regions of India has Christianity secured so great a hold, the Christians numbering, in 1901, 697,387. Trivandrum (q.v.) is the capital.

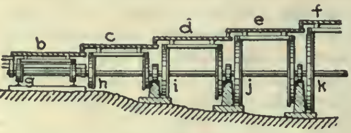
TRAVELER, The. A poem by Oliver Goldsmith (1764), containing many familiar lines and descriptions of various countries.

TRAVELERS, Law as to. See Highway; Ticket; Carrier, Common.

TRAVELER'S JOY. See Clematis.

TRAVELER'S TREE, or Ravenala (*Ravenala Madagascariensis*). A remarkable plant of the natural order Musaceæ, a native of Madagascar, where it forms a characteristic feature of the scenery. The stem resembles that of the plantain, but sends out leaves only on two opposite sides, like a huge expanded fan. The lower leaves drop off as the stem grows, and in old trees they are sometimes 30 feet from the ground. A tree often has 20 or 24 leaves, the stalk of each leaf being 6 or 8 feet long, and the blade 4 or 6 feet more. The blade of the leaf is oblong, bright green and shining. The fruit is not succulent, but is filled with a brilliant blue or purple fine silky fibre, among which are about 30 or 40 seeds. Forty or fifty fruits grow in a bunch, and three or four bunches may be seen at once on the tree. The leaves are much used for thatch, and for many other purposes, and the leafstalks for the partitions, and often even for the walls of houses. The bases of the leafstalks usually hold water, even in the driest weather, more than a quart being readily obtained by piercing the thick part of the base. This water, which may be used for drinking in case of need, has suggested the name.

TRAVELING SIDEWALK. An arrangement for the transportation of passengers, consisting essentially of a series of parallel closely abutting platforms traveling on wheels or rollers at different speeds. A sidewalk of this character was installed at the Columbian Exposition at Chicago to convey passengers from one part of the grounds to another, and similar structures have been employed elsewhere. The principle of operation of the traveling sidewalk may be readily understood by an explanation of the accompanying diagram. In this diagram *a*, *b*, *c*, *d*, *e*, and *f* are the parallel platforms. The platform *a* is stationary, but the others all travel by means of flexible rails riding on the rims of the wheels *g*, *h*, *i*, *j*, and *k*. These wheels rotate on a common shaft at the same number of rotations per minute, but, being of different characters, they carry the superimposed platforms at different speeds; thus platform *b* has, say, a speed of 3 miles per hour, *c* a speed of 6 miles, *d* a speed of 9 miles, *e* a speed of 12 miles, and *f* a speed of 15 miles. The platforms travel continuously, and a foot passenger desiring to use them steps from the stationary platform *a* onto the moving platform *b* and then onto *c*, *d*, *e*, and *f* in succession; the return to the stationary platform is made in a similar manner, but, of course, in the reverse direction. By having the difference between the speeds of any two adjacent platforms no greater than the speed of a brisk walk the transition from one speed of travel to the next higher or lower is accomplished without difficulty, and the pedestrian can board and leave the moving platforms at any point he may choose. A traveling stairway is a similar arrangement placed on an incline, but supplied with but one moving platform. They have been used for ascending to elevated railway platforms and in large shops.



SECTION OF TRAVELING SIDEWALK.

TRAVEMÜNDE, trä′ve-mụn-de. A town of Germany, the outport of Lübeck, lying nine miles northeast of that city at the mouth of the Trave (Map: Germany, D 2). It is a well-known watering place. The old walls of the town were torn down in 1882. Population, in 1900, 1849.

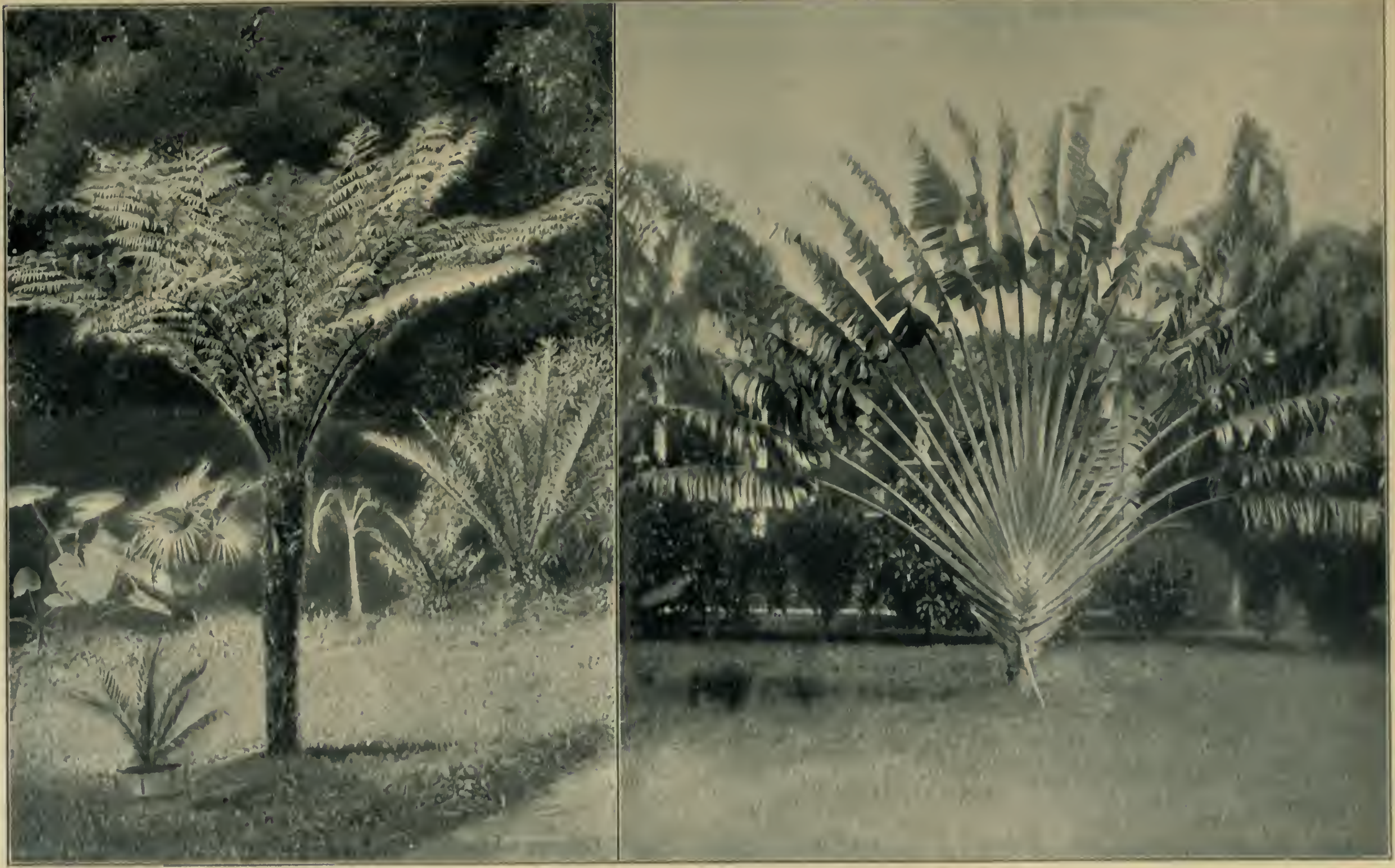
TRAV'ERS, John (c.1707-58). An English musician and composer, born in London. He was a chorister in Saint George's Chapel, Windsor, and served in a like capacity at Eton College as occasion demanded. Owing to the good offices of Dr. Godolphin, the provost of Eton, he was later enabled to continue his studies in music under Dr. Green, the organist of Saint Paul's. His first appointment was as organist of Saint Paul's and conjointly with that of Fulham Parish Church (c.1725). In 1737 he became organist of the Chapel Royal, which appointment he held until his death. His service in F and such anthems of his as "Keep, We Beseech Thee," and "Ascribe Unto the Lord" are still included in the repertoire of English church music. His canzonets, 18 in number, the words of which were from the posthumous writings of Matthew Prior, bear evidence of a grace of melody which even to-day commands admiration, old-fashioned as they are in general construction. He was also the author of the celebrated *Whole Book of Psalms, for one, two, three, four, and five voices, with a thorough bass for the harpsichord.*

TRAVERSE. In common-law pleading, a denial of facts alleged in a pleading. See Pleading.

TRAVERSE (OF., Fr. *travers*, from Lat. *traversus*, *transversus*, lying across, transverse, p. p. of *transvertere*, to turn across, from *trans*, across, through + *vertere*, to turn). A term in fortification, describing a cover or mask, constructed of earth in the same manner as the parapet of a redoubt. It is constructed in the interior of a redoubt, and is designed to protect the defenders from enfilade fire. In gunnery (q.v.) it describes the moving or pointing of a gun on its pivot, when taking aim, the gear by which the operation is accomplished being known as the traversing gear. The platforms by which heavy naval or fortress guns and carriages are moved into position, or by which their direction is changed, are called *traversing platforms.* See Fortification.

TRAV'ERSE CITY. The county-seat of Grand Traverse County, Mich., 60 miles northeast of Manistee; at the mouth of the Boardman River, on Grand Traverse Bay, an inlet of Lake Michigan; and on the Pere Marquette, the Grand Rapids and Indiana, and the Manistee and Northeastern railroads (Map: Michigan, H 4). It possesses an attractive situation and good fishing

TREE FERN AND TRAVELER'S TREE



TREE FERN

TRAVELER'S TREE

facilities, and enjoys considerable reputation as a summer resort. The Northern Michigan Insane Asylum is here. Traverse City is extensively engaged in manufacturing. It is known for its production of oval wood dishes and corn starch. Other important manufactures include baskets, lumber, interior finishings, farm implements, flour, leather, fur coats and robes, foundry and machine-shop products, etc. The government is vested in a mayor, chosen annually, and a unicameral council. The water-works are owned and operated by the municipality. Traverse City was settled about 1850 and was chartered as a city in 1895. Population, in 1890, 4833; in 1900, 9407.

TRAVERTINE (from It. *travertino*, *tiburtino*, from Lat. *tiburtinus*, travertine, relating to Tibur, from *Tibur*, an ancient town of Latium, now called Tivoli). A massive or crypto-crystalline variety of limestone that is deposited from springs or rivers, and usually has an irregularly banded structure owing to its mode of formation. A variety known as *calc tufa* consists of cellular depositions from the waters of small springs, and often contains fossil leaves, twigs, etc.

TRAVESTY (OF. *travesti*, p. p. of *travester*, to disguise, from Lat. *trans*, across, through + *vestire*, to clothe, from *vestis*, garment). A term applied in literature to denote a burlesque representation of something previously executed in a serious and lofty manner. It differs from parody (q.v.) in this respect: that while the latter changes the subject matter and the *dramatis personæ*, but mockingly imitates the style of the original, the former leaves the subject matter partially, and the *dramatis personæ* wholly, unaltered; producing a purely comic effect by the substitution of the mean, the frivolous, and the grotesque in action or speech, for the serious, the noble, or the heroic. See PARODY.

TRAV'IS, WILLIAM BARRETT (1811-36). An American soldier, born in Edgefield County, S. C. After studying law he began practice at Claiborne, Ala., about 1830. He removed to Texas, then beginning the struggle for independence, in 1832, and at once took part in the insurrection. He was made a colonel in the revolutionary army, and was captured by the Mexican forces, but was finally released. With about 150 men he defended the Alamo (q.v.) from February 23 to March 6, 1836, against General Santa Anna (q.v.) and about 5,000 Mexicans, and was killed just before the stronghold was taken.

TRAWLING (from *trawl*, from OF. *trauler*, *troller*, *troler*, Fr. *trôler*, to ramble, stroll, drag about; probably from MHG., Ger. *trollen*, to roll, run, and connected with Welsh *troell*, wheel, pulley, Bret. *trôel*, winding plant, *trô*, circle). One of two modes of deep-sea fishing, or of exploration of the depths. In Europe a 'trawl' or 'beam-trawl' is a triangular purse-shaped net, about 70 feet long, usually having a breadth of about 40 feet at the mouth. The upper part of the mouth is secured to a wooden beam which keeps the net open; this beam is supported on two upright iron frames, known as 'trawl-heads' or 'irons.' The under side of the net is made with a deeply curved margin attached to the 'ground-rope,' the whole length of it in contact with the ground. A trawl has also generally two pockets, one on each side, made by lacing together the upper and under parts, so that fish turning back from the cod may be caught in them. The meshes vary in size from four inches square at the mouth to an inch and a quarter square in the 'cod,' or narrow hinder end of the net. Two stout ropes about 15 fathoms long are fastened to the trawl-heads, and form a bridle, to which is shackled a towing-line 150 fathoms long. Trawling is generally in the direction of the tide, and can be followed with advantage only on a sandy bottom or other smooth ground. The vessels employed in trawling on the Dogger bank and elsewhere near the English coast vary in size from 35 to 60 tons. Many of these trawlers, however, stay out at sea for six weeks at a time in all seasons of the year, their fish being packed in ice, collected by fast-sailing cutters, and so conveyed to market. Cod, haddock, and similar fish are caught in great numbers by trawling; and some kinds of flat fish, as soles, are scarcely to be obtained by any other means. Smaller trawl-nets than those above described are used in bays and estuaries.

In the United States a 'trawl' is a long line anchored on the fishing ground, from which depends a row of short lines carrying baited hooks. The device is principally used on the fishing-banks. See DEEP-SEA EXPLORATION; FISHERIES.

TREACLE BIBLE. See BIBLE, CURIOUS EDITIONS OF.

TREACLE MUSTARD. See ERYSIMUM.

TREADMILL. A machine where the weight of men or animals acting on a series of treads or steps is employed to furnish power. The treads are so arranged on a cylinder or in an endless band that as a step is carried back under the weight of the operating man or animal, the latter is forced to move forward to the next in order to keep his footing. The most general application of this machine has been to farming machinery, where horses and dogs are used to supply the motive power. Such machines are employed for cutting hay or stalks, grinding and threshing grain, sawing wood, and in the case of the smaller machines for churning and similar light work. The endless band formed by the treads is inclined and is connected with a fly-wheel, to which the machinery to be operated is connected by belting. The term treadmill is most generally applied, however, to a device for carrying out a sentence of a prisoner to hard labor, which was formerly in general use in prisons in Great Britain. It consists of a wheel in the form of a long, hollow cylinder, with steps around its circumference and a hand rail above the wheel, so that a prisoner may support himself while treading the steps and thus working the wheel. The proper resistance may be created by means of weights, or the motive power thus created may be utilized to grind grain, etc. The physical exercise is severe, and the use of this form of prison discipline has been generally abolished. The *crank*, a small wheel with paddles, which revolves in a box partially filled with sand or gravel, has been generally substituted where unproductive hard labor is necessary. The number of revolutions of both a treadwheel and a crank may be recorded by a dial, and a prisoner's labor thus regulated according to his physical condition. Neither device is in use in the United States.

TREAD′WELL, Daniel (1791-1872). An American inventor, born at Ipswich, Mass. Among his more important inventions are a power printing press; a system of turnouts for single-track railroads (1826); the Gypsey, a hemp-spinning machine for the manufacture of cordage (1829); and a method of constructing cannon from wrought iron and steel. Of these, the spinning machine was probably the most successful. In 1822, in conjunction with Dr. John Ware, he founded the *Boston Journal of Philosophy and the Arts;* and from 1834 to 1845 he occupied the chair of Rumford professor at Harvard. Consult *Memoirs of the American Academy of Arts and Sciences,* vol. xi. (Cambridge, 1888).

TREASON (OF. *traison, traisson, trahison,* Fr. *trahison,* treason; from Lat. *traditio,* surrender, delivery, tradition, from *tradere,* to deliver over, betray, from *trans,* across, over + *-dere,* Gk. τιθέναι, *tithenai,* Skt. *dhā,* to put, place). At common law there were two distinct classes of crime known as treason, termed respectively *high treason* and *petit treason.* The first was disloyalty to the sovereign or a violation of the allegiance due to him. The second was a violation of the allegiance due from an inferior to a superior, by taking the life of the superior, as of a wife to her husband, a servant to his master, or an ecclesiastic to his superior. Petit treason is now everywhere punished only as a homicide. High treason, being in effect treachery against the sovereign, was the highest crime which a subject could commit. By the ancient common law, however, the crime was not clearly defined; hence there was great latitude as to what was held by the judges to be treason, whereby, says Blackstone, "the creatures of tyrannical princes had opportunity to create abundance of constructive treasons, that is, to raise, by forced and arbitrary constructions, offenses into the crime and punishment of treason, which never were suspected to be such." Thus, the accroaching, or attempting to exercise, royal power (a very uncertain charge) has been treated as treason; and killing the King's father or brother, or even his messenger, has also been so treated. The inconvenience of these constructive treasons led to the passing of the statute of 25 Ed. III., c. 2, which attempted to define treason; and it was defined in five forms: (1) When a man compasses or imagines the death of the King, Queen, or their eldest son and heir. Under this clause it was held that the husband of a queen-regnant was not included; but it includes a king *de facto* without regard to his title. The phrase "compassing and imagining the death of a king" has been held to mean the mere purpose or design, as distinguished from the carrying such design into effect; nevertheless, the purpose can only be proved by some overt act, such as providing weapons or ammunition for the purpose of killing the King, or assembling and consulting on the means to kill the King, although such acts might fall short of the legal definition of an attempt. The law has often, however, been strained, and in those arbitrary times even a sermon unpreached was held to convict Peacham; and a paper found in a closet, to convict Algernon Sidney (1683), though merely speculative in its character. (2) Another form of treason was the violating of the King's companion (i.e. wife), or his eldest daughter unmarried, or the wife of the King's eldest son and heir. (3) Another form was that of levying war against the King in his realm either by taking arms to dethrone the King, or under pretense to reform religion or the laws; by resisting the King's forces; or by joining an insurrection. (4) It was also treason to adhere to the King's enemies in the realm by giving them aid and comfort, as by sending intelligence or provisions or selling arms to them. (5) Lastly, it was treason to slap the Chancellor, Treasurer, or the King's justices of the bench, or in assize, while in their places administering justice. Besides these specific forms of treason, the statute of Edward III. enacted that, if there should be other cases not above specified, the judge should tarry without going to judgment, till the King and Parliament should judge it treason or other felony—which was a safeguard against the judges indulging too much in refinements about constructive treason. At a later period, between the reigns of Henry IV. and Mary, the courts, nevertheless, returned to the practice of inventing constructive treasons, and included as such the clipping of money, burning houses to extort money, refusing to abjure the Pope, etc. These and other newly invented treasons were totally abolished by a statute of 1 Ed. VI., c. 12, but many of like nature were established under Elizabeth. A subsequent statute of 1 Anne, c. 17, provided that whoever endeavors to hinder the next in succession under the Act of Settlement from succeeding to the crown is to be held guilty of treason; and whoever maliciously affirms another to have right to the crown, otherwise than according to the Act of Settlement, commits treason. Moreover, by 36 George III., c. 7, whoever compasses or intends death or bodily harm to the person of the King is to be adjudged a traitor. The act of 25 Ed. III., c. 2, was confirmed and made perpetual by 57 Geo. III., c. 6, which with the other statutes referred to embody the English statutory law upon the subject. There have been numerous statutes making certain specific acts treason, but most of these were repealed shortly after their enactment. All acting and abetting in the commission of treason are principals, there being no accessories in the crime of treason. See Principal; Accessory.

A copy of an indictment for treason and a list of the witnesses and jurors, together with the addresses of the latter, must be delivered to the prisoner ten days before the trial; and he is entitled to have counsel assigned to defend him. This right, which prisoners accused of other crimes have not in English law, was conferred by a statute of Will. III.

The punishment for treason was the most severe and revolting of the harsh punishments imposed by the common law. The traitor was to be drawn on a hurdle to the place of execution, hanged by the neck, his head then severed from the body, the body divided into four quarters, and the head and quarters to be at the disposal of the Crown. But in 1870 these barbarities were abolished, and the penalty is now changed to execution by hanging. The consequence of a conviction of treason was also forfeiture (q.v.) and corruption of blood, the corruption of blood having the effect that the attainted person could neither inherit lands from his ancestors nor transmit them to any heir. But this was altered as regards England and Ireland in 1870 by the statute 33 and 34 Vict., c. 23. The convict suffers forfeiture and is disqualified for any public office; the court may order him to pay the costs of his conviction, and his whole property is transferred to administrators named by the Crown, who administer it and retransfer the surplus to his heirs and representatives.

There are certain minor offenses which are called misprision of treason, being those closely bordering on treason. (See Misprision.) Such are offenses which consist in the bare knowledge and concealment of treason, without any degree of assent thereto, for any assent makes the party a principal traitor. The punishment of misprision of treason was loss of goods and lands during life.

In the United States treason may be either against an individual State or against the United States. In the former case it may be an offense at common law, although the Constitution or statutes of most of the States define the crime and provide a punishment. Most of these provisions, however, are modeled after the provisions of the United States Constitution defining treason. The Constitution of the United States (Art. 3, sec. 3) provides that treason against the United States shall "consist only in levying war against them, or in adhering to or giving aid and comfort to their enemies." It is further provided that no person shall be convicted of treason unless on the testimony of two witnesses to the overt act or upon confession in open court. The penalty is death or imprisonment and fine at the discretion of the court. Levying war within the meaning of this provision must be a defiance of public government by armed force, and must amount to more than a mere riot or an interference with the execution of the laws for some private purpose. The acts of the defendant must also proceed beyond mere preparation, as by enlistment of men for military service. They must meet or be assembled for a treasonable purpose and some act done toward executing with force their purposes. Thus an assembly of men arrayed in a military manner for the purpose of overawing the public and finally assailing the Government is levying war upon the Government, although no actual blow is struck. Adhering to or giving aid and comfort to the enemies of the United States means more than mere sympathy with enemies of the Government; it must be the voluntary giving of actual assistance to those who are waging war against the United States.

Most of the State Constitutions contain provisions similar to the clause of the United States Constitution, defining treason against the State and providing a punishment. Generally they provide that treason against a State may be committed by armed opposition to its laws or by forcibly attempting to overthrow or usurp the Government. In practice, the common law of crime and the statute law of crime in the several States have been found adequate to punish crime of a treasonable nature without resorting to prosecution for treason, and there have been few prosecutions for the specific offense of treason against a State. See Attainder; cf. Præmunire.

TREASURE ISLAND. A romance of adventure by Robert Louis Stevenson (1883). Though intended for boys, it first attracted the attention of the general public to his work.

TREASURER, Lord High. Formerly, the third great officer of the Crown in England, who was sole head of the King's exchequer. The office was originally held by one person, but in 1612 James I. put it in commission; and from the accession of George I. (1714) down to the present time, it has been the practice to vest the office in a board of Lords Commissioners of the Treasury.

TREASURE-TROVE (*treasure*, from OF. *tresor*, Fr. *trésor*, It., Sp. *tesoro*, from Lat. *thesaurus*, from Gk. *θησαυρός*, treasure, treasure-chest, storehouse, from *τιθέναι*, *tithenai*, to put, place + *trove*, from OF. *trover*, *trouver*, Fr. *trouver*, to find). In the common law of England, hidden treasure of gold, silver, and bullion accidentally found in the earth, the owner of which cannot be ascertained. Treasure-trove belongs to the Crown, and in certain districts the right to claim it has been granted to the nobility. In order to come within this rule, the treasure must be concealed, as distinguished from that which is casually lost and remains on the surface, as to which a different rule applies. A finder of treasure-trove is bound by law to give notice of his discovery to the proper officials of the Crown, and his failure to do so may subject him to fine and imprisonment. However, the present policy of the English Government is to allow a finder to keep treasure thus discovered, less a small percentage of its value to be paid to the Crown, unless it is of some value as an object of historical or antiquarian interest, in which cases it is claimed by the Crown in order to be preserved in the national museums. By the Treasure-Trove Act of India the finder may keep it if no owner is found, in which case the latter is entitled to three-quarters and the finder to one-quarter of its value.

Although there are some *dicta* to the effect that the common law as to treasure-trove applies in the United States, the right is seldom, if ever, enforced, if it exists. See Finding.

TREASURY, Department of the. The executive department of the Government of the United States controlling the national finances. It was established by act of Congress in September, 1789, and was the successor of the Treasury Department created by the Congress of the Confederation in 1781, of which Robert Morris was for a time superintendent. It is the most extensive and complex of the executive departments and in rank stands next to the Department of State. It is presided over by a Secretary appointed by the President, who is a member of the Cabinet (salary, $8000), and second among the Cabinet officers in the line of succession to the Presidency. The department as originally established consisted of a Secretary, a Comptroller, an Auditor, a Treasurer, a Register, and an Assistant Secretary, together with a few clerks. From this small beginning the department has grown to be a vast establishment employing some 5000 persons at Washington with numerous bureaus, branches, and offices throughout the country. The only qualification for the office of Secretary of the Treasury is the negative one that he shall not be interested in foreign commerce. He is required to digest and prepare plans for the revenue and public credit; to prescribe the forms for keeping the public accounts; to superintend the collection of the revenues; to grant all warrants under certain limitations for moneys issued from the Treasury in pursuance of appropriations made by law; and, in general, to perform all such duties relative to the finances of the United States as shall be required by law. Simultaneously with the development of the country the duties of the department have been extended to the management of the national debt, the supervision of the national banks, the internal revenue system, the legal-tender currency, the merchant marine, the lighthouse system, the life-saving and marine hospital services, the Coast Survey, etc. The Secretary is aided by three Assistant Secretaries. The business of the department is distributed among the following offices and bureaus: the Comptroller of the Treasury, six Auditors, the Treasurer, the Register, the Comptroller of the Currency, the Commissioner of Internal Revenue, the Mint, the Bureau of Engraving and Printing, and the Marine Hospital Service.

The Comptroller of the Treasury, since 1894, has been aided by an Assistant Comptroller. He exercises a kind of supervisory power over the auditors, countersigns warrants drawn by the Secretary of the Treasury, etc. The original act creating the Treasury Department provided for a single Auditor; four additional Auditors were provided in 1817, and a sixth was added in 1836. The six Auditors are assigned to the Treasury, War, Interior, Navy, Post-office, and State and other departments respectively, with the duty of examining accounts. The Treasurer is charged with the duty of signing the paper currency and of receiving and keeping the moneys of the United States and with disbursing the same on warrants properly drawn and countersigned. There are Assistant Treasurers at New York, Boston, Saint Louis, Philadelphia, New Orleans, Baltimore, Cincinnati, Chicago, and San Francisco. The Register signs all stocks and bonds and all Treasury notes and coin certificates issued under the authority of the United States. The Comptroller of the Currency enforces the provisions of the national banking laws and superintends the issue of banknote currency. At the head of the Bureau of Internal Revenue is a commissioner who is charged with the enforcement of the internal revenue laws and the collection of the internal revenues. He is aided by a collector in each revenue district. For the collection of the customs there is a collector in each district, a surveyor in the larger parts, and a general board of appraisers to hear appeals against decisions of the collectors with regard to the dutiability of imported goods. The Director of the Mint has the supervision of all mints and assay offices throughout the country and makes annual reports to Congress on the coinage of the country, the yield of precious metals, etc. The Bureau of Engraving, established in 1874, has charge of the preparation of designs, stamps, bank notes, bonds, Treasury drafts, and other securities of the United States. The Solicitor of the Treasury has charge of all legal measures to prevent the evasion of the revenue laws and the counterfeiting of the coin and other securities of the United States.

TREASURY NOTE. A certificate of credit issued by the Treasury Department on the authority of the Government and made receivable for government dues. In the United States, treasury notes bearing interest were issued at different times before the Civil War, but it was during that struggle that the financial necessities of the Government first led to the issue of very great quantities of non-interest bearing treasury notes, which, however, were made legal tender for all public and private debts except duties upon imports and interest on the public debt. See MONEY.

TREAT, ROBERT (1622-1710). A Colonial Governor of Connecticut, born in England. He emigrated to America with his father, and settled in Wethersfield, Conn. In 1639 he settled in Milford, from 1653 to 1659 was a deputy, and from 1659 to 1664 was an assistant. He opposed the union of the Connecticut River and New Haven settlements, and went with the dissatisfied faction which founded Newark, N. J. In 1672 he returned to Milford, and later distinguished himself in King Philip's War. In 1676 he was chosen Deputy Governor of Connecticut, and in 1683 was elected Governor, and with the exception of the two years in which the colony was under Sir Edmund Andros (1687-89), served until 1698. From the latter year to 1708 he was again Deputy Governor.

TREATIES, INDIAN. The first step of the United States Government in determining its policy in regard to the Indians, whether expressed or implied, was to decide as to the nature of their territorial rights, this being the chief and altogether the most important factor in their relations with the whites. The decision reached on this point is distinctly stated by the United States Supreme Court in the case of Johnson and Graham's lessee *v.* McIntosh (8 Wheaton, 453 et seq.), as follows: "It has never been contended that the Indian title amounted to nothing. Their right of possession has never been questioned. The claim of the Government extends to the complete, ultimate title, charged with the right of possession, and to the exclusive power of acquiring this right." The next step was to determine the branch of the Government to carry out this policy. By the ninth of the Articles of Confederation it was declared that "the United States in Congress assembled have the sole and exclusive right and power of regulating the trade, and managing all affairs with the Indians not members of any of the States."

It is evident, therefore, that while acting under the Articles of Confederation the right of managing and controlling the relations with the Indians resided in Congress alone. When the Constitution was framed this authority was conferred upon the legislative department in the following brief statement: "To *regulate commerce* with foreign nations and among the several States, and with the *Indian tribes.*"

It is apparent, from the use of the term 'tribes,' that the framers of the Constitution had in contemplation the method of dealing with the Indians as tribes through treaties. This is clearly shown by the act of March 1, 1793, in which it is stated that no purchase or grant of lands from the Indians shall be of any validity "unless the same be made by a treaty or convention entered into pursuant to the Constitution." This action of Congress necessarily placed the initiatory steps in dealing with the Indians under the jurisdiction of the President as the treaty-making power, subject to confirmation by the Senate.

The colonies and also the mother country had treated with the Indians as 'nations,' their chiefs or sachems often being designated as 'kings'—and this idea, being retained by the founders of our Government, was ingrafted into their policy. It must also be remembered that the colonies then were weak, and that the Indian tribes were comparatively strong and capable of requiring recognition of equality. Notwithstanding the evident anomaly of such a course, the growth in numbers and strength of the whites, and the diminishing power of the natives, this implied equality was recognized in the dealings between the two until the act of March 3, 1871. During all this time Indian titles to lands were extinguished only under the treaty-making clause of the Constitution; and these treaties, though the tribe may have been reduced to a small band, were usually clothed in the same stately verbiage as the most important treaty with a great European power.

It was ordered by this act of March 3, 1871, that "No Indian nation or tribe within the territory of the United States shall be acknowledged or recognized as an independent nation, tribe, or power with whom the United States may contract by treaty," thus terminating a legal fiction which had been kept up for nearly a hundred years. It appears from the annual report of the Commissioner of Indian Affairs for 1890, that the Indian title to all the public domain had been extinguished except in Alaska, in the portions included in 162 reservations, and those acquired by the Indians through purchase. As the title to reservations is derived in most cases from the United States, and title by purchase is derived directly or indirectly from the same source, it may be stated that the Indian title to all the public domain, except in Alaska, had practically been extinguished by the year 1890. It would seem, in fact, that the United States Government proceeded on the theory that *all* the lands within its bounds were held by the natives, and hence that their possessory right must be extinguished. The only known variation from this rule was in the case of the Uintah Utes, where an omitted portion of their claimed territory was taken possession of without agreement. From the formation of the Government up to March 3, 1871, 653 treaties were made with 97 different tribes or recognized tribal organizations.

A natural corollary of land cessions by the Indians to the United States Government was the establishment of reservations for these natives either within the limits of the original territory or elsewhere. These reservations, which up to March 3, 1870, were usually determined by treaty or agreement, were the restricted areas to which the Indians were confined in order to bring them more directly under the control and care of the Government, and to lessen the liability of conflict with the whites and warring between the tribes. It was hoped also that by thus curbing the wandering habit these reservations might become, by the fostering hand of the Government, the first step toward civilization. This policy, which has been also followed in Canada under both French and English control, was inaugurated by the Government as early as 1786, and continued as an established policy to the present day. The earliest reservations were chiefly formed as the direct result of the cession of lands by the tribes, thus restricting their limits, but expressly stating in the treaty defining the bounds that the portion so limited was 'allotted to' or 'reserved for' the given Indians. Up to 1890 162 of these reservations had been established. The method of establishing reservations has not been uniform, some being by treaty, some by executive order, and others by act of Congress. Those established by executive order, independent of the act of Congress, were not held to be permanent before the General Allotment Act of 1887, under which the tenure has been materially changed, and all reservations, whether by executive order, act of Congress, or treaty, are held permanent. Reservations by executive order under authority of an act of Congress are those which have been authorized or established by acts of Congress and their limits defined by executive order, or have been first established by executive order and subsequently confirmed by Congress.

Other respects in which the power of Congress intervenes in reference to Indian lands, or is necessary to enable the Indians to carry out their desires in regard thereto, are the following:

(1) Allotments of land in severalty previous to the act of February 8, 1887, could be made only by treaty or by virtue of an act of Congress, but by this act general authority is given to the President for this purpose.

(2) Leases of land, sale of standing timber, granting of mining privileges and right of way to railroads are all prohibited to the Indians without some enabling act of Congress. On the other hand, it is obligatory on the Government to prevent any intrusion, trespass, or settlement on the lands of any tribe of Indians except where their consent has been given by agreement.

TREATY (OF. *traite, traicte*, Fr. *traité*, It. *trattato*, treaty, from ML. *tractatus*, treaty, agreement, from Lat. *tractare*, to treat, manage, frequentative of *trahere*, to draw, drag). A compact or agreement entered into between the governments or sovereigns of two or more States. A treaty is somewhat analogous to a contract in private law, the main differences being in the origin, purpose, and manner of enforcement. Thus a treaty is concluded with more formality than a private contract, its purposes are usually of a public character, while its enforcement rests chiefly upon the good faith of the contracting parties. The right of entering into treaty relations is one of the essential attributes of sovereignty, and is therefore not usually permitted to so-called dependent States except under certain restrictions, nor to the component members of States having the federal system of government. So-called dependent States frequently retain the right of making commercial and extradition treaties, postal and customs conventions, and sometimes treaties of alliance and of naturalization. Component members of confederate States usually retain a considerable degree of treaty-making power, as, for example, the members of the German Bund of 1815-66 or the States of Argentina (q.v.). Under the present German Empire the individual States enjoy the power to make treaties only with their immediate foreign neighbors, and only concerning postal and telegraph communication across the boundary between them. The Commonwealths of the United States are expressly forbidden to enter into treaty relations with foreign States or to make agreements among themselves except with the consent of Congress. The treaty-making power of a country is determined by its Constitution. In the United States it is vested in the President, acting by and with the advice and consent of the Senate, two-thirds of the members concurring. The President exercises this power through the Department of State or through special plenipotentiaries appointed for the purpose. In monarchical countries the treaty-making power is usually a prerogative of the Crown, but an indirect influence is frequently exercised by the legislature, especially when an appropriation of money is necessary to carry into effect the stipulations of the treaty. In the German Empire treaties which relate to any subject already regulated by Imperial law require the approval of the legislature. In the French Republic the President is empowered to negotiate treaties; but if the treaty is one of peace or commerce, or involves the finances or the territory of the State, or relates to the personal or property rights of Frenchmen in foreign States, the approval of the two Chambers is necessary. With the few exceptions of this kind, the negotiations and ratification of treaties in the European States are in the same hands, but they are distinct and separate steps, and ratification may be withheld after the treaty has been negotiated. Everywhere formal ratification is essential to the validity of a treaty.

In the United States, where the negotiating and ratifying authorities are in different hands, the question of ratification assumes a double importance, for it by no means follows that ratification is a matter of course. In several notable instances treaties negotiated by the President have been rejected by the Senate. Foreign governments, therefore, negotiating with the President of the United States are presumed to know that negotiation is only the initial stage in the procedure. The Senate has, moreover, claimed the right, and has exercised it in several instances, of ratifying only a part of a treaty instead of sending it back as a whole for revision. An important question has arisen in the United States as to whether Congress is bound to enact the necessary legislation to carry into effect the stipulations of a treaty negotiated by the President and duly ratified by the Senate. This question first arose in 1794 in connection with the unpopular Jay Treaty which called for an appropriation of money to carry it into effect. The House of Representatives was at first inclined to refuse its concurrence, and only gave in after a sharp struggle, and then by a very close vote. It is impossible to say even now that the question has been decided one way or another. The rule now is to lay reciprocity treaties before Congress for its approval and for the enactment of the necessary legislation to carry them into effect. This practice has been followed in the case of reciprocity treaties with Mexico, Canada, and Cuba.

The question has also been raised as to how far the Government is bound by the action of its negotiator provided he has not exceeded his instructions. Formerly the rule prevailed that if the plenipotentiary acted in accordance with his *full power* his principal was bound by his action, since the knowledge of the full power by the other party was a motive which induced him to negotiate. Some writers, following the doctrines of the Roman law, still hold that the principals are in good faith bound by the acts of their duly authorized plenipotentiaries. Others make a distinction in this respect between treaties proper and contracts, holding that, in view of the magnitude of the interests involved in agreements between States and the possibility of errors of judgment or of policy on the part of negotiators, a right of examination and of rejection is indispensable. It is now universally conceded that the principal may withhold his ratification from treaties negotiated strictly in pursuance of instructions where it is found to be impossible from physical or other reasons to fulfill their stipulations, or on account of mutual error by which both parties were misled, or where a change of circumstances upon which the validity of the treaty was made to depend has occurred, or where ratification of the treaty would involve injury to a third party.

The extent of the treaty-making power unless restricted by the Constitution is almost unlimited. It includes the acquisition of foreign territory; the disposal of domestic territory; the recognition of new States; the creation of servitudes; the formation of alliances; the granting of special privileges with respect to trade, commerce, and residence; the delimitation and rectification of boundaries; the guarantee of territorial integrity; the neutralization of ship canals, etc., etc. It is a common provision in European constitutions to restrict the treaty-making power with regard to the cession of domestic territory by requiring the approval of the legislature in such cases. A constitutional question has been raised in the United States as to whether the treaty-making power extends to the alienation of land belonging to a State, and on this point constitutional lawyers differ in opinion, but the better view seems to be that where doubt exists as to the right of a State to land which it claims the disputed territory may be ceded by treaty. On the other hand, it is contended that land to which the right of the State is undisputed cannot be disposed of without the consent of the State except in case of conquest, where transfer is inevitable as a means of terminating the war.

The usual conditions essential to the validity of a treaty are, first, that the contracting parties shall possess the requisite capacity for entering into treaty engagements. Thus, neutralized States like Belgium and Switzerland are lacking in the capacity to enter into treaties which contemplate the waging of offensive war. In the second place, the plenipotentiaries who negotiate the treaty must be properly authorized. In the United States the President rarely if ever participates directly in the negotiations. This duty generally devolves upon the Secretary of State, although not infrequently the work is intrusted to a minister resident or to a special plenipotentiary or commissioner. Agreements entered into in excess of their authority are invalid and ratification may be withheld. An unauthorized agreement is called a *sponsion* and is of no effect unless approved by the sponsor's Government. The third essential to the validity of a treaty is freedom of consent on the part of the signatory powers. If either part acts under constraint the resulting agreement is void except in the case of treaties or other agreements arising in the course of war, where from the nature of the case the element is present. But an error as to the value of a consideration such as may result from imperfect geographical knowledge with regard to a boundary will not affect the validity of the treaty. Finally, treaties which stipulate for the execution of objects which are physically impossible of execution, which are repugnant to the usages of international law, or which conflict with previous engagements with other powers are held to be invalid. Thus treaties stipulating the establishment of slavery, assuming joint control over a portion of the high seas, or impairing the sovereignty of a third power would be invalid.

Treaties are susceptible of classification along different lines. Vattel classifies them as equal and unequal, or those in which the reciprocal considerations are equal and those in which they are unequal; personal treaties, which expire with the death of the sovereign who contracts them; and real treaties, which bind the State permanently. De Martens follows the same arrangement, but adds transitory conventions and mixed treaties. Calvo distinguishes treaties, with reference to their form, into transitory and permanent; with reference to their nature, into personal and real; with reference to their effects, into equal and unequal and simple and conditional; and, finally, with reference to their objects, into treaties of guarantee, commerce, neutrality, alliance, etc. Hall arranges them as follows: (1) those which are declaratory of the law as understood by the contracting parties; (2) those which stipulate for practices which the contracting parties wish to incorporate into the usages of law, but which they know to be outside the actual law; (3) those which are, in fact, mere bargains, in which, without any reference to legal considerations, something is bought by one party at the price of an equivalent given by the other.

Cartels, capitulations, and suspensions of arms, or truces, are sometimes involved in the classifications of treaties, although strictly speaking they are not treaties. Transitory agreements or conventions are treaties which contemplate the immediate execution of the stipulations and which are complete when this act has been performed. Examples are treaties of delimitation, of cession, etc. Permanent treaties are those which are continuous in effect, either perpetually or for a specified period. Such are treaties of amity and commerce, of neutrality, of extradition, postal and customs conventions, etc. Cartels are agreements entered into in time of war between the commanders of opposing armies for the purpose of effecting an exchange of prisoners, and they may be transitory or for the period of the war. Capitulations are similar agreements for the surrender of a place, fleet, or army. Every general commanding is presumed to have authority to enter into agreements of this kind subject to any restrictions that may be imposed by the authority of his own State.

A treaty of alliance is an agreement between two or more States with a view to concerted action for a certain purpose. It may be temporary or permanent, equal or unequal, and offensive or defensive or both. Defensive alliances are usually formed with a view to preventing armed aggression against either party while offensive alliances are formed for the purpose of waging war against another State or States. A good example of the first class was the treaty of 1778 between the United States and France, while the alliances formed among various European States to curb the ambitions and aggressions of Louis XIV. and Napoleon I. were in form examples of offensive alliances, although defensive in character. Treaties of guarantee are entered into for the purpose of securing the observance and execution of already existing treaties or for the maintenance of certain existing conditions for a limited period or in perpetuity. Among the conditions which have been made the subject of guarantee may be mentioned the independence and territorial integrity of States, as, for example, Greece in 1832, and the Ottoman Empire in 1856; the neutralization of States, as in the case of Belgium and Switzerland; the neutralization of ship canals, as in the case of the Suez and proposed Panama canals; the free navigation of rivers; and the payment of State debts.

What are known as reciprocity treaties have been the subject of frequent negotiations in recent years, on account of the increasing importance of international commercial relations. Such treaties provide for reciprocal commercial advantages, usually in the form of reduced customs tariffs on the products of each State when imported into the other. They are usually entered into for limited periods of time. and are sometimes subject to revision at stated periods. It is generally held that the special privileges granted by reciprocity treaties cannot be claimed by other States having treaties which entitle them to privileges allowed to the most favored nation, the latter class being regarded in the light of contract obligations. Treaties of peace resemble ordinary treaties in form and in substance, but differ from them as regards the position of the contracting parties, since the element of duress is usually present in the negotiations, and hence freedom of conduct is not one of the requisites to the validity of such treaties. See WAR, LAWS OF.

As regards the preparation of treaties, it has already been said that the ordinary method of negotiation is by a regular agent or commissioner. During the nineteenth century, however, the preparation of a number of the most important European treaties has been intrusted to general international congresses or conferences composed of ambassadors and in some cases of the sovereigns of the States concerned. Such were the Congress of Vienna of 1815 called to settle the questions growing out of the Napoleonic wars; the Congress of Aix-la-Chapelle in 1818, which terminated the military occupation of France; the congress at Paris in 1856. which effected a partial settlement of the Eastern Question at the close of the Crimean War and drew up a declaration relative to the usages of maritime warfare; and the Congress of Berlin of 1878 in respect to the questions growing out of the war between Turkey and Russia.

The language employed in the preparation of treaties was formerly Latin. Toward the close of the seventeenth century it was replaced by French, which is now the general diplomatic language of Europe and America. Each signatory power may insist upon the use of its own language, in which case a copy is prepared for each State in its own language and is usually arranged in parallel columns. Two States having a common tongue naturally employ that language. With regard to the form it may be said that no fixed rule prevails except that the stipulations of the treaty are usually preceded by a recital of the names and titles of the negotiators, with a statement of the purposes which the treaty is intended to accomplish. The treaty is divided into articles and clauses, ending with the terms of ratification and the signatures of the negotiators. A copy is prepared for each contracting party and the signatures follow, usually according to the principle of the *alternat*—that is, the plenipotentiary from each State signs first the copy intended for the use of his own Government. After the act of ratification by each of the parties there follows the formal exchange of ratifications, when the operation of the treaty begins. Treaties sometimes contain provisions for the accession of third parties. Such were the Declaration of Paris in 1856, the Geneva Convention of 1868, and the Treaty of Washington of 1871.

Treaties are terminated in various ways. They cease to be binding with the mutual consent of the parties thereto; or with the denunciation of either party if that right has been reserved; when the object of the treaty has been attained, as in the case of a boundary treaty, an arbitration treaty, or convention for the settlement of claims; when the operation of the treaty is conditioned upon terms which no longer exist, as in the case of a treaty allowing free navigation on a river which has ceased to be navigable; and when either party refuses to perform mutual stipulations. In the latter case the other party may consider itself released from its obligations, or it may demand a fulfillment of the treaty and require an indemnity for injuries resulting from any infractions thereof. By the usages of international law the refusal of either party to abide by a treaty, however burdensome, is a sufficient cause of war, since, as in the case of an ordinary contract, it is binding upon both parties until mutually abrogated. Finally, it is to be said that a treaty is terminated when the state of things contemplated by the parties and hence its real basis no longer exists. Thus a treaty is entered into in contemplation of the continuance of a particular form of government which in the course of time is displaced by another. Or the basis of the treaty may be changed by the absorption of one State by another, as in the case of Algeria, a State with which the United States had a treaty previous to the French conquest begun in 1830. Similarly the establishment of the German Empire in 1871 put an end to the treaties between the United States and the several German States with which she had entered into treaty relations. When a State is destroyed or loses its national character by other means its treaties fall to the ground, but ordinarily a mere change in the form of government will not affect its obligations to other States. In case of war between the contracting parties all treaties are suspended while certain of them are terminated. Treaties stipulating for a permanent arrangement of territorial and other national rights are at most simply suspended during the war and revive at peace. Such are treaties which recognize within certain territorial limits the independence of one of the contracting parties; treaties which establish new rules or modify old rules of international law, such as the Declaration of Paris of 1856; and treaties which contemplate a state of war and which come into effect only at the outbreak of hostilities, such as treaties of alliance and treaties which regulate blockades, and define contraband of war, regulate rules of capture, etc. Treaties of commerce and navigation and postal conventions are usually extinguished by war.

Sir Travers Twiss says that Great Britain in practice admits of no exception to the rule that all treaties as such are put an end to by subsequent war between the contending parties. In pursuance of this rule the treaties of Westphalia and Utrecht were several times reversed by the signatory powers after they had engaged in war with one another. A notable diplomatic discussion between Great Britain and the United States arose after the War of 1812 over the question of whether the treaty of 1783, in so far as it granted to the colonists fishery rights at Newfoundland, was suspended by the subsequent war between the contracting parties. The United States claimed that the treaty provision in question was not extinguished, it being the recognition of a preëxisting right which the colonies had always enjoyed in common with the mother country. Great Britain claimed, on the other hand, that the permission to fish on British coasts was in the nature of a grant of a special privilege and therefore terminated by the war.

As in the case of private contracts, certain rules for the interpretation of treaties have grown up. Phillimore arranges the rules of interpretation under three heads: (1) Authentic interpretation, that is, the interpretation supplied by the lawgiver himself; (2) usual interpretation, based on usage and precedent; and (3) doctrinal interpretation, or the interpretation founded upon scientific exposition of the terms of the treaty itself. The following are the commonest rules of interpretation: Words are presumed to have been used in their ordinary sense, but technical terms are used in the sense and with the meaning applied to them in the particular art to which they belong; the provision of a treaty can have but *one* true meaning and the interpretation must be mutual; the interpretation should be made with regard to the context and spirit of the whole treaty; terms peculiar to the language of one of the contracting parties must be given the meaning which they have in that language; clauses defining grants, privileges, and favors should be strictly interpreted; an interpretation which renders a treaty inoperative is to be avoided; special clauses are to be preferred to general, prohibitory to permissive; earlier clauses are explained by later ones and obscure clauses by clearer ones in later treaties, as later treaties explain and modify earlier ones on the same subject. The rule has been laid down by the United States Supreme Court that a treaty is on the same plane of equality with a statute of Congress, so that a later statute may supersede a prior treaty, while a subsequent treaty may supersede a prior statute on a given subject. A notable instance was the supersession in 1882 of a treaty with China by the act of Congress for excluding Chinese laborers. This mode of terminating treaties, however, is not sanctioned by international law and does not affect the responsibility of either contracting party for the fulfillment of its obligations. In the United States treaties go into effect from the date of signature, so far as the contracting parties are concerned, but only from the date of ratification so far as the rights of the individual are involved. Another rule of interpretation in the United States is that the Supreme Court will not undertake to enforce a treaty which requires Congressional legislation for its execution. Until such legislation is forthcoming the individual concerned must address himself to the political departments of the Government.

To secure the enforcement of treaties, it was formerly the custom to demand and receive hostages, the last instance of the kind being in 1748 to secure the execution of the Treaty of Aix-la-Chapelle. Solemn oaths accompanied by religious rites on the occasion of ratification were once common, but are no longer resorted to. Pledges are sometimes required, as in the case of the treaty of peace between Germany and France in 1871, when certain French fortresses were retained by the Germans as security for the payment of the large indemnity exacted from France. The organs for the enforcement of a treaty are the courts, the legislature, the executive, and the army and navy. Thus treaties of peace, of cession, of commerce, etc., are enforced for the most part by the legislative branch assisted by the executive, while in the case of treaties of naturalization, extradition, and treaties affecting the rights of foreigners the judicial branch plays an important part.

The most complete collection of treaties in English is that of Hertslet, four volumes. See also *The Map of Europe by Treaty*, by the same author; *Treaties and Conventions of the United States* (1776-1889); De Martens, *Recueil des principaux traités*, etc. (1761-1818). For a general discussion of the subject of treaties, see the authorities cited under the article INTERNATIONAL LAW, and Butler, *The Treaty Making Power* (2 vols., New York, 1902).

TREATY ELM. The tree in Shackamaxon, Philadelphia, under which William Penn made his famous treaty with the Indians in 1682. Its supposed site is now occupied by the Penn Treaty Monument.

TREATY RIGHTS, ECCLESIASTICAL. Those rights which are secured by treaty to the subjects or citizens of one State while residing in the territory of another State, relating to the exercise of their religion. The international agreements from which such rights arise differ radically from those treaties, generally known as concordats, which are made from time to time between sovereign States and the See of Rome to regulate the condition of the adherents of the Roman Catholic Church within the jurisdiction of the contracting State, since no ecclesiastical authority is made a party to the contract, which is directly between sovereign States in favor of the citizens of one or both. Such a body of rights belongs to the department of private international law. It had its origin in the Reformation period, when the organic unity of Western Christendom was broken and there was no single ecclesiastical authority with which a State could deal in relation to all its subjects. At the present time among the great powers of the world, and especially among those of Western civilization, the liberties and rights of foreign-born residents are amply secured by what are known as 'the most favored nation clause' of the prevailing treaties. Those nations, however, which have been foremost in missionary enterprise among peoples of a different civilization have found their interests to require intervention by their governments, and the United States of America, in the protection of widespread missionary enterprise, has secured for its citizens ecclesiastical rights in many countries. These rights differ considerably both in extent and kind, although, speaking generally, they have been elaborated as time went on and intercourse became more frequent. The first of such rights specifically mentioned was secured by the United States in its treaty of 1805 with the Sultan of Tripoli, in which it was provided that the consul or agent of the United States should have liberty to exercise his religion in his own house, and that his servants should not be impeded in going to his house at the hours of prayer. The Treaty of Guadalupe Hidalgo concluded with the Republic of Mexico in 1848 stipulated for American residents freedom from persecution on account of their religion and also liberty to propagate it. The treaty concluded in 1856 with the King of Siam provides that all American citizens visiting or residing in Siam shall be allowed the free exercise of their religion, and liberty to build places of worship in such localities as shall be assented to by the Siamese authorities. Americans have ecclesiastical treaty rights in China which were not abrogated by the foreign intervention following the 'Boxer' uprising. They are provided by two treaties, one of June 18, 1858, and the other of July 4, 1868. American citizens have a right by the terms of these treaties to teach and practice peaceably the principles of the Christian religion, to reside in those places where foreigners are permitted to reside and in such places to establish and maintain schools, and to maintain cemeteries free from profanation. They have also the right to attend the Chinese educational institutions under the control of the central Government. By the treaty of 1858 with Japan Americans are secured the free exercise of their religion and the right to erect suitable places of worship. American citizens are forbidden to injure any Japanese temple or *Mia*, and neither Americans nor Japanese are allowed to do anything calculated to excite religious animosity. The Government of Japan has abolished the practice of trampling on religious emblems. By the treaty of 1859 with the Republic of Paraguay, citizens of the United States residing in Paraguay are at liberty to exercise in private and in their own dwellings or the dwellings of the consuls of the United States their religious services, but no right of propaganda is specified. The treaty of 1830 with the Ottoman Empire merely confirmed as the treaty rights of Americans privileges already existing. American missionaries were first established in Turkey in 1818, and the privileges of extra-territoriality were then assigned to them by ancient usage. The liberty to exercise their religious functions, as a privileged class, had been *ab antiquo* granted by a voluntary extension of what is known as the 'Edict of Toleration' granted by the Turks, upon their conquest of Constantinople, to the ecclesiastics of any friendly Christian nation. While the United States was not a party to the Treaty of Berlin (1878), yet the guaranty given by the Turkish delegates applies to American cities: "Throughout the (Ottoman) Empire the most different religions are professed by millions of the Sultan's subjects, and not one has been molested in his belief, or in the exercise of his mode of worship. The Imperial Government is determined to maintain this principle in its full force, and to give to it all the extension that it calls for." By a protocol of 1874 a qualified right to hold real estate is granted to American citizens. What is known as the 'Protestant Charter' regulates mission schools. By the treaty of 1880 with the Sultan of Morocco the right to hold property is recognized as belonging to all foreigners. The purchase of property must take place with the previous consent of the Government, and the title of such property shall be subject to the forms prescribed by the laws of the country. No freedom of religious propaganda is specified.

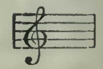
TREB′BIA (Lat. *Trebia*). A river of Northern Italy. It rises in the Appenines of Liguria and after a northeasterly course of 58 miles joins the Po near the city of Piacenza. Upon its banks Hannibal defeated the Romans under Sempronius in B.C. 218. (See HANNIBAL.) In the vicinity the Austrians and Russians under Suvaroff were victorious over the French under Macdonald, June 17-19, 1799.

TREBITSCH, trā′bĭch. A town of Moravia, Austria, 40 miles by rail east of Brünn. A fine abbey in the transition style of the thirteenth century and the palace of Count Waldstein are worthy of notice. Woolens, shoes, and malt are manufactured, and horses are dealt in. Population, in 1900, 10,597.

TREB′IZOND (Turkish *Tirabzon* or *Taraburun;* Lat. *Trapezus;* Gk. Τραπεζοῦς, *Trapezous*, probably so called because founded on a table-land, from τράπεζα, *trapeza*, table). A city of Asia Minor, capital of the Turkish Vilayet of Trebizond (Map: Turkey in Asia, H 2). It is on the Black Sea coast near its eastern end, 570 miles east of Constantinople. The city has a remarkable location, being built on a small table-land falling in steep precipices on either side toward two deep parallel valleys which run out to the coast. The highest portion is crowned by an ancient castle, and the city is still surrounded by Byzantine walls. The streets are narrow, but the city has a wide extent, nearly every house being surrounded by gardens. There are numerous churches and mosques, some of the latter being old Byzantine churches. The bazaars are mostly situated outside of the walls in the Christian quarters, the intramural portion being reserved for the Mohammedan population. The industries include wool, silk, and linen weaving, tanning, dyeing, and filigree manufactures. The harbor is an exposed roadstead, but the geographical position of Trebizond has for many centuries made it the chief entrepôt for the transit trade between Persia and Europe. It is the terminus of the main caravan route to Persia via Erzerum. The transit trade has, however, greatly declined since the opening of the Russian railroad to Batum. In 1900 the exports, which chiefly consist of cattle, hazel-nuts, tobacco, and carpets, were valued at $3,696,850, while the imports amounted to nearly twice as much. The population is estimated at about 35,000, of whom considerably more than half are Mohammedans, the rest being chiefly Greek and Armenian Christians.

Trapezus was founded by Greeks about B.C. 700 as a colony of Sinope. It was a flourishing city when Xenophon and his Ten Thousand reached it after the famous retreat. In 1204, after the occupation of Constantinople by the Crusaders, Prince Alexius of the Comnenian family established the Empire of Trebizond, and made the city his capital. This empire lasted until 1461, when it was overthrown and the city captured by the Turks.

TREBLE (OF. *treble*, *treible*, triple, from Lat. *triplus*, threefold, from *tres*, three + *-plus*, -fold). The highest part in harmonized music, which in general contains the melody, and is sung by a soprano voice. The treble or G clef is placed on the second line of the staff, indicating that the note G occupies the line encircled by its lower curve. It is one of the two clefs in use in music for keyed instruments. For the history of the sign of the treble clef, see NEUMES.



TRED′EGAR. A market town on the northwestern border of Monmouthshire, England, 18 miles northwest of Newport (Map: England, C 5). Coal-mining is the chief industry. The formerly important iron and steel works have been abandoned. The town owns gas and waterworks, and cemeteries. Population, in 1891, 17,341; in 1901, 18,574.

TREE (AS. *trēo*, Goth. *triu*, tree; connected with OIr. *dair*, *daur*, OChurch Slav. *dryevo*, *drŭva*, Lith. derva, Gk. δρῦς, *drys*, Skt. *dāru*, Av. *aru*, tree, wood). A plant which attains a considerable height and has a relatively large development of woody tissue. Trees differ from herbs in their size and in the amount of woody tissue. They differ from shrubs chiefly in size, although there are all gradations between trees and shrubs. Trees differ widely among themselves, especially in mode of branching and in leaf characters. For a discussion of their branching, see STEMS. For the differences between deciduous and evergreen trees, see DURATION, also FOREST.

TREE, HERBERT BEERBOHM (1853—). An English actor and manager, born in London. He made his début in 1878 in the character of Grimaldi at the Globe Theatre. In 1884 he made a great hit in *The Private Secretary* at The Prince's. He undertook the management of the Comedy Theatre in 1887, and successfully produced *The Red Lamp*. The same year he took the Haymarket, where among his subsequent productions were *Hamlet* (1892), *Hypatia* (1893), *The Tempter* (1893), *A Bunch of Violets* (1894), *John-a-Dreams* (1894), *Trilby* (1895). In 1897 he opened the new Her Majesty's Theatre with *The Seats of the Mighty.* In 1898, after a revival of *Julius Cæsar*, he produced Grundy's *The Musketeers*, which enjoyed an exceptionally long run. Among his plays in 1901 was Clyde Fitch's *The Last of the Dandies*, in 1902 *Ulysses.* As an actor Mr. Tree is considered remarkable for his versatility, and he is also known as a writer and lecturer.

TREE-BOA. Any of various long, slender, active South American snakes of the boa family, which spend their lives in trees and have acquired a remarkable power of clinging to the moving branches, even in a high wind, without coiling their bodies about any support. The name is also specifically given to the large ringed boa (*Epicrates cenchria*). See BOA.

TREE-CAT. See PALM-CIVET.

TREE-CREEPERS, or WOOD-HEWERS. A group of birds, forming the family Dendrocolaptidæ, related to the ant-thrushes (Formicariidæ) and true oven-birds (Furnariidæ), with the tail-feathers stiff and sharp-pointed as in the woodpeckers, and similarly useful in climbing tree-trunks. The bill is usually curved and slender, and often is elongated, enabling them to pull insects out of deep crevices. About 80 species are known. all confined to tropical America; all have a similar style of coloration, some shade of brown, with white spots beneath and rufous on the wings.

TREE-CRICKET. Any one of a group of small, pale-colored crickets which usually inhabit trees and shrubs. They are nocturnal in their habits, and lay their eggs in the twigs of various plants, a habit which, when the insects are numerous, results in damage to vineyards and to raspberry and blackberry plantations. The common snowy tree-cricket (*Œcanthus niveus*) is a delicate whitish-green insect. The young hatch about the first of May, and feed upon plant-lice and the eggs of other insects. When full-grown they feed upon vegetation.

TREE-FISH. One of the Californian rock-fishes (*Sebastodes serriceps*), about a foot long. It is dark olive, blackish above and yellowish below, with the front of the head coppery red, two black bands downward and backward from the eye, and several oblique black cross-bands on the sides. Black prominent ridges cross the cranium. See ROCKFISH; and Plate of ROCKFISH, ETC.

TREE-FROG, or TREE-TOAD. A frog of the family Hylidæe, connecting the toads with the typical frogs, and of prevailingly arboreal habits. Tree-frogs have teeth on the upper jaw and vomers, and in some genera elsewhere in the mouth. The toes are invariably claw-shaped and swollen at the base; and each carries at the tip a flattened, adhesive cushion, whose sticky secretion greatly aids the animal in clinging to smooth surfaces. Most of them are of small size, more elegant in form than the true frogs, of brighter colors and more active habits. They feed on insects, which they pursue on the branches and among the leaves of trees or shrubs. All have loud, piping notes, and are remarkable for their power of changing their colors to simulate the tint of the resting-place. (See METACHROSIS.) They are also remarkable for the great variety in their methods of placing their spawn, and the character of their metamorphoses, which are severally described under CRICKET-FROG, FERREIRO, MARSUPIAL FROG, etc. The principal genus is Hyla, which contains about 150 species scattered all over the warmer forested parts of the world, but especially numerous in tropical America. The type is *Hyla arborea*, common throughout all Central and Southern Europe and Asia. Of the North American species the most familiar is *Hyla versicolor*, which is a green, gray, or brown warty frog, whose clear, loudly trilled rattle is an almost daily evening sound. One of the first notes heard in the spring in the Eastern United States is the piping of *Hyla Pickeringii*, a smaller, more yellowish species, often called 'the peeper.' The cricket-frog (q.v.) is another numerous species. Various others inhabit the Southern States. Many species of the West Indies and South America carry their eggs about on the back of the females, glued to or sunken into the skin, as is notably the case with *Hyla Goeldii.* Notable cases are described in the *Proceedings of the Zoölogical Society of London* for 1895. Australia possesses several species of great interest, especially the familiar *Hyla Cærulea*, whose cry is a sharp crackling bark. The whole group is one of extraordinary variety and interest.

Consult authorities cited under FROG. See Colored Plate accompanying article TOADS.

TREE-HOPPER. Any insect of the homopterous family Membracidæ, a very strange group comprising a variety of grotesque forms. The antennæ are inserted in front of and between the eyes, and the prothorax is so prolonged that it covers the rest of the body, and its curious modifications have been developed in order to bring about a protective resemblance of these insects to various plant structures. The tree-hoppers, like other Homoptera, have an incomplete metamorphosis, and the young are active and suck the juices of plants by means of their beaks. The species are very numerous, and the group is one of wide distribution. The most bizarre forms occur in tropical regions, but many curious species are found in the temperate zone. A common form in the United States is the little humpbacked *Telemona monticola*, which sometimes swarms on the branches of the Virginia creeper in June. Another interesting form (*Entillia sinuata*) is found upon the leaves of the sunflower and other annual plants. It lays its eggs in the midrib of the upper leaves; the mother insect broods over her eggs, and the young from the time of hatching until full-grown are constantly attended by ants, which are attracted by a sweet secretion. The 'buffalo tree-hopper' (*Ceresa bubalus*), so called from its horned prothorax, is a species of considerable economic importance, which damages the small twigs of fruit trees in the act of laying its eggs. Large holes are made in the bark, in which the eggs are inserted in clusters. Consult: Comstock, *Manual for the Study of Insects* (Ithaca, 1895); Howard, *The Insect Book* (New York, 1902).

TREE-KANGAROO. One of a genus of kangaroos which in the forests of Northern Australia and New Guinea inhabit trees, although they creep awkwardly about the branches, as if not yet well adapted to an arboreal life. They constitute the genus Dendrolagus, and embrace several species of which the black one (*Dendrolagus ursinus*) of New Guinea, which is very dark in color, except the whitish face, and about 20 inches long, exclusive of the tail, is one of the best known. See Plate of KANGAROOS.

TREE OF HEAVEN. See AILANTHUS.

TREE-PORCUPINE. One of the small, short-spined, prehensile-tailed arboreal porcupines of South America of the genus Sphingarus. See PORCUPINE, and Plate of PORCUPINES AND HEDGEHOGS.

TREE-SHREW, or SQUIRREL-SHREW. One of the curious insectivorous animals of the family Tupaiidæ, of the Oriental region and eastward to Borneo. They are related to the hedgehogs, but outwardly have almost exactly the appearance of ordinary squirrels, except for the long, flexible, shrew-like nose. Some 20 species have been named, of which the Malayan banxring (*Tupaia ferruginea*) is one of the best known, and often becomes a pet, or resides, half-tame, in gardens and village shade-trees. The Madras tree-shrew (*Tupaia Ellioti*) is found throughout India. All are much alike, feeding on both insects and fruits, and expressing emotion by a short, whistling cry.

TREE-SNAKE. Many snakes are more or less arboreal in habits, but some are so distinctively so as to merit the name especially. Many of the smaller boas (see TREE-BOA) live almost wholly in tree-tops, as is necessary in the flooded parts of the Amazonian region. Among the colubrine groups of that region is the genus Leptophis, whose species are very slender, with long whip-like tails. The best known (*Leptophis liocercus*) is a beautiful creature six feet long, the upper surface golden green, the lower yellow or white; it subsists upon small reptiles and birds and their eggs. An Oriental genus (*Dendrophis*) has the ventral scales keeled and notched, enabling them to take hold of a surface so securely that they are able to glide up the branches of trees in almost straight lines. A group of tropical green tree-snakes (Dipsadomorphæ) exists, the species of which are highly poisonous; and in Africa are found 'tree-vipers' (q.v.).

TREE-TOAD. See TREE-FROG.

TREE-VIPER. A genus (Atheris) of rather small, arboreal vipers of Africa. They are of bright green and yellow colors, so as to be readily concealed in foliage. Their tails are especially prehensile, like those of boas. Four species are known.

TREE-WORSHIP. See NATURE-WORSHIP, paragraph *Dendrolatry.*

TREFOIL. A frequent charge in heraldry (q.v.), representing the clover-leaf, which is always depicted as *slipped*, i.e. furnished with a stalk.

TREFOIL (OF. *trifoil*, *trefeul*, Fr. *trèfle*, from Lat. *trifolium*, trefoil, three-leaved, from *tres*, three + *folium*, leaf), BIRD'S-FOOT (*Lotus*). A genus of plants of the natural order Leguminosæ. The pods are cylindrical, somewhat spongy within and imperfectly divided into many cells. The name bird's-foot trefoil is derived from the resemblance of the clusters of pods to a bird's foot. The numerous species are natives of the temperate and colder regions of the Old World. The common bird's-foot trefoil (*Lotus corniculatus*) is common in European pastures. The spreading decumbent stems, 4 to 16 inches long, arise from a short, thick rhizome and bear umbel-like cymes of five to ten yellow flowers, which have a rich, honey-like odor. The leaves have three obovate leaflets, and at the base of each leafstalk there are two large leaf-like ovate stipules. The plant is by some regarded as the shamrock (q.v.) of Ireland. It is nutritious and much liked while young by all kinds of stock. It has been introduced into the United States, where it is common, especially in the South. A larger species, very similar, with stem nearly erect, more compact heads of smaller flowers, and much smaller seeds, is the greater or narrow-leaved bird's-foot trefoil (*Lotus major*) of much the same range. The characteristic differences remain under cultivation in every variety of soil and situation. Marsh bird's-foot trefoil (*Lotus uliginosus*) is a species common in damp meadows. The winged pea (*Lotus Tetragonolobus*), remarkable for four membranous wings which run along its pods, is a native of Southern Europe, where it is grown for salads and as an ornamental plant. It is cultivated in the United States mainly as a forage plant and a winter crop for plowing under in spring as green manure. In some parts of Europe its seeds are used as a substitute for coffee.

BIRD'S-FOOT TREFOIL (*Lotus corniculatus*).

TRE FONTANE, trȧ fôn-tä'nȧ (It., Three Fountains). The traditional scene of Saint Paul's martyrdom, a spot outside of Rome, three miles from the Porta San Paolo. According to the legend, when the Apostle's head was struck off, it made three bounds, and at each spot a spring gushed forth. Over the springs stands the Church of Saint Paul without the Walls, which contains also the column to which Saint Paul was bound.

TREGELLES, trĕ-gĕlz', SAMUEL PRIDEAUX (1813-75). An English scholar and New Testament critic, born at Falmouth, of Quaker parentage. Though he attended the Falmouth Classical School for four years (1825-28), he was in the main a self-educated man. During the greater part of his life he was connected with the Plymouth Brethren, but in his last years he was in the communion of the Established Church. Tregelles's interest in critical studies began early, and from 1838 to his death he devoted himself almost exclusively to the study of the New Testament text and related subjects. In 1844 he published *The Book of Revelation in Greek, Edited from Ancient Authorities with a New English Version.* In 1854 his valuable *An Account of the Printed Text of the Greek New Testament* appeared. This work was not only a history, but a discussion of principles of textual criticism as well, and as such is still of great value. His next important work was his revision of the New Testament part of Horne's *Introduction* under the title, *An Introduction to the Textual Criticism of the New Testament* (1856). During all these years he was assiduously collecting material for a new critical edition of the Greek Testament, collating manuscripts, examining patristic readings and the important ancient versions with greatest care. The first part of Tregelles's *Greek New Testament, Edited from Ancient Authorities,* appeared in 1857. The last installment was published in 1872, sent out while the author was suffering from the severe illness which proved fatal not long after. Among numerous other writings not directly connected with the New Testament text his facsimile edition of the *Canon Muratorianus* (1860) and his translation of Gesenius's Hebrew Lexicon (1847) deserve mention. Tregelles's scholarship was exact and painstaking, and his industry was remarkable. His edition of the Greek Testament ranks with those of Tischendorf and of Westcott and Hort, as one of the three great critical editions of the last century. His principles, clearly worked out and consistently applied, were similar to those of Lachmann, but his reconstructed text was based on a wider and more thorough survey of the field of evidence than was Lachmann's. An *Appendix* to Tregelles's Greek Testament, edited by Hort and Streane, from Tregelles's own papers was published in 1879.

TREITSCHKE, trītsh′ke, Heinrich von (1834-96). A German historian. He was born in Dresden, and studied at Bonn, Leipzig, Tübingen, and Heidelberg. In 1857 he became lecturer at Leipzig, and in 1863 he was called to a professorship at Freiburg. He was an ardent believer in German unity and the mission of Prussia, and when Baden cast its lot with Austria in the Seven Weeks' War he resigned his chair and became editor of the *Preussische Jahrbücher* at Berlin, to which he had been for many years a diligent contributor. In 1866 he was called to a chair at Kiel and the following year he became professor of history at Heidelberg, where he remained until 1874, when he was called to Berlin. From 1871 to 1888 he was a member of the Reichstag, where he became a prominent spokesman of the National Liberals. He resigned the editorship of the *Preussische Jahrbücher* in 1889. After Ranke's death he became Prussian State historian (1886). He was a most successful lecturer in spite of his total deafness in his later years, and he impressed his intense German patriotism upon a large body of students who came under his instruction. He lacked the clear and impartial objectiveness of Ranke, but his sincerity and ability entitle him to a place in the group of eminent German historians. His principal work is *Deutsche Geschichte im neunzehnten Jahrhundert* (Leipzig, 1874-94), covering the period down to 1848. This work shows in the most marked degree the partisanship which appeared as so strong an element in Treitschke's scholarship. Of his numerous other writings may be mentioned *Zehn Jahre deutscher Kämpfe, 1865-74* (1874); *Schriften zur Tagespolitik* (1874-79); *Der Sozialismus und seine Gönner* (1875); *Ein Wort über unser Judentum* (1880); *Zwei Kaiser* (1888); and the posthumous volumes *Reden im deutschen Reichstag* and *Biographische und historische Abhandlungen* (1897).

TRELAWNY, tre-lạ′nĭ, Edward John (1792-1881). An English author, especially known as the friend of Shelley and Byron. He was born in London. Though he was of an ancient and famous family, his education was neglected. Entering the royal navy at the age of thirteen, he served in the fleet blockading Cadiz (1805). He subsequently deserted and passed through some exciting adventures in the East Indies. In January, 1822, he met Shelley (q.v.) and Byron (q.v.) at Pisa. He was the last to see Shelley's boat disappear in the fog on the memorable eighth of July, 1822; and he superintended the cremation of Shelley's body at Viareggio, snatching the heart from the flames. In 1823 he accompanied Byron to Greece, where he took an active part in the war of liberation, and married, as his second wife, the sister of the Greek chieftain Odysseus. After living in Italy and traveling in the United States (1833-35), he settled in England, where he became the lion of London society. His last years were passed mostly in the country, in Monmouthshire and in Sussex. He died at Sompting, in Sussex. His body was cremated and buried by the side of Shelley's in the Protestant cemetery at Rome. Trelawny charmed two generations by his rich fund of anecdote. In his old age he was sought out by young men who wished to see and hear the man who had been a comrade of Byron and Shelley. He was of magnificent physique. Millais chose him for the old seaman in "The Northwest Passage." Trelawny wrote his early autobiography under the title *The Adventures of a Younger Son* (anonymous, 1831). How much is truth and how much is fiction in this book will probably never be determined. Trelawny is best known for *The Recollections of the Last Days of Shelley and Byron* (1858), republished, with changes, as *Records of Shelley, Byron, and the Author* (1878). Both are brilliant books, and the latter is of great value. Consult the edition of *The Adventures of a Younger Brother,* with memoir by E. Garnett (London, 1890).

TRELAWNY, Sir Jonathan (1650-1721). An English bishop and third Baronet of Trelawny. He was born at Pelynt, Cornwall; graduated at Christ Church, Oxford, in 1672, and took priest's orders in 1676. He took an active part in suppressing Monmouth's Rebellion of 1685, and was rewarded with the Bishopric of Bristol. The appearance of the

First Declaration of Indulgence alienated him from King James; he refused to sign the declaration, and later successfully opposed the effort of the Earl of Bath to control the Cornish elections in the interests of the Crown. On May 18, 1683, he united with five other bishops and the Archbishop of Canterbury in drawing up a petition against the Second Declaration of Indulgence. As a result all seven were in the following month committed to the Tower on a charge of seditious libel, but were acquitted, and soon afterwards King James II. was driven from the throne. Trelawny seems not to have united in the invitation of William, but after the coronation of the new sovereigns he was made Bishop of Exeter. Consult Strickland, *Lives of the Seven Bishops Committed to the Tower in 1688* (London, 1866).

TRELEASE, tre-lēs′, WILLIAM (1857—). An American botanist, born at Mount Vernon, N. Y. He graduated at Cornell in 1880, and after serving as instructor in botany at Harvard and at Wisconsin University, was professor at Wisconsin in 1883-85. In 1885 he was made Engelmann professor of botany in Washington University, Saint Louis, and in 1889 was chosen director of the famous Missouri Botanical Garden there. He was the first president of the Botanical Society of America (1884-85). He translated Poulsen's *Botanical Micro-Chemistry* (1884) and Salomonsen's *Bacteriological Technology* (1890).

TREM′ATO′DA (Neo-Lat. nom pl., from Gk. *τρηματώδης*, *trēmatōdēs*, having many holes, porous, from *τρῆμα*, *trēma*, hole). A class of Platyhelminthes, the flukes, characterized by the possession of certain suctorial pores or openings. They have soft, roundish or flat bodies, and their visceral organs are lodged in the parenchyma of the body. Most of them are hermaphrodites. They seldom reach a large size (the greatest length is about five inches), but are usually visible to the naked eye. The color is usually dull gray, green, or brown, sometimes mottled. The reproductive organs are complicated and developed to a remarkable degree, occupying a very large part of the body. These worms are not all parasitic, nor are the parasitic forms confined to a single host during the whole of their existence. Many of them, indeed, have a most remarkable life history, showing an extraordinary succession of generations, in which the young resemble not the parents or grandparents, but the great-great-grandparents. The first three or four generations live in the body of some invertebrate, especially water-snails; but the next generation is a free-swimming one, and its offspring are like the original form and parasitic within some vertebrate.

The Trematoda are divided into two orders: (1) *Ectoparasitica*, trematodes with three or more suckers, living on the outside of their hosts, and with a direct development from the egg; (2) *Endoparasitica*, trematodes with not more than two suckers, living in the blood-vessels, alimentary canal, or other spaces of the higher animals, and undergoing a complicated alternation of generations. This order includes a large number of species, many of which are dangerous, not only to the domestic animals, but even to man himself. See FLUKE (WORM).

TREMBLEY, trän′blā′, ABRAHAM (1700-84). A Swiss naturalist, principally known for his studies in Holland of the Hydra, and the discovery of its power of regenerating lost parts. (See REGENERATION.) His *Mémoires pour servir à l'histoire d'un genre de polypes d'eau douce à bras en forme de cornes* brought him great fame, and has become a classic.

TREMOLITE (from *Tremolo*, an Alpine village, where the mineral was discovered). A variety of amphibole, consisting of calcium and magnesium silicate. It is white to dark-gray in color. It occurs usually in monoclinic prisms, although sometimes it is found in fibrous aggregates with a silky lustre.

TREM′OLO (It., trembling). In music, an expression indicating that a note or a chord is to be reiterated with great rapidity for an indefinite number of times, so as to produce a quavering sort of effect. In singing, the tremolo is highly effective in dramatic situations. But with many singers it is a mannerism arising from improper control of the breath. (See SINGING.) For the stringed instruments the tremolo is extensively employed by composers, and is written . It is produced by a very rapid alternation of the up and down stroke of the bow.

TREMULANT (from ML. *tremulans*, pres. part. of *tremulare*, to tremble, from Lat. *tremulus*, trembling, from *tremere*, Gk. *τρέμειν*, *tremein*, to tremble). A mechanical device in an organ for producing a tremolo. It is regulated by a separate draw-stop affecting a thin metal plate which interferes with the free influx of air into the pipes. The rapid vibration of this plate causes corresponding oscillations in the column of air.

TRENCH, MILITARY (from OF. *trencher*, *trancher*, Fr. *trancher*, to cut, from Lat. *truncare*, to lop, from *truncus*, trunk, from *truncus*, OLat. *troncus*, maimed). An excavation of varying dimensions, the earth from which is placed directly in front to form a parapet. Trenches are to be found in permanent and semipermanent fortifications, as well as hasty intrenchments (see FORTIFICATION), their nature, number, and methods of construction varying with the circumstances. Trenches are necessary for both the attack and the defense, modern conditions and future indications giving a constantly increasing importance to their use by an attacking force. Time is perhaps the greatest factor in the determination of the style of trench to be adopted, or the number of men required for its construction. Usually, an average of one pace per rifle is reckoned for shelter trenches, which for troops kneeling would require a depth of about three feet, while as a shelter for men standing it would necessary to excavate to 4 feet 7 inches, the removed earth in both cases being sufficient to provide an upper parapet of about three feet in thickness. See FORTIFICATION for illustrations and further material on field intrenchments.

TRENCH, RICHARD CHENEVIX (1807-86). Archbishop of Dublin, poet, and scholar. He was born in Dublin, and educated at Harrow and Trinity College, Cambridge, where he took his degree in 1829, and was intimate with the members of the 'Apostles' Club,' including Tennyson, Hallam, and Sterling. He was ordained deacon in 1832, and became curate to Hugh James Rose (q.v.) at Hadleigh, identifying himself to a certain extent with the High-Church Party. He held the living of Curdridge, in Hampshire, from 1835 to 1841, and then once more served as a curate under the future Bishop Wilberforce. From 1846 to 1858 he held a theological professorship at King's College, London, having meantime been appointed in 1856 to the deanery of Westminster. In 1863 he became Archbishop of Dublin, and took a foremost position in the opposition to the disestablishment of the Episcopal Church in Ireland, as well as in the settlement of the delicate questions which arose after it had been accomplished. He resigned his see, owing to infirmity, in 1884, and died in London two years later. He is remembered chiefly as a writer. Noteworthy among his theological works are: *Notes on the Parables* (1841); *Notes on the Miracles* (1846); *Commentary on the Epistles to the Seven Churches* (1861); and *Studies in the Gospels* (1867), all of which were widely popular and influential. His poetical work is graceful, tender, and thoughtful as a whole. A collected edition appeared in two volumes, 1885. His best-known books in philology are *The Study of Words* (1851), and *English, Past and Present* (1855). To these may be added his *Lectures on Mediæval Church History* (1877). Consult Trench, *Letters and Memorials of Archbishop Trench* (London, 1886).

TRENCH'ARD, Stephen Decatur (1818-83). An American naval officer, born in Brooklyn, N. Y. He became a midshipman at the age of sixteen; was promoted to passed midshipman in July, 1840; was wrecked in the *Washington* off the coast of North Carolina in 1845; was attached to the *Saratoga* during the Mexican War; became a lieutenant in 1847; and was slightly wounded while serving under Tatnall when that officer assisted the English in their attack on the Pei-ho forts in China. During the Civil War he served on the *Rhode Island;* was made commander in July, 1862, and participated in the bombardments of Fort Fisher. He was promoted to be captain in 1866, to be commodore in 1871, and to be rear-admiral in 1875; commanded the North Atlantic Squadron in 1876-78; and retired in 1880.

TRENCK, Franz von der, Baron (1711-49). A German soldier of fortune, born at Reggio, in Calabria, the son of a lieutenant-colonel in the Austrian service. He became a cavalry officer at seventeen, distinguished himself by his mental accomplishments, his remarkable success in the fields of gallantry, and his love for dueling, and miscellaneous murder, which in the end forced him to leave the army. He went to Russia, where he was made a captain of hussars, but was cashiered not long afterwards for gross insubordination and imprisoned at Kiev, whence he returned to settle on his estates in Slavonia. There it is we first meet with the Trenck of history. The Turkish frontier was overrun with banditti. Trenck armed and drilled 1000 of his tenants, whom he called Pandours, and by their means succeeded in restoring order. In 1741 he offered the services of his regiment to Maria Theresa, and his aid was accepted. In 1740 he took part in the Silesian wars at the head of his men. On September 7, 1742, he attacked Cham, a trading town in neutral territory, and annihilated it. After the battle of Sohr, in September, 1745, he made an unsuccessful attempt to capture Frederick the Great. His deeds of violence at last led to his trial before a court martial and condemnation to imprisonment for life. He was confined at the Spielberg, near Brünn, until his death, caused by poisoning himself when he found escape impossible. Consult: Hübner, *Franz von der Trenck* (Stuttgart, 1788); and Trenck's own Memoirs, *Merkwürdiges Leben und Thaten des Freiherrn Franz von der Trenck* (Vienna, 1770).

TRENCK, Friedrich von der, Baron (1726-94). A German adventurer, born at Königsberg, the son of a Prussian general and cousin of the preceding. At sixteen he became a cornet in the guards and in 1744 ordnance officer to Frederick the Great, but was soon after imprisoned at Glatz, either because of a love affair with the King's sister or because of his correspondence with his cousin Franz which raised doubts as to his loyalty. He escaped in 1746 and after many wanderings became, in 1749, captain of cuirassiers in the Austrian service. While in Danzig in 1754 he was arrested by order of Frederick and kept in severe confinement at Madgeburg till 1763. After his release he settled at Aix-la-Chapelle, where he married the burgomaster's daughter, gave himself to literary pursuits, and went into business as a wine merchant. In 1774-77 he traveled in England and France, and, restored to the possession of his Prussian estates after the death of Frederick II., lived at Berlin and Königsberg. In 1791 he went to Paris and became a zealous adherent of the Mountain Party. He was, however, suspected of plotting with the foreign enemy and was guillotined July 25, 1794. Consult the autobiographical *Friedrich Trencks merkwürdige Lebensgeschichte* (Berlin, 1787), which he rendered into French in 1789. His collected writings were published at Leipzig in eight volumes (1786).

TRENDELENBURG, trĕn′de-len-bōōrk, Adolf (1802-72). A German philosopher, born at Eutin. He was educated at Kiel, Leipzig, and Berlin; was appointed professor extraordinary of philosophy in the University of Berlin, 1833, and full professor in 1837. In this position, which he held until his death, January 24, 1872, he exercised very great influence upon the course of philosophical thought. His criticism of Hegel procured him great renown, and was one of the most effective forces that broke the hold of Hegelianism on the German mind. The foundation of his own philosophic doctrine is Aristotelianism, which, however, was modified by Platonic elements. He held and developed the teleological view and maintained that it is confirmed by empirical fact. Mechanical causation he viewed as the servant of teleology, not its enemy. He called his philosophy the 'organic view of the world.' His most important works are *Logische Untersuchungen* (1840, 3d ed. 1870) and *Naturrecht auf dem Grunde der Ethik* (1860; 2d ed. 1868). His *Historische Beiträge zur Philosophie* (1846-67) are also valuable helps in the study of the history of *philosophy*. Consult: Bonitz, *Zur Erinnerung an Trendelenburg* (Berlin, 1872); Bratuscheck, *Adolf Trendelenburg* (ib., 1873).

TREN'HOLM, George A. (1806-76). An American merchant and financier, born at Charleston, S. C. He engaged in business at Charleston, and was very successful. During the Civil War he successfully ran the blockade and secured much needed supplies for the Confederacy. From June, 1864, until the end of the war, he was Secretary of the Treasury of the Confederate States. After being imprisoned until October, 1865, he was pardoned by President Johnson.

TRENT. A river rising on the northwest border of Staffordshire, England, about 10 miles north of Burslem (Map: England, F 4). It flows first southeast to the border of Derbyshire, and afterwards in a generally northeast direction, through the counties of Derby, Nottingham, and Lincoln, to a point about 8 miles east of the town of Goole, where it unites with the Ouse (q.v.) to form the Humber (q.v.). It receives the Derwent, Idle, and Tarn from the west, and the Soar from the south; it is navigable by barges for 120 miles, from its mouth to Burton-on-Trent. Length, 170 miles.

TRENT. A wide and picturesque river of Ontario, Canada, which has its outlet at Trenton, on the Bay of Quinté, Lake Ontario (Map: Ontario, F 3). It issues from the northeast end of Lake Rice and drains a system of lakes and rivers which extends to Georgian Bay on Lake Huron.

TRENT (It. *Trento,* Ger. *Trient*). A town of Tyrol, Austria, 76 miles northwest of Venice, on the left bank of the Adige (Map: Austria, B 3). It is built largely in the Italian style and has some beautiful old palaces. In the Piazza Grande is the celebrated Fountain of Neptune, made of red marble. A beautiful bronze statue of Dante (by Zocchie, 1896) stands in the Piazza di Dante. The Romanesque cathedral, begun in its present form early in the thirteenth century and completed in the fifteenth, constructed entirely of white marble, is the most striking public building. The Church of Santa Maria Maggiore is noted as the sitting place of the Council of Trent (q.v.). Among the other interesting architectural features are the castle (the former residence of the prince bishops) and two ancient towers. The municipal building contains a museum of Roman antiquities and other objects. Trent is the chief town of the Italian or 'Welsch' division of Tyrol. The chief industries are silk-weaving, the making of salami (a kind of sausage), playing-cards, pottery, cloth, and wines, and the quarrying of marble and gypsum. The town is the seat of a bishop. Population, in 1900, 24,908. Trent is the ancient Tridentum, which was a Roman colony. It was under the rule of bishops from the eleventh century to the beginning of the nineteenth century, when it passed to Austria.

TRENT, Council of. The most notable of the modern ecumenical councils of the Roman Catholic Church, held with intermissions from 1545 to 1563. It was the culmination of the Counter-Reformation (q.v.), and its decrees crystallized the results of that movement into the permanent law of the Church. For centuries those who felt the need of reform within the Church had appealed to a general council, and the long-growing discontent with the condition of things after the Great Schism had led to the great councils of the fifteenth century. The Protestant Reformation had taken many of the most ardent advocates of reform out of the Church, and left the conservative-minded party in control. A council was at first desired by Luther and his supporters as a means of closing the great breach. At the Diet of Nuremberg in 1523 the German estates appealed to Adrian VI. for the summoning of a council "within a year, in concert with the Imperial Majesty and in a German city." Adrian died in the same year, and his successor, Clement VII., while not refusing a council, did nothing toward calling one; and the political breach between Charles V. and the Holy See made the Emperor's requests unfruitful. Thus it happened that when the design was put into execution in the pontificate of Paul III., the Augsburg negotiations (see Reformation) had failed, the break in Christendom was an accomplished fact, and the sincere but reactionary party was left in control.

The Council was finally assembled at Trent, December 13, 1545. The Emperor desired to have the discussions opened on points of general agreement, in the hope of gaining the confidence of the Protestants; but the party in control brought to the front the questions most in dispute—the authority of the Scriptures in the Vulgate text, the right of interpretation, ecclesiastical tradition, and the doctrine of justification, as to which the old positions were maintained. Certain administrative reforms were early decreed. Bishops were to provide better schools in their dioceses, and were themselves to expound the Word of God; qualifications for the episcopal office were defined, and penalties imposed for the neglect of duties; dispensations and privileges were restricted. The Emperor opposed the course of the Council, and on March 11, 1547, its sittings were transferred to Bologna, where it was thought the Imperial influence would not be so much felt. In 1549 Paul III. died and was succeeded by Cardinal del Monte as Julius III. The latter reassembled the Council at Trent May 1, 1551; but, after the sixteenth session, the city having become insecure on account of the activity of the Protestant forces under Maurice of Saxony, the sittings were again suspended for two years. After the brief reign of Marcellus II., Cardinal Caraffa, one of the ablest leaders of the uncompromising Catholic party, came to the Papal throne as Paul IV.

The Council now proceeded to carry out a conservative reorganization of the Church, though its work was again suspended for a time owing to the disturbances of Paul's pontificate. Pius IV., the former Cardinal Gonzaga, reconvened it in 1560, and much important work was done, looking to a restoration of the Papal authority in its fullness. Ecclesiastical laws were codified; questions which had hitherto been open were definitely ruled; uniformity of faith and discipline was established. To regulate some of the abuses of the system of indulgences, it was decreed that bishops should collect the payments made in connection with it, while the power of granting indulgences was affirmed as instituted by Christ and to be retained as useful to Christians. Episcopal control of monastic orders was provided for, though the Jesuits secured a larger measure of freedom. Several matters of detail were referred to the Pope for decision. The decrees were read and subscribed by about 200 bishops on December 3 and 4, 1563, and the Council finally adjourned. The decrees were confirmed by the Pope January 26, 1564, and he also prepared a confession of faith summarizing their doctrinal features. (See PIUS IV., CREED OF.) In spite of opposition, the work of the Council was so clear, logical, and thorough, and so well supported by the hierarchy, that it had a permanent and far-reaching effect, setting the standard of Roman Catholic faith and practice (with the exception of the two definitions of the Immaculate Conception and the Infallibility of the Pope) to the present day. The best modern edition of the documents relating to the Council is *Tridentinum Concilium; Actorum, Epistularum, Tractatuum nova Collectio* (Freiburg, 1901 et seq.), or Theiner, *Acta Genuina Sacri Concilii Tridentini* (Agram, 1874). The approved English translation is that of O'Donovan. Works supplementary to that of the Council itself were a catechism by the Pope for parish priests and preachers, and authentic editions of the Vulgate Bible, the missal, and the breviary. A permanent tribunal at Rome, the Congregation of the Council, deals with questions which arise as to the meaning, authority, or effect of the decrees and canons of the Council. The contemporary histories of the Council were those of Fra Paolo Sarpi (see SARPI, PAOLO), *Istoria del Concilio Tridentino* (London, 1619; in Latin, 1620; Eng. trans. by Brent, 1676), written from a hostile, almost a Protestant point of view; and Sforza Pallavicini, *Istoria del Concilio di Trento* (Rome, 1656-57; revised by the author, 1666; ed., annotated by Zaccaria, 1833; French trans. by Migne, Paris, 1844), a friendly history, a reply to Sarpi. Consult also: Mendham, *Memoirs of the Council of Trent* (London, 1834-42); Wessenberg, *Die grossen Kirchenversammlungen des fünfzehnten und sechszehnten Jahrhunderts* (Constance, 1840), a Roman Catholic work; Göschl, *Histoire du grand concile général de Trente* (Regensburg, 1840); Maynier, *Etudes historiques sur le concile de Trente* (Paris, 1874); Döllinger, *Sammlung von Urkunden zur Geschichte des Concils von Trient* (Nördlingen, 1876); Philippson, *La contre-révolution religieuse au XVIème siècle* (Paris, 1884).

TRENT, WILLIAM PETERFIELD (1862—). An American literary critic, born in Richmond, Va. He was educated at the University of Virginia and at the Johns Hopkins University. From 1888 to 1900 he was professor of English and history in the University of the South (Sewanee, Tenn.), and in 1893-1900 was dean of the academic department of that institution. In 1900 he was appointed professor of English literature in Columbia University. He founded the *Sewanee Review* in 1892, and edited it until 1900. He contributed articles in American literature to *The New International Encyclopædia*, and published the following works: *English Culture in Virginia* (1889); *William Gilmore Simms* (1892); *Southern Statesmen of the Old Régime* (1896); *The Authority of Criticism* (1899); *Robert E. Lee* (1899); *Verses* (1899); *John Milton* (1899); *War and Civilization* (1901); *Progress of the United States During the Nineteenth Century* (1901); and *A History of American Literature* (1903), besides editions of school texts of Balzac's *Comédie Humaine* (32 vols., 1900) and of *Colonial Prose and Poetry* (with B. W. Wells, 3 vols., 1901).

TRENT AFFAIR, THE. A diplomatic episode growing out of the seizure by an American vessel on November 8, 1861, during the Civil War in America, of two Confederate commissioners on board a British mail steamer. In the autumn of 1861 the Confederate Government sent John Slidell and James M. Mason as commissioners to France and England respectively. They ran the blockade at Charleston and went to Havana, where they embarked for England on the British mail steamer *Trent*. On November 8th Capt. Charles Wilkes (q.v.) of the United States vessel *San Jacinto* stopped the *Trent* on the high seas, sent a searching party on board and arrested the commissioners, who were eventually placed in Fort Warren, Boston Harbor, as prisoners. This act was applauded by the people of the North, and by many of the political leaders, including the Secretary of the Navy; but President Lincoln and Secretary of State Seward recognized the impropriety of the act and strongly disapproved it, and when a formal demand was made by the British Minister for the surrender of the commissioners it was speedily complied with and an apology tendered, on the ground that the commissioners had been forcibly taken from a neutral vessel on the high seas and in the prosecution of a voyage from one neutral point to another. Consult Harris, *The Trent Affair* (Indianapolis, 1896), which contains a bibliography.

TREN′TON. A town and port of entry of Hastings County, Ontario, Canada, on both banks of the Trent at its outlet in the Bay of Quinté, Lake Ontario (Map: Ontario, F 3). It has lumbering and manufacturing interests. Population, in 1901, 4217.

TRENTON. The county-seat of Grundy County, Mo., 83 miles east by north of Saint Joseph; on the Chicago, Rock Island and Pacific, and the Omaha, Kansas City and Eastern railroads (Map: Missouri, C. 1). It is the seat of Ruskin College (non-sectarian), opened in 1900, and has the Jewett Norris Free Public Library, with 6000 volumes. Trenton is largely interested in coal-mining. The Chicago, Rock Island and Pacific Railroad maintains repair and machine shops here. Under a charter of 1893 the government is vested in a mayor, elected biennially, and a unicameral council. Trenton was settled in 1840, and was first incorporated in 1857. Population, in 1890, 5039; in 1900, 5396.

TRENTON. The capital of New Jersey and the county-seat of Mercer County, 57 miles southwest of New York and 33 miles northeast of Philadelphia; on the Delaware River, at the head of steamboat navigation, on the Pennsylvania and the Philadelphia and Reading railroads, and on the Delaware and Raritan Canal (Map: New Jersey, C 3).

An electric railway covers the city in every direction, and four suburban trolleys radiate in all directions to numerous towns and villages. Cadwalader Park, a beautiful public resort of 100 acres, is supplemented by several smaller parks. Riverside Park, embracing two miles of river front, is being laid out (1904). A graceful granite shaft 160 feet high and surmounted by a bronze statue of Washington, of colossal size, marks the spot at the 'head of town' where Washington planted his cannon at the battle of Trenton. Among other monuments is one of granite in Riverview Cemetery over the grave of Gen. George B. McClellan.

Conspicuous public buildings are the State Capitol, the new white marble city library, which has some 30,000 volumes, the new $300,000 county court-house, Young Men's Christian Association building, Masonic Temple, the high school, and three large theatres. A State armory, to cost $250,000, is in course of construction (1904). There are 28 public schools with about 200 teachers and about 9000 pupils; also a public school of industrial arts, one Catholic college, and the State Normal and Model schools. The State schools have over 1000 students. There are three hospitals, two day nurseries, and two children's homes. The State Deaf Mute School, the New Jersey Odd Fellows' Home, the New Jersey Home for Girls (reformatory), a State Hospital for the Insane, the State Prison, and the State Arsenal are also here. The Inter-State Fair held each fall at Trenton is one of the largest exhibitions of its kind in the East.

Trenton is a noted industrial centre. In the census year 1900 the various manufactories had $26,175,000 capital, and an output valued at $31,646,000. The potteries, 40 in number, and employing 5000 hands, produce annually $5,000,000 worth of table ware, plumbers' supplies, electrical fixtures, and artistic porcelain. Of national reputation is the John A. Roebling's Sons Company, wire and cable manufacturers, whose works cover 30 acres, employ about 5000 hands, and produce $15,450,000 worth of goods annually. Other notable establishments are the American Bridge plant, the Jordan L. Mott Iron Works, the De Laval Steam Turbine Works, a dozen big rubber concerns, large tile factories, and the Trenton Iron Works. There are also watch works, numerous brick yards, builders' hardware works, woolen mills, shirt waist factories, carriage factories, anvil and tool shops, breweries, an oilcloth and linoleum factory, church and school furniture works, boat-building yard, etc. The shipping facilities by rail, canal, and river are excellent and considerable freight is handled. There is also a large retail trade with the rich agricultural country which supplies Trenton markets.

The government is vested in a mayor, elected biennially, a common council of 28 members, and the usual administrative boards. The assessed valuation of property is about $35,000,000; and the public debt is less than $2,000,000. Trenton's municipal expenditures aggregate about $700,000 annually, of which about $90,000 is for schools; a like sum for the police department; $80,000 for the fire department; and $60,000 for street lighting. The water supply from the Delaware is stored in a new $500,000 reservoir of 110,000,000 gallons' capacity. The water-works are owned by the municipality.

Population, in 1790, 1946; in 1810, 3002; in 1850, 6461; in 1870, 22,874; in 1880, 29,910; in 1890, 57,458; in 1900, 73,307. The total in 1900 included 16,793 persons of foreign birth and 2096 of negro descent.

First settled about 1676, Trenton was generally known as 'The Falls' until in 1719 it received its present name in honor of William Trent, Speaker of the House of Assembly. It was incorporated as a borough in 1746, was selected as the State capital in 1790, and was chartered as a city in 1792. In 1776 it was occupied by the British, who pursued General Washington to this point. Late in December, 1776, Washington, stationed with his army on the other side of the river, planned a movement against Trenton and Bordentown, where General Donop with a small Hessian force was stationed. Trenton was occupied by a garrison of about 1500 Hessians under Colonel Rahl. General James Ewing with about 550 men was to cross the Delaware just below Trenton, seize the Assanpink, and thus sever communication between Donop and Rahl; Colonel John Cadwalader was to cross at Bristol, below Bordentown, and attack Donop from the south, and General Putnam with about 1000 men was to coöperate with about 1000 men from Philadelphia. The main movement, however, was to be made by Washington in person, who with 2400 men was to cross at McConkey's Ferry, nine miles above Trenton, and assail Rahl at Trenton. The movement was set for the night of December 25th-26th. By reason of storms and of the river being clogged with ice, Ewing and Cadwalader were unable to effect a crossing, while Putnam was detained in Philadelphia. Washington, however, with the aid of Marblehead fishermen under Glover, crossed in spite of all obstacles by 3 o'clock in the morning of the 26th, began his march to Trenton at about 4 o'clock, and at about eight completely surprised the garrison, which, after a night of Christmas festivities, had taken little precaution against surprise and had made little preparation for resistance. Rahl was soon forced to surrender, and Washington secured about 1000 prisoners. The American loss was 2 killed and 3 wounded, while the Hessians lost about 40 killed or wounded. Soon afterwards Washington recrossed the Delaware to his former position. This success, together with that at Princeton on January 3, 1777, greatly revived the spirits of the Americans, and did much to prevent the threatened disintegration of Washington's army. Consult: Lee, *History of Trenton* (Trenton, 1895); Raum, *History of the City of Trenton* (Trenton, 1871); and Stryker, *The Battles of Trenton and Princeton* (Boston, 1898).

TRENTON SERIES. An important stratigraphic division comprising the Trenton, Utica, and Hudson stages of the Ordovician system. The type localities of the rocks are in central and eastern New York, where the lowest stage—the Trenton—consists of a thinly bedded, dark gray to black limestone, while the Utica and Hudson stages are represented by carbonaceous shales. The same series of strata appears also on the northern shores of Lake Ontario in Canada, outcropping as far west as Georgian Bay. In Ohio the Hudson stage is known as the Cincinnati shales and is of great thickness. The strata occur also in the Upper Mississippi Valley and in several of the Rocky Mountain States. The Trenton rocks are the source of the great petroleum industry in the Lima field of Ohio and Indiana, and in addition yield valuable supplies of natural gas. The Salina limestone, which is the equivalent of the Upper Trenton stage and outcrops in Iowa, Illinois, and Wisconsin, contains important deposits of lead and zinc ores. See ORDOVICIAN SYSTEM.

TREPANG (from Malay *tripang*), or BÊCHE DE MER. The dried body of a holothurian (q.v.), regarded as a delicate article of food by the Chinese. Several species are utilized, especially *Holothuria edulis*, which abounds along the coasts of Eastern Asia and all the islands to the Philippines and Eastern Australia. These animals are usually about eight or nine inches long, but some are two feet in length. They are often found nearly buried in the coral sand, their tentacles only appearing above it. The larger ones are sometimes speared in shallow water; but most of them are taken by divers. They are split down one side, boiled, pressed flat with stones, dried in the sun, and afterwards in smoke, and packed in bags. Macassar is the centre of the trade, whence several hundred tons are annually sent to China. Trepang is also gathered and prepared to some extent in California. It is highly gelatinous and nutritious, though almost tasteless. It is utilized as an ingredient in soups.

TREPHINE, TREPHINING (Fr. *tréphine*, for **trépine*, diminutive of *trépan*, trepan, from ML. *trepanum*, from Gk. *τρύπανον*, *trypanon*, auger, trepan, from *τρυπᾶν*, *trypan*, to bore, from *τρύπη*, *trypē*, hole, from *τρέπειν*, *trepein*, to turn). The operation of trephining consists in the perforation of a bone by means of a trephine, which is a small cylindrical or circular saw, with a centre-pin on which it works. The trephine produces a hole in the skull varying usually from one-fourth to an inch or more in diameter. The larger sizes of trephines are not now employed so much as formerly, it being usually the custom to make as small an opening as possible with the trephine, enlarging it where necessary by means of rongeur forceps, the chisel, or some short special form of saw, such as Hey's saw. The trephine is especially employed in fracture of the skull where the fragments of bone cannot otherwise be raised, as by the use of the elevator and chisel alone. In other conditions the operation of trephining is often a mere introductory step, giving a point of entrance at one or more places from which extensive flaps of bone are broken away or turned back for free access into the cranial cavity. The operation is oftenest employed alone in cases of abscess of the brain where a very limited area of brain substance requires to be exposed. The point of application of the trephine in cases of abscess as well as many cases of pressure from hemorrhage, either above or below the dura, is often clearly indicated by definite symptoms of brain irritation, known as 'localizing symptoms.'

TRÉPORT, trâ'pôr', LE. A town of the Department of Seine-Inférieure, situated at the mouth of the Bresle, and overhung by a high, picturesque cliff, 45 miles north-northeast of Rouen (Map: France, H 1). Its proximity to Paris has made it a popular bathing resort. Tréport has a sixteenth-century tower, now used as the town hall, the sixteenth-century Church of Saint Jacques, an old Renaissance Timber House, and a conspicuous casino. There is a considerable trade. Sugar is the leading export. The harbor is good, and a canal extends to Eu. Population, in 1900, 4949.

TRES'COT, WILLIAM HENRY (1822-98). An American diplomatist, born at Charleston, S. C. He graduated at Charleston College in 1840; studied law in Harvard, and was admitted to the bar in 1843; became secretary of the United States legation in London in 1852; and was Assistant Secretary of State from June, 1860, until the secession of South Carolina. During a part of this period he was also the confidential agent of his State. In 1862, 1864, and 1866 he was elected to the State Legislature, and he also served on the staff of General Ripley. In 1877 he was one of the agents of the United States Fishery Commission at Halifax; in 1880 helped to revise the treaties between the United States and China; in 1881 was sent as special envoy to Chile, Bolivia, and Peru, which were then at war; and in 1882 was associated with General Grant in negotiating a new treaty with Mexico. Among his published works are: *Diplomacy of the Revolution* (1852); *An American View of the Eastern Question* (1854;) and *Diplomatic History of the Administrations of Washington and Adams* (1857).

TRESPASS (OF. *trespas*, departure, Fr. *trépas*, decease, from OF. *trespasser*, to pass over, depart, die, Fr. *trépasser*, to die, from ML. *transpassare*, to pass over, from ML., Lat. *trans*, across, through + ML. *passare*, to pass, to step, from Lat *passus*, pace). This term first appears in English law as the name of a form of action brought for the recovery of damages resulting from an act of violence done to the person or property of the plaintiff. Now that forms of action are generally abolished, the term is used almost exclusively to denote the wrongful conduct for which an action in trespass, as distinguished from an action on the case, or of trover, could have been brought at common law. In this sense, trespass means a direct and forcible injury to the person or the property of another. The most frequent examples of trespass to the person are afforded by assault and battery (q.v.) and by false imprisonment (q.v.). It does not extend to acts which are lawful in themselves, and are actionable only because done negligently. Such acts were remediable under the old system of procedure by an action on the case.

Trespass to goods or chattels consists in the wrongful disturbance of another's possession of them. Thus, if one injure or destroy a chattel which belongs to another without taking it from the possession of the rightful owner, or if he wrongfully deprive such owner of its possession without doing it any injury, or if he do both of such wrongs, he is guilty of trespass. There is no crime involved in thus forcibly taking property from the possession of its owner, unless the act be done *animo furandi*—i.e. with an intent to commit a felony. The mere wrongful retention of the personalty of another, even though it follow a trespass in the taking thereof, is not in itself a trespass, but constitutes the tort of conversion. It is no defense to an action of trespass that a third party was entitled to the property at the time the defendant disturbed the plaintiff's possession, unless it is also shown that the defendant's act was authorized by such third party. The defendant must stand, if at all, on the strength of his own right to possession, not on the weakness of the plaintiff's. A wrongful intention is not necessary to actionable trespass to chattels. One who voluntarily interferes with the possession of another is bound to know whether he is acting lawfully or not. Inevitable accident, however, is a defense.

Trespass to real property is an unlawful entry upon the lands of another. Every man's land is regarded by the law as surrounded and separated from that of his neighbors by a *close* or boundary. This may be a visible, tangible object, such as a fence or a hedge; but if none such exist, there is thrown around the land, in contemplation of law, an invisible, ideal boundary which effectually separates it from the property of all other persons. Any unwarrantable breaking through this *close,* and thereby entering or sending a person or personal property upon the land which it surrounds, even though no actual injury be done to the property, constitutes a trespass, for which an action at law will lie in favor of any one rightfully in possession when such act is done. No crime is usually committed by such a wrongful entry; and this is so even when the owner or rightful possessor has put up notices upon the land, as is so frequently done, stating that 'Trespassers will be prosecuted,' or using other words to that effect. If, however, the trespasser wantonly injure the property, as by breaking down the trees or crops, he may be criminally prosecuted for malicious mischief. A person may commit trespass for which he will be liable in a civil action for damages, not only by his own entry upon land, but also by wrongfully sending his personal property upon it or permitting it to go there. Thus, if he unwarrantably drive his cattle upon his neighbor's soil or negligently permit them to go upon it, he becomes liable to an action in trespass for the resulting damages. The common law also gives to the injured land-owner, in such cases, another remedy by permitting him to distrain or impound the cattle thus *damage feasant,* or doing damage, until their owner renders him satisfaction for the injury sustained.

At common law the owner of a dog or cat was not liable for its trespasses. Various reasons were assigned for this, such as the difficulty of keeping these animals under restraint, the slightness of the damages ordinarily inflicted by their wanderings, and the common usage of allowing them greater liberty than that accorded to cattle. But if a dog, or cat, or other such animal be known by its owner to have vicious propensities, and, because of his failure properly to restrain it, it injure the person or property of another, he will be liable in damages.

There are some circumstances under which entry upon the land of another without his consent is justifiable or excusable, and so does not constitute a trespass. Thus, if a public highway be so obstructed as to be impassable, a traveler may rightfully go around the obstruction upon the private land of an individual; and a person who, by virtue of a contract with another, has become the owner of personal property upon the latter's land, may enter and take it from such land; and again, when a vendor of personal property has rescinded the sale because of fraud practiced upon him, he may enter upon the land of the vendee, if not forbidden by the latter, and retake the property sold, and the same rule holds whenever an owner of land has wrongfully acquired possession of the personalty of another and placed it upon his own land. It is generally the rule, however, with these few exceptions, that a person who goes or sends upon the land of another, and takes his own chattels without permission of such land-owner, however such chattels may have come to be there, is guilty of a trespass. If a trespass be attempted upon real property, or upon personal property which is in the actual possession of its owner, the person rightfully in possession of the same may properly use all the force that is necessary to prevent the commission of the wrong. But if he employ more force than is actually needed to repel the violence of the intruder, he makes himself liable to an action for assault and battery, and his act may constitute a crime. Growing out of this right to make use of so much violence as is requisite to prevent intrusion is the well-known common-law maxim that "A man's house is his castle." Yet there are a few cases in which even the privacy of a person's dwelling-house may be invaded without his permission. An officer of the law, when executing criminal process—as in seeking to apprehend a criminal or one charged with a crime—may use the needed force to enter a building in which such person is secreted. And even in the execution of civil process an officer may break open inner doors after he has peaceably obtained entrance into the house; but no civil process can authorize him to employ force or violence to obtain ingress through the outer door of a dwelling. There are, moreover, many circumstances under which persons are invited, by implication, to go upon the property of others and so do not become trespassers, if, not being expressly forbidden to do so, they so enter. Thus, it is ordinarily no act of trespass for a person to enter the house of his neighbor upon matters of business or to make a social call; so keepers of stores, theatres, hotels, etc., hold out to the public a general invitation to enter upon their properties for the purpose of dealing with them. But even in such cases those who enter or remain against the express prohibition of the owner or proprietor become trespassers in so doing. If one go upon the property of another rightfully, but abuse or make ill use of the privilege or authority under which he entered, as if he go into a tavern or theatre and refuse to leave within a reasonable time or when ordered to do so, he thereby becomes a trespasser *ab initio,* or from the time when he entered.

Consult: Pollock and Maitland, *History of English Law* (2d ed., Boston, 1899); Pomeroy, *Remedies and Remedial Rights* (Boston, 1883); Pollock, *The Law of Torts* (London and New York, 1901).

TRESSURE. In heraldry (q.v.), a subordinary.

TREVELYAN, tre-vĕl′yan, Sir CHARLES EDWARD (1807-86). An Anglo-Indian official. He was born at Taunton, Somersetshire; received his education at the Charterhouse and Haileybury College; entered the East India Company's civil service, and in 1827 went to Delhi as assistant to Sir Charles Theophilus Metcalfe, chief commissioner. Through his efforts in the cause of native education the Government encouraged and supported the promotion of European literature and science among the natives. In 1840 he was appointed Assistant Secretary to the Treasury, retaining the position until 1859. With Sir Strafford Northcote he prepared in 1853 a report entitled *The Organization of the Permanent Civil Service*, which is the basis of all subsequent civil-service legislation. In 1848 he was made Knight Commander of the Bath, and in 1859 was appointed Governor of Madras. He was appointed Finance Minister in India in 1862, and retired in 1865 on account of ill health. Important reforms were made in the system of accounts during his financial administration, and the resources of India developed by a great expansion of public works. He was created a baronet in 1874. He was the author of several valuable treatises; of which the better known are: *Education of the People of India* (1838); *The Irish Crisis* (1848); *Christianity and Hinduism* (1882).

TREVELYAN, Sir George Otto (1838—). An English politician and author, the only son of Sir Charles Edward Trevelyan (q.v.) by his wife, Hannah More Macaulay, sister of Lord Macaulay. He was born at Rothley Temple, Leicestershire, and was educated at Harrow and at Trinity College, Cambridge. After a short period in the East Indian civil service, he entered Parliament in the Liberal interest, for Tynemouth (1865) and for the Hawick Burghs (1868). He was appointed Civil Lord of the Admiralty under the first Gladstone Administration (December, 1868), but resigned (July, 1870) owing to disagreement with the Premier on the Education Bill. In the second Gladstone Administration he became Parliamentary Secretary to the Admiralty (November, 1880), Chief Secretary to the Lord Lieutenant of Ireland (May, 1882), and Chancellor of the Duchy of Lancaster (1884). At the beginning of the third Gladstone Administration he was appointed Secretary for Scotland (1886), but he resigned (March, 1886) because of the bill for establishing an Irish Parliament. And again in the last Gladstone Administration he was Secretary for Scotland (1892-95). In 1897 he resigned his seat. Trevelyan was among the foremost in abolishing the purchase of commissions in and out of Parliament and in extending household suffrage to the counties. Among his publications are: *The Competition Wallah* (1864); *Cawnpore* (1865); *The Life and Letters of Lord Macaulay* (1876); *The Early History of Charles James Fox* (1880); and the very valuable work *The American Revolution* (parts 1 and 2, 1899, 1903).

TREVES, trēvz (Ger. *Trier*). A city of Prussia, in the Rhine Province, on the right bank of the Moselle, 69 miles southwest of Coblenz (Map: Germany, B 4). It is situated in a region of hills, vineyards, and woods, and presents a picturesque appearance. The town lies in a compact form, surrounded on three sides by promenades called allées. In the old city proper the streets are narrow and crooked. On the north is the Porta Nigra, an ancient fortified gate with towers—a splendid Roman relic. In the northeastern part of the city stands the cathedral, one of the oldest churches in Europe. The ancient edifice on whose site it stands appears to have been used as a church already in Roman times. The building has been repeatedly restored as the result of wars and the ravages of centuries. Among its contents are an alleged nail from the cross, and the famous seamless 'Holy Coat,' which is exposed to view at stated, though not frequent, times. There are fine cloisters leading to the charming Liebfrauenkirche—an early Gothic structure belonging to the first half of the thirteenth century.

In the southeastern part of Treves is the spacious Palace Square, at the north end of which stands a brick basilica dating probably from the commencement of the fourth century, now used as a Protestant church. At the south end of the square rises the Roman palace, a picturesque mass of ruins. The valuable provincial museum is near by. Among its remarkable antiquities are 60 hermæ, torsos of Cupid and of an amazon, a mosaic credited to Monnus, and the Roman tombs from Neumagen, dating from the commencement of the Christian Era and representing the costumes and daily life in this region at that period. A short distance southeast of the city is a Roman amphitheatre, built in Trajan's time. In the southwestern part of Treves, close to the Moselle, are the Roman baths—a vast and impressive ruin. Two miles to the west, on a hill, rises the Column of the Virgin, commemorating the promulgation of the dogma of the Immaculate Conception.

The municipal library, containing over 100,000 volumes and manuscripts, is connected with the gymnasium, and possesses rare works of ancient date. Among them is the illuminated Codex Egberti, dating from the close of the tenth century. There are also the Codex Aureus and the Fust and Gutenberg Bible of 1450. The manufacturing interests are varied and important. There are tanneries, iron foundries, dye works, furniture and piano factories, glass painting works, etc. The trade is extensive in wine, fruit, and wood. The town possesses a school of viticulture. There are many mines in the vicinity, including lead, copper, and tin mines. The population in 1900 was 43,324.

History. Treves is usually considered the most ancient town of Germany. It was the capital of the Celtic Treviri, from whom it took its name (anciently Augusta Trevirorum). The Romans made it a colony and it grew in importance. It was an Imperial residence in the later times of the Roman Empire, which explains the presence of the magnificent Roman relics. Treves had a bishop at a very early date. It fell into the hands of the Franks in the fifth century. The see appears to have been erected into an archbishopric about the beginning of the ninth century. About a century later the city, after having for a time belonged to Lorraine, was permanently united with Germany. It rose to great importance under its archbishops, who exercised temporal sway over a considerable district, and who held a place among the Imperial Electors. After a long struggle with its ecclesiastical overlords, Treves was recognized as a free city toward the close of the sixteenth century. The French took Treves in 1794, and within a few years nearly the whole of the archiepiscopal see was in their possession. The archbishopric was abolished. The Congress of Vienna (1814-15) handed the city and the former see over to Prussia. Consult: Wilmowski, *Der Dom zu Trier* (Treves, 1874); Freeman, *Historical and Architectural Sketches*

(London, 1876); Woerl, *Führer durch die stadt Trier* (Würzburg, 1887).

TREVI, trā′vė, Fountain of. A noted fountain in Rome, with which the superstition is connected that a traveler's return to Rome is assured by dropping a coin in its basin and drinking its waters. It is built aganst the façade of the Palazzo Poli and was completed in 1762. The water of the ancient Aqua Virgo spouts from the crevices of the rocks and from the nostrils of the horses of Neptune, who stands in his chariot above the fountain surrounded by Tritons.

TREVIGLIO, trȧ-vē′lyȯ. A town in the Province of Bergamo, Italy, 20 miles by rail and by steam tramway east by north of Milan (Map: Italy, D 2). It has an attractive church. There is a library. The town manufactures silks, woolens, ironware, and chemicals. Population (commune), in 1901, 15,138.

TREVISO, trȧ-vē′zȯ. The capital of the Province of Treviso, Italy, situated in a fertile valley, on the Sile, 18 miles north by west of Venice (Map: Italy, G 2). It is connected with the lagoons of Venice by a canal. The town has a mediæval appearance with its high walls flanked with bastions. The imposing twelfth-century cathedral, restored in the fifteenth century, has five cupolas. The Gothic Church of San Niccolò has a curious wooden roof, and is adorned with admirable frescoes. The Borgo Cavour contains a library of 50,000 volumes and a picture gallery. Among the educational institutions are a technical school, a school of navigation, a bishop's seminary, and an academy of sciences. The city manufactures silk and woolen goods, metal ware, machinery, chemicals, and paper. Population (commune), in 1881, 31,249; in 1901, 33,987. Treviso, the Roman Tarvisium, was an important city toward the end of the Roman Empire. It figured among the cities of the Lomabrd League. It came under the rule of Venice in the fourteenth century. In 1797 it was taken by the French under Mortier, who received the title of Duke of Treviso.

TREV′ITHICK, Richard (1771-1833). A British mechanical engineer and inventor, distinguished for his improvements of the steam engine and as the designer of the first practicable locomotive. He was born at Illogan, in Cornwall, and received a common-school education previous to becoming an engineer in the mines in his vicinity. Engaged in the construction of pumping and other engines, he was associated with Murdock, Bull, and other well-known engineers and was constantly experimenting with machinery. He was as well known in his neighborhood for his muscular strength as for his inventive genius. He effected various improvements in pumps and designed a high-pressure steam engine in 1800 which was soon in wide use in the mines of Cornwall and Wales. Turning his attention to the designing of steam vehicles, as early as 1796 he made a number of models on a small scale, and in 1801 completed a full-size vehicle for which he received a patent in the following year. This steam carriage operated so successfully that Trevithick with the assistance of Andrew Vivian was led in 1804 to build a locomotive engine to operate on the Merthyr-Tydvil tram road. This was the first application of steam to the hauling of loads on a railway and led to the construction of further steam locomotives operating on rails, including one which was exhibited in London in 1808 on a circular track. As Trevithick understood that the friction of the wheels on the rails was sufficient for the traction of cars on ordinary grades (in distinction from other inventors who employed a cog and rack), and as he was the first to use a return flue boiler and a steam jet in the chimney, and to couple together the wheels of a locomotive, he is considered by many entitled to the credit of being the real inventor of the locomotive steam engine. It is however, to Stephenson (q.v.) that we must look for the perfection of a practical application of the machine. See Locomotive, in which article will be found descriptions of Trevithick's locomotives. See also Railways.

After devoting himself to the construction of steam drills and dredging machines he became interested in an unsuccessful attempt to tunnel the Thames, and also carried on experiments on engines suitable for ship propulsion and other purposes. In 1816 Trevithick went to Peru, where a number of his engines had been introduced into the silver mines, and after being successful in several undertakings, lost his entire property through the outbreak of war, which forced him to retire from the country. At Cartagena in 1827 he encountered Robert Stephenson (q.v.), who assisted him to return to England. The remainder of his life was spent in further experiments, few of which came to a successful outcome, and he died in poverty. While Trevithick reaped but little material reward for any of his inventions, yet he made many discoveries which were of the greatest use to other engineers when practically applied and successfully developed. His work for the steam engine stands out conspicuous and ranks him among the most prominent engineers and inventors of the nineteenth century. Consult: Trevithick, *Life of Richard Trevithick* (London, 1872); Smiles, *Lives of Engineers* (ib., 1861).

TRIAD (from Lat. *trias*, from Gk. *τριάς*, number three, triad, from *τρεῖς*, *treis*, three). In music, a chord of three tones built upon any tone with its third and fifth above. According to the character of the intervals the character of the triad varies materially. Thus, C E G consists of a major third + a minor third; C E♭ G of a minor third + major third; C E G♯ of two major thirds; C E♭ G♭ of two minor thirds. These triads are known as major, minor, augmented, and diminished triads, respectively. If in four or five part writing one or two tones of a triad are doubled, the character of the triad is not at all affected. See Harmony.

TRIAL (OF. *trial*, from *trier*, to try, choose, thresh, from ML. *tritare*, to thresh, rub, frequentative of Lat. *terere*, to rub, thresh; connected with OChurch Slav. *trieti*, *trŭti*, Lith. *triti*, *trinti*, to rub). A regular and formal examination or inquiry into the material facts of a controversy in issue before a competent tribunal, in order finally to determine the respective rights of the parties thereto. Trials may be divided into two classes: those by a judge and jury, and those before a judge without a jury. In a legal action the trial is usually before a jury. (For the ordinary steps in a jury trial, see Jury.) In courts of equity, trials are conducted before the chancellor or judge without a jury, substantially in the same manner as in a jury trial. The codes of reformed procedure and practice acts in most of the States regulate the details of trials in their various courts. See the articles Evidence; Jury; Pleading; Practice; Nonsuit; Nolle Prosequi; etc., and consult the authorities referred to under Pleading; Evidence; Jury; etc.

TRIAL BY JURY. The first comic opera by Gilbert and Sullivan (1875). Its success was due largely to its allusions to the Tichborne Case (q.v.), then at its height.

TRIANGLE (Lat. *triangulus*, three-cornered, from *tres*, three + *angulus*, angle). A figure formed by three intersecting lines. The sides of a *plane* triangle are straight lines, and those of a *spherical* triangle are geodetic lines or arcs of great circles. Triangles are called *equilateral, isosceles*, and *scalene* according as three sides, two sides, or no sides are equal. Of two angles of a plane triangle that opposite the greater side is the greater, but the angles do not vary as the sides, the ratio of two sides being equal to that of the sines of the opposite angles. (See Trigonometry.) In a spherical triangle the sines of the sides are proportional to the sines of the opposite angles. The sum of the angles of a plane triangle is 180° according to Euclidean geometry (see Geometry); but in the case of a spherical triangle the sum varies from 0° to 540°. The geometry of the triangle is extensive, and a few of the most important propositions are given under Concurrence and Collinearity, and Maxima and Minima. The area of any plane triangle is given by the formulas $\triangle = \frac{bh}{2}$ and $\triangle = \sqrt{s(s-a)(s-b)(s-c)}$, where b is the base, h the altitude, a, b, c the sides, and s the semi-perimeter. In case the triangle is equilateral $\triangle = \frac{a^2\sqrt{3}}{4}$, where a is the side. If one angle of a plane triangle is a right angle the triangle is called a right-angled triangle, the side opposite the right angle being the hypotenuse. The *spherical* triangle of one, two, or three right angles is called a rectangular, birectangular, or trirectangular triangle, respectively. The spherical triangle in which one, two, or three sides are quadrants is called a quadrantal, biquadrantal, or triquadrantal triangle, respectively. The area of a spherical triangle is given by the formula $\triangle = \frac{\pi R^2 E}{180}$, where R is the radius of the sphere and E the spherical excess (q.v.), or $A + B + C - 180°$. Consult Catalan. "Quelques formules relatives aux triangles rectilignes," in the *Mémoires couronnés* of the Brussels Academy (1891); Casey, *Sequel to Euclid* (5th ed., Dublin, 1888).

TRIANGLE. A musical instrument consisting of a steel rod bent into a three-sided figure open at one angle. It is hung by a string at the upper angle, and attached to the performer's left hand, to his desk, or to his drums. Modern composers frequently use it in marches, dances, and fantasias. As it is only used for rhythmic figures, the music is written, as for drums and other instruments without fixed pitch, upon a single line.

TRIANGLE SPIDER. A spider (*Hyptiotes cavatus*) of the family Uloboridæ, common in the Eastern United States. Its web is usually stretched between the twigs of dead branches and at first appears like the fragment of an orb web. It consists of four plain radiating lines and a series of double cross-lines. From the apex of the triangle a strong line extends to the supporting twig. The spider stations itself on this line and draws up a slack which when loosened jars the whole web, entangling engaged insects in the cross-threads. Consult Wilder, in *Popular Science Monthly*, 1875.

TRIANGULAR NUMBERS. See Number.

TRIANGULATION. A method used in surveying when the area to be surveyed is of considerable extent. It consists, as the name indicates, in laying out a system of triangles by means of which intermediate points are located. See Surveying.

TRIANON, trē'ȧ'nôɴ'. The name given to two villas in the Park of Versailles. The Grand Trianon was built in 1685 by Louis XIV. for Madame de Maintenon, and is a handsome building, one story in height, containing interesting furnishings. In it the trial of Marshal Bazaine took place in 1873. The Petit Trianon, built by Louis XV. in 1776 for Madame Du Barry, was afterwards a favorite resort of Marie Antoinette. It has a fine English garden with a Temple of Love, a lake, and several rustic cottages.

TRI'AR'THRUS (Neo-Lat., from Gk. τρεῖς, *treis*, three + ἄρθρον, *arthron*, joint). A genus of Ordovician trilobites with depressed convex carapace of elongate oval outline, of which the middle third is occupied by the broad axis. The thorax has 14 to 16 segments in the middle of each of which there is a rounded knob, and the pygidium is small and semicircular. The best known species is Triarthrus becki of the Utica shale of North America. See Trilobite.

TRIASSIC SYSTEM (from Lat. *trias*, number three, triad). A group of rocks immediately following the Carboniferous and preceding the Jurassic system. It is therefore the oldest formation of the Mesozoic era. The rocks of this system were at first associated with the Permian under the name of the New Red Sandstone (q.v.), but they were finally separated and designated as the Trias by German geologists, who divided the system into three series, the Keuper, Muschelkalk, and Buntersandstein. The Rhætic clays and sandstones were subsequently added to the system.

Much difficulty has been found in subdividing the American Trias, and still more in correlating it with the European beds. Indeed, in the United States it is often difficult to separate the Triassic from the Jurassic, and consequently the plan adopted by the United States Geological Survey is to designate them as the Jura-Trias, thus considering the deposits as one formation. The American Triassic is subdivided as follows:

	Pacific Border	Atlantic Border
TRIASSIC SYSTEM	Bajuvaric Series	Newark Series
	Tirolic Series	
	Dinaric Series	
	Scythic Series	

The Pacific Coast beds are marine, while those of the Atlantic border are estuarine. In the Eastern States the Triassic formation consists of a series of sandstones and shales extending more or less unbrokenly from the Connecticut Valley to South Carolina. The rocks were deposited in shallow water along the continental shores. The Newark rocks are in many places faulted and intruded by igneous rocks, the eruptions having in some cases occurred while the deposition of sediment was still going on, being thus in the nature of submarine outbursts. The Palisades of the Hudson River and the East Rock at New Haven, Conn., are formed of diabase erupted during the Triassic period. Some doubt exists as to whether the Triassic rocks of the Atlantic border were one continuous belt or whether they were deposited in separated troughs. In the interior of the continent along the Rocky Mountains there are extensive beds of red sandstone which were deposited in an inland sea, but whether they belong to the Triassic or Jura-Trias is unsettled. On the Pacific Coast the Triassic rocks have a maximum thickness of nearly 5000 feet. Triassic rocks are known in Central and South America, Europe, Asia, and Australasia.

The plant life of the Triassic included ferns, cycads, conifers, and gigantic representatives of the Equiseta or horsetails. The accumulated remains of these plants contributed to the formation of important coal seams. Among the vertebrates fishes were fairly abundant, the dominant type being ganoids; but the most characteristic class was the Amphibia, which attained its greatest development in this period. Of reptiles the ichthyosaurs, plesiosaurs, dinosaurs, crocodiles, and turtles were present, while the earliest representatives of the Mammalia came into existence.

The Triassic beds of the Atlantic border yield great quantities of sandstone (brownstone) for building, which has been quarried chiefly in the Connecticut Valley and New Jersey. Deposits of coal are found in the Triassic of Virginia and North Carolina and in parts of Europe, but they are of minor importance compared with the great coal measures of the Carboniferous age.

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TRIBE (Lat. *tribus*, tribe; possibly connected with *trabs*, beam, Oscan *trübom*, Lith. *trobà*, building, OWelsh, OBret. *treb*, habitation, subdivision of the people, Goth. *þaúrp*, field, OHG. *dorf*, Ger. *Dorf*, Eng. *thorp*, village, or perhaps rather with Lat. *tres*, three, cf. Gk. τριφυής, *triphyēs*, Skt. *tribhu*, threefold, in allusion to the three legendary tribes of early Rome; hardly connected with Gk. ἀτρύγετος, *atrygetos*, unfruitful, or with OChurch Slav. *trŭgŭ*, market-place). In general, an interrelated group, as a group of individuals defined on the basis of relationship; specifically, a consanguineal group of mankind. In savagery the social organization rests on the basis of kinship traced in the female or maternal line. Usually the family comprises the mother with her children. The rôle of the husband and father is often that of a perpetual guest possessing little if any right over property or person; while the several families of sisters (i.e. daughters of the same mother) form a clan of which the mother or elderwoman is the lawgiver and her eldest brother the executive or chief. Commonly several such clans coexist and are united on the basis of real or assumed sisterhood of the elderwomen or on some other basis connected in some way with kinship; and the union constitutes a tribe in the specific sense of the term. Ordinarily the tribe is perpetuated by marital regulations; mating is usually proscribed within the clan, which thereby becomes exogamous, and prescribed within the tribe, which is thereby rendered endogamous, and in more primitive societies, such as that of the Australian natives and that of certain American aborigines, the laws are complex and restrict intermarriage to certain clans and even to a certain order within these clans. While the elderwomen remain lawgivers in the tribe as in the clan, the larger organization requires enlarged executive powers, which are usually vested in elder brothers of the matrons, so that the control is measurably or wholly avuncular. In a still further enlargement of the group by multiplication of families the chiefs assume added prerogatives, and their power may rise above the kinship bonds and may even become hereditary, so that a reigning clan may be established. In the somewhat more advanced culture commonly called barbarism the family and tribal organization undergo a change; paternity is recognized and kinship is traced in the male lines; and commonly the father assumes control of property and person, exercising authority not only over his children, but over his wife or wives. This stage is that of patriarchy with its concomitants of enslavement and polygamy. In the patriarchal condition the group of closely related families forms a gens, while the less closely related gentes are usually organized in a tribe under a common chieftaincy. The organization is perpetuated partly by means of marital customs and partly by means of property regulations, while the chiefship may be determined in various ways; yet the fundamental idea of the social organization or law remains that of kinship or consanguinity, either real or assumed. The chief function of the tribe is military, while that of the clan is juristic. The social organization on this basis is conveniently styled tribal society, in contradistinction from the national society found among peoples organized on a territorial basis. Consult: Morgan, *Ancient Society* (New York, 1877); Maine, *Ancient Law.*

TRI'BONIA'NUS. A distinguished Roman jurist of the sixth century A.D. He was of Macedonian parentage, but was born at Side, in Pamphylia. He held, under the Emperor Justinian (q.v.), the offices of quæstor, master of the Imperial household, and consul. But he is famous chiefly through his labors in connection with the

Code of Justinian and the pandects. Tribonianus died in 545.

TRIBUNE (Lat. *tribunus*, originally a tribal officer, from *tribus*, tribe). In ancient Rome the name tribune was applied to two distinct functionaries, the military tribunes (*tribuni militum*) and the tribunes of the plebs (*tribuni plebis*), which will be considered separately. (1) In the traditional organization of the citizens by Romulus the leader of the quota of warriors furnished by each of the three tribes was called *tribunus militum;* and the same was true when the tribes were increased to four under Servius Tullius, when we read also of *tribuni ærarii*, whose duty it was to collect and pay into the treasury the tribal taxes ('tribute'). Under the Republic each legion was under the command of six military tribunes, at first appointed by the consuls (who were the commanders-in-chief), afterwards elected at the *comitia tributa.* Their importance was greatly diminished at the end of the Republic, when the actual command of the legion in the field was confided to a skilled officer called *legatus legionis*, and the six *tribuni militum* were retained only as an honorary staff of the general. With the formal development of the *cursus honorum*, or regular sequence of offices for men of senatorial rank, the military tribuneship took its place in the preliminary service, as a stepping-stone by which young nobles might reach the higher positions. Under the Empire the name *tribunis* was given also to the officers of each cohort of the prætorian guards, city guards (*cohortes urbanæ*), and night-watch (*vigiles*).

(2) In the early period all the perquisites and prerogatives of government in Rome were in the hands of the patricians, while the plebs, the bulk of the people, had only the burdens of taxation and military service. This galling condition is said to have been partly remedied by the secession of the plebs in B.C. 494, when they secured the right to have annual magistrates, called *tribuni plebis*, chosen from their number to look after their especial interests and needs. These were six in number (at first perhaps five), served for one year, and were reëligible. They were invested with three important privileges: (1) *ius auxilii*, the right to defend a plebeian on any charge; (2) *intercessio*, the right of vetoing any measure proposed by the senate; (3) personal inviolability during their term of office. After B.C. 471 the tribunes were regularly elected by the popular *comitia tributa.* The power and energy of the plebeian tribunes were responsible for the gradual extension of political rights to all the people, and to the struggle between patricians and plebeians that marks the history of the Republic. They caused the codification of the laws ('Twelve Tables') in B.C. 451; the recognition of the popular decrees (*plebiscita*) as binding on all alike, B.C. 449; the right of intermarriage between patricians and plebeians by the *lex Canuleia*, B.C 445; the successive opening up of the high offices to the plebeians; the Licinian Rogations (q.v.), B.C. 367; and the agrarian agitation of Tiberius and Gaius Gracchus. (See GRACCHUS). Augustus Cæsar took to himself the power and rights of the tribunes (*tribunicia potestas*), and hence under the Empire the office lost its importance, becoming a function for senators of plebeian rank, held between the quæstorship and the prætorship.

TRIBUTE (Lat. *tributum*, from *tribuere*, to grant, pay, or assign, originally to a tribe, from *tribus*, a tribe). Money, commodities of value, or services rendered by one ruler or State to another in token of submission, as distinguished from taxation, which is the legal imposition of financial burdens by a State upon its own subjects. This distinction cannot be said, however, always to have prevailed, and under the feudal system especially, taxation, tribute, and rent were in many cases identical. This was natural under a system where the political superior was at the same time the owner of the land, and where such land was held largely by military tenure. 'Aids' and 'reliefs' were essentially of the nature of tribute, as also were the tolls and services levied upon the cultivators of the soil by their lords, or exactions like that of heriot (q.v.). See FEUDALISM.

TRICER'ATOPS (Neo-Lat., from Gk. *τρεῖς*, *treis*, three + *κέρας*, *keras*, horn + *ὤψ*, *ōps*, face). A very interesting fossil reptile, a horned dinosaur of most formidable aspect, of which skeletons are found in the Upper Cretaceous rocks of Colorado, Dakota, Wyoming, and Montana. The animal was about 25 feet long, with heavily built legs and powerful tail. The most peculiar feature is the heavy armature of the massive head. The skull is larger than that of any other known land animal, with a length of six feet and a width across the crest of about five feet. It is wedge-shaped and narrow in front of the small orbits, and expanded behind into a broad solid bony frill or crest which projects far backward over the neck and shoulders, and the edges of which are armed with a row of sharp projections that were covered with horn.

On the facial region of the skull are three horns: a long outward spreading pair over the orbits and a small horn on the nose. The jaws have strong turtle-like beaks on their tips and series of two-rooted teeth placed in sockets in their posterior portions. The brain of this creature was smaller than that of any other known vertebrate, with a ratio to bulk of body of two pounds to ten tons. The feet were three-toed, and the beast walked on all fours and fed on plants. Consult: Zittel and Eastman, *Textbook of Palæontology*, vol. ii. (London and New York, 1902); Marsh, "The Dinosaurs of North America," *Annual Reports of the United States Geological Survey*, vol. xvi., part i. (Washington, 1896); Lucas, *Animals of the Past* (New York, 1901), which contains interesting observations on the habits of Triceratops. See DINOSAURIA.

TRICHIASIS, trĭ-kī'ȧ-sĭs (Neo-Lat., from Gk. *τριχίασις*, from *θρὶξ*, *thrix*, *τριχός*, *trichos*, hair). An inversion of one or more eyelashes, their points rubbing against the globe of the eye. It results from cicatricial contraction or long continued inflammation of the eyelids. The symptoms, like those of entropion (q.v.), are caused by irritation of the conjunctiva by the rubbing of the eyelashes. Unlike entropion, however, the inversion of the hairs is not due to inversion of the margins of the lids, which are in their natural position. This affection causes great annoyance, by exciting a pricking sensation, and by the constantly irritated and watery state of the eye which it induces. The treatment consists in plucking out the offending hairs (if they are few in number) from time to time. Electrolysis may be employed. If they form a little group, they must be removed by dissecting out a portion of the lid and uniting the wound with a suture. In other cases it may be necessary to remove the entire margin of the lid.

TRICHINA, trĭ-kī'nȧ (Neo-Lat., from Gk. θρίξ, *thrix*, hair). A peculiar nematode worm, which, in its sexually immature state, inhabits the muscles of mammals, usually the pig. It was discovered in 1835.

The young trichinæ, as they are seen in human muscle, present the form of spirally coiled worms, in the interior of small, globular, oval, or lemon-shaped cysts, which appear as minute specks scarcely visible to the naked eye. The cysts are sometimes altogether absent, and hence they must be regarded as formations resulting from local inflammation set up by the presence of the worm, which in this larval condition of existence measures about a millimeter long. These larval worms exhibit a well-marked digestive apparatus, and afford evidence of the presence of reproductive organs, which are often sufficiently developed to enable the observer to determine the sex. The number of larval trichinæ that may simultaneously exist in the muscles of a single man or animal is enormous.

When an animal is fed with flesh containing the larval worm and is killed a few days afterwards, a large number of minute worms are found mixed with the contents of the small intestines. On the second day after their introduction these intestinal trichinæ attain their full sexual maturity, and in six days the females contain perfectly developed and free embryos in their interior.

The female is a slender round worm, varying in length from $\frac{1}{12}$ to $\frac{1}{8}$ of an inch. The anterior end presents a bead-like appearance, from which the intestinal canal proceeds. The posterior three-fourths are mainly occupied by the reproductive organ, which is filled partly with free embryos, and partly with eggs in various stages of maturity. The females continue bringing forth young for a period of two or three weeks. The embryos penetrate the walls of the intestine, and pass either through the body cavity or by means of the blood-vessels into the muscles of the host, where, if the conditions are otherwise favorable, they are developed into the encysted form. Some of them reach the muscles of the extremities and other distant parts; but the majority remain in those sheathed muscular groups which are nearest to the cavity of the body (abdomen and thorax), especially in those which are smaller and most supplied with connective tissue. These embryos penetrate into the interior of the separate muscle fibres, and in the course of fourteen days acquire the size and organization of *Trichina spiralis*. In the adult condition trichinæ perish in cold water in about an hour, and cannot survive the decease of their host for more than six hours, but the larvæ remain alive in water for a month, and will live for a long time in flesh which has become putrid. In this way a carcass near a marsh or rivulet may communicate the parasites to the ruminants that drink the water, or to pigs. The formation of the cysts is the cause of more or less serious injury to the host, according to the number present. When abundant, the weakness is very marked and is often fatal. In man infection occurs, almost invariably through the eating of raw or underdone pork containing the cysts. If the meat is properly cooked the worms will be destroyed. Consult Braun, *Die tierischen Parasiten des Menschen* (Würzburg, 1902). See PARASITES, ANIMAL.

TRICHINIASIS, trĭk'ĭ-nī'ȧ-sĭs, or **TRICHINOSIS**, -nō'sĭs (Neo-Lat., from *trichina*, trichina). A disease caused by the ingestion of food containing trichina (q.v.), characterized by a number of puzzling symptoms. The disease was noted by Wormald, who saw the characteristic specks while dissecting subjects in Saint Bartholomew's Hospital; but its cause was demonstrated by Paget and the naturalist Robert Brown, in 1835. Virchow (q.v.) first propagated the nematode in an animal and demonstrated its presence in the intestine in 1859. Leuckart in the following year presented a full, lucid, and complete solution of the whole question. After being swallowed, in pork, for example, the trichina worms traverse the connective tissue and gain access to all parts of the body. They are found, after death, in the muscles of the trunk and head, as well as in the extremities; and most thickly placed in the diaphragm, the intercostals, the muscles of the neck (especially of the larynx) and of the eyes. The intestinal mucus also contains many. The intestinal canal shows catarrhal changes. The mesenteric glands are swollen. The heart muscle is almost invariably free from invasion.

The symptoms of the disease are as follows: On the second or third day after eating the infected meat the patient suffers from nausea, vomiting, colic, and diarrhœa. Constipation may follow. The muscles then become weak, and great weariness is experienced. Between the tenth day and the sixth week the muscles become stiff, of a wooden consistency, and very tender. This condition is most noticeable in the flexors of the extremities, and occasionally the knees or elbows will be bent and rigid. The temperature generally remains normal or is subnormal; rarely it rises. Œdema is characteristic and appears about the seventh day, first in the eyelids and the face, next in the extremities. In the legs it may be extreme. It is probably due to toxins excreted by the parasites. Owing to the invasion of the larynx, hoarseness or aphonia is common, as also dyspnœa, bronchitis, and pneumonia. Profuse sweating is also characteristic. Acne, herpes, and boils may appear on the skin; pruritus is common. Insomnia is a common symptom and is constant in severe cases. Headache occurs if pneumonia be present. Swine suffer principally, among the lower animals; but rats, mice, rabbits, and guinea pigs are easily infected. Horses, cattle, sheep, goats, and dogs are with difficulty infected. It has been stated by some that rats carry the parasites to swine. Cats are occasionally victims of trichiniasis.

It is supposed that the parasite gained access into Europe through the introduction of the Chinese pig early in the nineteenth century. The disease was epidemic in Syria in 1881. It has appeared in Algiers; in South America; in the West, and Massachusetts; in the United States;

in France; in Basle, Switzerland; in Malaga, Spain; in Russia, Sweden, Norway, and Denmark; in England in 1871; in North Germany, since 1849, an epidemic occurring in Hettstädt in 1863.

Prophylaxis consists in inspection of swine, after slaughtering, by competent microscopists, who shall take sections from the muscles of mastication, the laryngeal and abdominal muscles, and the diaphragm.

There is no treatment for the disease, and in all probability many non-fatal cases occur which are diagnosed as rheumatism or some acute fever, as well as some cases of pneumonia in which the trichina parasite is the unidentified cause. Consult: Chaten, *La trichine et la trichinose* (Paris, 1883); Leuckart, *The Parasites of Man* (trans. by Hoyle, London, 1886).

TRICHINOPOLI, trĭch′ĭ-nŏp′ō̇-lĭ. The capital of a district of Madras, British India, on the right bank of the Kaveri, below the island of Srirangam (q.v.), 56 miles from the sea, and 190 miles by rail southwest of Madras (Map: India, C 6). The old town, now inclosed by boulevards, stands at the base and on the rugged slope of a granite rock 273 feet high, crowned by a temple, a much-frequented pilgrimage shrine. The native town is inhabited by a dense population dwelling in low, closely packed huts. The chief building is the former Nawab's palace, now restored and used as Government offices. There are several Protestant missions and a college, and also a Jesuit college. Beyond the boulevards is Saint John's Anglican Church, containing the tomb of Bishop Heber, who died here in 1826; to the south near Golden Rock, a hill about 100 feet high, is the central jail, one of the largest buildings of its kind in Madras. Cheroots are manufactured in large quantities from excellent tobacco grown in the vicinity. Weaving and the manufacture of hardware, cutlery, jewelry, gold chains, harness, and saddlery are extensively carried on. Trichinopoli was governed by a line of rajas that died out in 1732 when it came under the rule of the Nawab of Arcot. It came under British control in 1801 with the rest of the region. Population, in 1891, 90,609; in 1901, 104,690.

TRICHOME (from Gk. τρίχωμα, *trichōma*, growth of hair, from τριχοῦν, *trichoun*, to furnish with hair, from θρίξ, *thrix*, hair). A hair-like outgrowth from the epidermis of plants, usually arising from a single cell. These structures are known variously as hairs, glands, bristles, bladders, scales, prickles, warts, etc., and may be one or many celled. The long hairs on the seeds of cotton are simple and unicellular. The filaments on the stamens of the spider lily (Tradescantia) are multicellular and simple. Branched unicellular hairs may be found on the common shepherd's purse (Capsella) and branched multicellular hairs on mullein. Hairs with flattened expansions at the top are called scales. Glandular hairs are widely distributed among plants, being usually unbranched and with a knob at the apex, which secretes such substances as resins, gums, ethereal oils, mucilage, and sugar. When the substance is secreted in a liquid form it moistens the surface, but when volatile it is recognized as an odor. Root-hairs are one-celled outgrowths from the epidermis of the root, having very delicate walls. Their office is to absorb nutritive materials for the plants. Many plants and organs which bear hairs during early stages of development become smooth as they grow older. Environment also affects the hairiness of a structure. A plant growing in a very dry situation may be hairy, while another individual of the same species growing in a wet situation may be much less hairy or even entirely smooth. Systematists have made large use of the trichome in describing plants, and have developed a large number of descriptive terms.

TRICHOPTERA, trĭ-kŏp′te-rȧ (Neo-Lat. nom. pl., from Gk. θρίξ, *thrix*, τριχ-, *trich-*, hair + πτερόν, *pteron*, wing). An order of insects containing the caddis fly (q.v.).

TRICOLOR (Fr. *tricolor*, from Lat. *tres*, three + *color*, color). Literally a flag in three colors, which is the case in almost every national ensign, but usually restricted in sense to flags having three colors in equal masses. The principal tricolor ensigns are those of France—blue, white, and red, divided vertically; Germany—black, white, and red, divided horizontally; Russia—white, blue, and red, divided horizontally; Italy—green, white, and red; Belgium—black, yellow, and red; and Mexico—green, white, and red; the last three all divided vertically. The French tricolor took its use at the outbreak of the Revolution of 1789, as the badge of the National Guard. The red and blue were selected as the arms of Paris, and the white was added as the color of the army, to show the intimate union which should subsist between the people and the national defenders.

TRICYCLE. See BICYCLE.

TRIDENT (Lat. *tridens*, three-toothed, from *tres*, three + *dens*, tooth). In classic mythology, the attribute of Poseidon, god of the sea. It consists of a staff, armed at one end with three short prongs, with double barbs at the points.

TRIDYMITE (from Gk. τρίδυμος, *tridymos*, three-fold, from τρεῖς, *treis*, three; so called from its frequent crystallization in groups of three). A mineral silicon dioxide crystallized in the hexagonal system. It resembles quartz, from which it differs, however, in having a lower specific gravity. It occurs chiefly in acidic volcanic rocks and was originally discovered in 1868 in the trachyte of San Crystobal in Mexico. It has since been found in various localities in Germany, Hungary, and elsewhere. It has been prepared artificially by dissolving a silicate in a bead of phosphorus salt.

TRIENNIAL ACT. A British statute of the reign of William III. (1694), directing that no Parliament should last longer than three years. This period was extended to seven years by the Septennial Act of George I. (1716).

TRIER, trēr. The German name for Treves.

TRIEST, trē̇-ĕst′, or **TRIESTE**. The principal seaport of Austria-Hungary, situated at the northeast extremity of the Adriatic Sea, on the Gulf of Triest, 367 miles by rail southwest of Vienna (Map: Austria, C 4). Triest and the adjoining district form an Austrian crownland, and the city is the general administrative seat of the Austrian Küstenland (q.v.). The city, which is strongly fortified, extends somewhat in the manner of an amphitheatre along the acclivity of the Karst (q.v.). The old town, with its narrow, crooked, and steep streets, lies at the base of the Castle Hill and between it and the gulf. In its northwestern corner, close to the water, is the Tergesteo, whose cruciform arcades, roofed with glass, are used for the exchange. Near by are the two leading squares, the Piazza della Borsa and the Piazza Grande. From this vicinity the Corso, the principal street, extends eastward, separating the old town from the new quarter, where broad avenues lead up toward the inclosing hills. On the west side of the Castle Hill, in the old town, the cathedral occupies a conspicuous site where a Roman temple once stood. It is a composite structure, dating from the fourteenth century. It was formed by joining three ecclesiastical edifices, which had stood there since the sixth century. On the Piazza Grande are the splendid new municipal buildings. Triest has a Museo Lapidario, an open-air museum of Roman antiquities, occupying an old cemetery. The town possesses a nautical academy containing the municipal museum, with Roman antiquities, and the Ferdinand-Maximilian Museum, remarkable for its collection of Adriatic fauna.

Toward the southern end of the city is the Museo Civico Revoltella, in the palace of that name. Near by stands the fine bronze monument to Maximilian of Mexico by Schilling. From this point leading south and following the curve of the gulf extends the Passeggio di Sant' Andrea, affording fine views for more than three miles, and reaching the vast wharves of the Lloyd Company. The public gardens are on the northeast of the city. Among the attractions of Triest is the famous Château of Miramar, situated on the sea to the northwest, which belonged to Maximilian. It has a lovely park and offers beautiful sea views. The city contains a Greek church with rich decorations, a Jesuits' church, and a Capuchin convent. There are a university, a royal academy with an observatory, a public library with over 50,000 volumes, and the literary Società della Minerva.

The harbor, the main attraction of Triest proper, has been greatly extended and improved. There are a number of moles and an immense breakwater. The Canal Grande (only 400 yards long) penetrates the city north of the Corso, and permits vessels to load and unload at the warehouses. Triest has a naval arsenal and is the storehouse for the Imperial Navy. Since 1891 the whole town, except the harbor proper, has been inside the customs limit. Triest has of late years found a dangerous rival in the Hungarian port of Fiume, but its commercial preëminence is vigorously supported by the Austrian Government. Nearly 20,000 vessels visited the harbor in 1901, with a total tonnage in and out of 4,560,000, with cargoes valued at $127,000,000. Corn, oil, wine, and many other products are heavily dealt in. The local mercantile fleet is large. At the Austrian Lloyd shops many vessels are annually constructed, and over 3000 men are employed. Triest builds ships of all varieties, and manufactures marine steam engines, cables, furniture, silks and cottons, clothing, liquors, wax-lights, soap, etc. The population in 1900 was 134,143. The Italians largely predominate.

HISTORY. Triest is the Roman Tergeste. It has belonged almost uninterruptedly to Austria since 1382. It was made a free port in 1719 by Charles VI., which date marks the beginning of its importance. It finally became the commercial rival of Venice. Consult: Löwenthal, *Geschichte der Stadt Triest* (Triest, 1857-59); Scussa, *Storia cronografica di Trieste* (ib., 1885-86).

TRIFAIL, trē′fīl. A town in Styria, Austria, on a tributary of the Save, 66 miles southwest of Marburg. Trifail has one of the most productive mines of lignite in Austria. There are large cement, chemical, and glass works. Population, in 1900, 10,851.

TRIFOLIUM. See CLOVER.

TRIFO′RIUM (ML., from Lat. *tres*, three + *foris*, door, opening), or TRIFORIUM GALLERY. The arcade opened up in the wall of the nave of a mediæval church immediately above the vaults of the side aisles and under the line of clerestory windows. The name was derived from the custom of dividing each bay of this gallery into three arches, though this was by no means the constant rule, early galleries having often a single arch and later ones having two, four, or more arches in each bay. The triforium was usually inserted between the summit of the aisle vault and the top of its slanting roof, but in developed Gothic the roof-line was often changed so as to let light into the gallery. While not unknown in Romanesque architecture, this was especially valuable as a feature of Gothic interiors. The earlier Gothic churches had higher galleries, especially in England, on account of the high Norman galleries; and during the thirteenth century the French Gothic diminished their size and usefulness, retaining them mainly for decorative purposes and as blind or semi-blind galleries, whereas at first they could be used by the congregation.

TRIGGER-FISH. One of the fishes of the plectognath family Balistidæ, characterized by an ovate body covered with large rough scales, and the fact that the first spine of the anterior of the two dorsal fins is high and very strong, and may be lifted, when it is locked erect by the spine behind it; whence the name. About fifty species are known, mainly in the Indo-Pacific region, where they become rather large and remain near shore; some are herbivorous, others carnivorous. Their flesh is rarely eaten, as it is reputed poisonous, and in some cases, at least, does produce death with muscular spasms and extreme suffering. Several species of the genus Balistes inhabit the American tropics, of which one, the cicuyo, or leather-jacket (*Balistes Carolinensis*), is very common in the Gulf of Mexico and on our South Atlantic coast, and also in the Mediterranean Sea. See Plate of PLECTOGNATH FISHES.

TRI′GLYPH (Lat. *triglyphus*, from Gk. *τρίγλυφος*, three-grooved, from *τρεῖς*, *treis*, three + *γλύφειν*, *glyphein*, to carve). In the Doric frieze, the projecting block between the metopes (q.v.). It is supposed to represent the ends of the beams in the original structure of wood and crude brick. Its face regularly contains two triangular, vertical furrows, and the edges are chamfered.

TRIGO′NIA (Neo-Lat. nom. pl., from Gk. *τρίγωνος*, *trigōnos*, triangular, from *τρεῖς*, *treis*, three + γωνία, *gōnia*, angle). This genus, represented at the present time by only five species living in the Australian seas, was one of the most important types of lamellibranchs in the Mesozoic seas of Europe. Trigonia appeared first in the Liassic, became very abundant in the Middle and Upper Jura and the Middle Cretaceous, and then in the Tertiary declined in number of species to the present time. The Mesozoic species, some of which are four or five times the size of the living species, are arranged into groups according to the markings of their shells, which are often elaborately sculptured. Consult: Louis Agassiz, *Etudes critiques sur les mollusques fossiles. Memoire sur les trigonies* (Neuchâtel, 1840); Lycett, "A Monograph of the British Fossil Trigonias," *Palæontographical Society Monographs* (London, 1872-79); Von Zittel and Barrois, *Traité de paléontologie*, part i., vol. ii. (Paris, Munich, and Leipzig, 1887).

TRIG′ONOCAR′PUS (Neo-Lat., from Gk. τρίγωνος, *trigōnos*, triangular + καρπός, *karpos*, fruit). Fossil seed pods and fruits, probably of various kinds of plants, which in cross section have a triangular form. See Carpolith; Cordaites; Conifera; Paleobotany.

TRIGONOMETRIC SERIES. See Series.

TRIGONOMETRY (from Gk. τρίγωνον, *trigōnon*, triangle, from τρεῖς, *treis*, three + γωνία, *gōnia*, angle + -μετρία, *metria*, measurement, from μέτρον, *metron*, measure, from μετρεῖν, *metrein*, to measure). Originally the study of triangles, especially the theory of the measurement of their sides, angles, and areas; now the measure of triangles is merely a part of the general subject. That portion of the subject which deals with the measurement of figures in a plane is called *plane* trigonometry, and that which deals with figures on the surface of a sphere is called *spherical* trigonometry. That branch of the subject which deals with the circular functions of angles is called *goniometry.* The pure theory of trigonometric functions, apart from their application to problems of measurement, is called *analytic* trigonometry. Elementary trigonometry has many useful applications, as in the measurement of areas, heights, and distances. It is indispensable to the study of astronomy, physics, and the various branches of engineering.

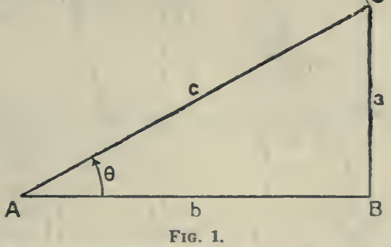


Fig. 1.

The common functions of trigonometry may be defined as ratios of certain sides of a right triangle. Thus, in the figure, the ratio $\frac{a}{c}$ is called the *sine* of the angle θ, commonly written $\sin\theta = \frac{a}{c}$. The ratio $\frac{b}{c}$ is called the *cosine* of the angle θ, written $\cos\theta = \frac{b}{c}$. The other functions are *tangent* of θ symbolically written $\tan\theta = \frac{a}{b}$; *cotangent* of θ, or $\cot\theta = \frac{b}{a}$; *secant* of θ, or $\sec\theta = \frac{c}{b}$; and *cosecant* of θ or $\operatorname{cosec}\theta = \frac{c}{a}$. There are also used the functions *versine* of θ, or $\operatorname{vers}\theta = 1 - \frac{b}{c}$; and *coversine* of θ, or $\operatorname{covers}\theta = 1 - \frac{a}{c}$. The propriety of calling these ratios 'functions' of the angle θ consists in this, that the value of any ratio depends upon the value of θ. That is, in any right-angled triangle AB′C′, having an acute angle θ, the corresponding ratios $\frac{a'}{c'}, \frac{b'}{c'}, \frac{a'}{b'}$ (Fig. 2), are equal to the ratios $\frac{a}{c}, \frac{b}{c}, \frac{a}{b}$; and in any right-angled triangle in which the acute angle θ' is not equal to θ the corresponding ratios are not equal to those for θ. The trigonometric functions as defined by the above ratios are evidently limited to angles less than 90°, since a triangle contains but one right angle. However, the definition may be extended to angles of any size and the functions expressed by line segments.

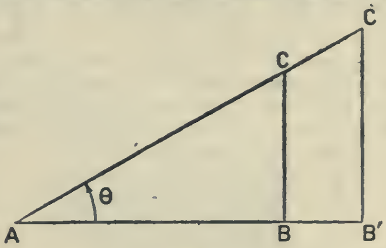


Fig. 2.

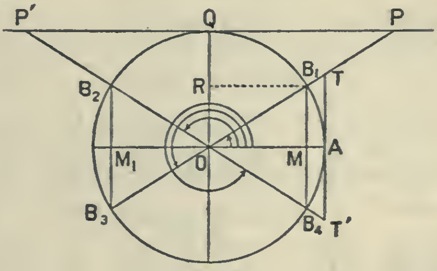


Fig. 3.

In Fig. 3 the radius OA(=OB) may be regarded as the unit of length, hence the ratio $\frac{B_1M}{OB_2} = B_2M_1$ and $\sin AOB_1 = B_1M$. Similarly $\cos AOB_1 = OM$, $\tan AOB_1 = AT$, $\cot AOB_1 = PQ$, $\sec AOB_1 = OT$, $\operatorname{cosec} AOB_1 = OP$, $\operatorname{vers} AOB_1 = MA$, and $\operatorname{covers} AOB_1 = QR$. If the angle is obtuse as AOB_2, or reflex as AOB_3, AOB_4, the functions are represented by the corresponding lines. E.g. $\sin AOB_3 = B_3M_1$, $\tan AOB_4 = AT'$. The following convention of signs (see Fig. 4), however, serves to associate these values with the proper angle: Lines measured to the right of the vertical diameter, as OM_2, are called positive, and those to the left, as OM_2, negative; lines measured upward as B_2M_1 from the horizontal diameter are called positive, and those downward as M_4B_4, negative; the revolving radius OB is always positive. Thus (see Fig. 4) the signs of the functions of an angle not exceeding 90° are all plus. The versine and coversine are evidently always positive. The sine and the cosecant are positive in the first and second quadrants, and negative in the third and fourth. The cosine and the secant are positive in the first and fourth quadrants and negative in the second and third. The tangent and cotangent are positive in the first and third quadrants, and negative in the second and fourth. We have, therefore, the following relations:

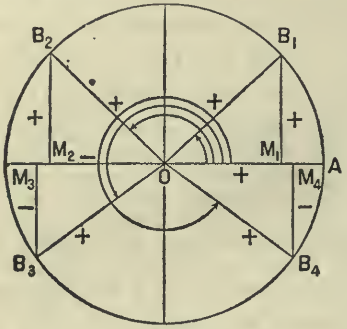


Fig. 4.

$$\begin{aligned} \sin(-\alpha) &= -\sin\alpha \\ \cos(-\alpha) &= \cos\alpha \\ \tan(-\alpha) &= -\tan\alpha \\ \cot(-\alpha) &= -\cot\alpha \end{aligned}$$

For the definition of a negative angle, see Angle.

A given value of a function does not, however, uniquely determine the angle, as will appear from the following table of relations:

First Quadrant

$$\begin{array}{l|l} \sin(90^\circ - \theta) = \cos\theta & \tan(90^\circ - \theta) = \cot\theta \\ \cos(90^\circ - \theta) = \sin\theta & \cot(90^\circ - \theta) = \tan\theta \end{array}$$

Second Quadrant

$$\begin{array}{l|l} \sin(180^\circ - \theta) = \sin\theta & \sin(90^\circ + \theta) = \cos\theta \\ \cos(180^\circ - \theta) = -\cos\theta & \cos(90^\circ + \theta) = -\sin\theta \\ \tan(180^\circ - \theta) = -\tan\theta & \tan(90^\circ + \theta) = -\cot\theta \\ \cot(180^\circ - \theta) = -\cot\theta & \cot(90^\circ + \theta) = -\tan\theta \end{array}$$

Third Quadrant

$$\begin{array}{l|l} \sin(180^\circ + \theta) = -\sin\theta & \sin(270^\circ - \theta) = -\cos\theta \\ \cos(180^\circ + \theta) = -\cos\theta & \cos(270^\circ - \theta) = -\sin\theta \\ \tan(180^\circ + \theta) = +\tan\theta & \tan(270^\circ - \theta) = \cot\theta \\ \cot(180^\circ + \theta) = +\cot\theta & \cot(270^\circ - \theta) = \tan\theta \end{array}$$

Fourth Quadrant

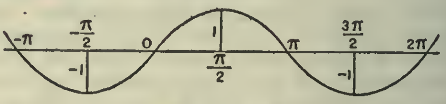
$$\begin{array}{l|l} \sin(360^\circ - \theta) = -\sin\theta & \sin(270^\circ + \theta) = -\cos\theta \\ \cos(360^\circ - \theta) = \cos\theta & \cos(270^\circ + \theta) = \sin\theta \\ \tan(360^\circ - \theta) = -\tan\theta & \tan(270^\circ + \theta) = -\cot\theta \\ \cot(360^\circ - \theta) = -\cot\theta & \cot(270^\circ + \theta) = -\tan\theta \end{array}$$

Thus to express the trigonometric functions of angles greater than 90° in terms of those of angles less than 90°, determine first the sign of the function to be so expressed, next subtract from the angle whatever multiple of 90 is necessary to make it less than 90°. If an even multiple of 90° is subtracted the name of the original function is retained, but if an odd multiple is subtracted the original function is replaced by the *co-named* function. E.g. to express $\cos(270^\circ - \theta)$ in terms of a function of . This angle is in the third quadrant and therefore its cosine is negative. To make the angle $270^\circ - \theta$ less than 90° we must subtract 180° and we have $\cos(270^\circ - \theta) = -\cos(90^\circ - \theta)$. But $\cos(90^\circ - \theta) = \sin$, and we have $\cos(270^\circ - \theta) = -\sin\theta$.

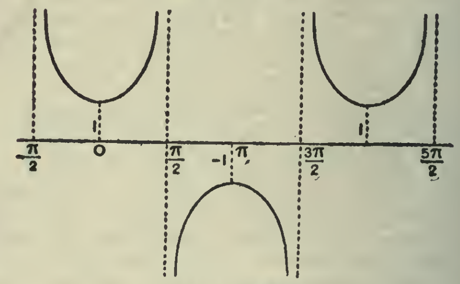
The increasing of an angle by 360° or any multiple of 360° does not alter the value of the trigonometric functions of that angle. (See Function.) It appears from the geometric representation of the functions that the values of the sines and cosines of all real angles lie within the interval $+1, -1$; the values of the tangents and cotangents of all real angles lie within the interval $+\infty$ and $-\infty$; those of the secants and cosecants without the interval $+1, -1$, as is shown in the following table:

FUNCTION	0°	90°	180°	270°	360°
Sine	0	1	0	− 1	0
Cosecant	∞	1	− ∞	− 1	∞
Cosine	1	0	− 1	0	1
Secant	1	∞	− 1	− ∞	1
Tangent	0	∞	0	− ∞	0
Cotangent	∞	0	− ∞	0	∞

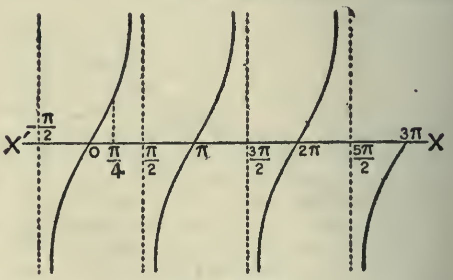
The variations of the functions are best exhibited by means of graphs. In the figures the arcs are laid off as abscissas and the functions as ordinates. See Coördinates.



GRAPH OF SIN θ.



GRAPH OF SEC θ.



GRAPH OF TAN θ.

From the definition of the trigonometric functions, it is evident that they bear certain relations one to another. Some of the fundamental ones are, $\sin^2\theta + \cos^2\theta = 1$, $\sin\theta \csc\theta = 1$, $\cos\theta \sec\theta = 1$, $\tan\theta \cot\theta = 1$, $\tan = \sin\theta / \cos\theta$, $1 + \tan^2\theta = \sec^2\theta$, $1 + \cot^2\theta = \csc^2\theta$, from which many others readily follow. Besides these relations existing between the functions of a single angle, there are those connecting the functions of several angles. Thus

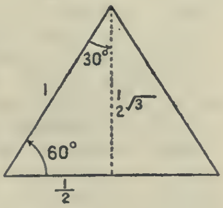
$$\sin(A \pm B) = \sin A\cos B \pm \cos A\sin B,$$
$$\cos(A \pm B) = \cos A\cos B \mp \sin A\sin B,$$
$$\tan(A \pm B) = \frac{\tan A \pm \tan B}{1 \mp \tan A \tan B},$$
$$\cot(A \pm B) = \frac{\cot A \cot B \mp 1}{\cot A \pm \cot B};$$

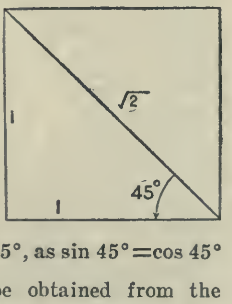
and $\sin 2A = 2 \sin A \cos A$, $\cos 2A = \cos^2 A - \sin^2 A$, $\tan 2A = \frac{2 \tan A}{1 - \tan^2 A}$, and $\cot 2A = \frac{\cot^2 A - 1}{2 \cot A}$, which are easily derived from the corresponding formulas for $A + B$ by putting $A = B$. Some of the formulas for functions of half an angle are: $\sin \frac{1}{2}A = \pm\sqrt{\frac{1 - \cos A}{2}}$, $\cos \frac{1}{2}A = \pm\sqrt{\frac{1 + \cos A}{2}}$, $\tan \frac{1}{2}A = \pm\sqrt{\frac{1 - \cos A}{1 + \cos A}}$, and $\cot \frac{1}{2}A = \pm\sqrt{\frac{1 + \cot A}{1 - \cot A}}$. By reapplying these formulas it is evident that functions of 3A, 4A, ... nA may be expressed as functions of A and also as functions of various fractional parts of A.

To every function there is an inverse function or anti-function just as to every logarithm there is an antilogarithm. The formula to express the angle whose sine is x is $\sin^{-1} x = \theta$, read "θ is the angle whose sine is x." Similarly $\tan^{-1} y = \theta$ is read, "θ is the angle whose tangent is y," or "anti-tangent of y equals θ." All inverse functions admit of translation into the direct formulas. Thus $\sin^{-1}x = \theta$ reduces to $\sin\theta = x$, and $\tan^{-1} = y = \theta$ to $\tan\theta = y$. All inverse or anti-functions can be expressed in series, as in the case of the functions. (See SERIES.) The following will serve as examples:

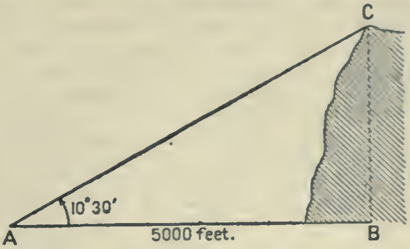
$$\sin^{-1} x = \frac{x}{1} + \frac{1}{2}\cdot\frac{x^3}{3} + \frac{1\cdot3}{2\cdot4}\cdot\frac{x^5}{5} + \cdots + \frac{1\cdot3 \ldots\ldots (2r-1)}{2\cdot4 \ldots\ldots 2r}\frac{x^{2r+1}}{(2r+1)} + \ldots\ldots \quad \tan^{-1} x = \frac{x}{1} - \frac{x^3}{3} + \frac{x^5}{5} - \ldots\ldots + (-1)^n \frac{x^{2n-1}}{2n-1} + \ldots\ldots$$

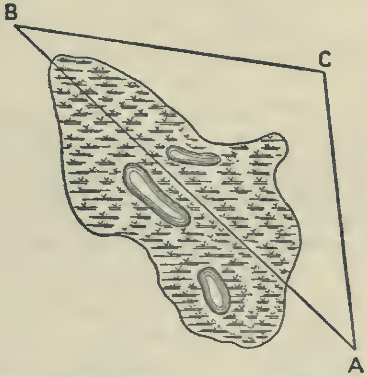
The values of the functions of certain angles may be calculated by reference to geometric figures, but the tables of such values for all angles have been calculated to a close degree of approximation by means of the trigonometric series. The equilateral triangle serves to exhibit the values of the functions of 60° and 30°. If the side be taken as 1, the figure shows that $\sin 60° = \frac{1}{2}\sqrt{3}$, $\cos 60° = \frac{1}{2}$, $\tan 60° = \sqrt{3}$, and so on. Similarly the functions of 45°, as $\sin 45° = \cos 45° = \frac{1}{\sqrt{2}} = \frac{1}{2}\sqrt{2}$, may be obtained from the square.





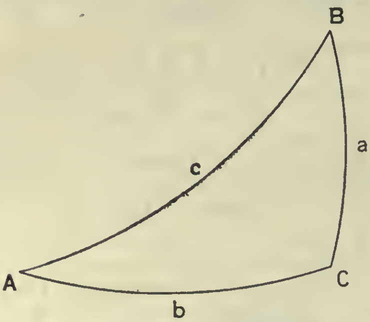
The following problems will serve to illustrate the use of trigonometry in practical mensuration: (1) Required the height of a hill above the horizontal plane of an observer, the distance of the observer from the point below the summit being 5000 feet and the angle of elevation 10° 30′. The height of the hill, represented by BC in the figure, is given by the equation $BC = \tan 10° 30' \; 5000 \text{ feet} = 0.1853 \times 5000 \text{ feet} = 926.5$ feet, $\tan 10° 30'$ being taken from a table of natural tangents. (2) Required the distance between two points A and B separated by an impassable swamp, the line AC, as represented in the figure, being 15 chain lengths, the angle A 40° 15′, and the angle C 110° 32′. The length of the line AB is given by the equation $AB = \frac{AC \sin 110° 32'}{\sin 150° 47'} = \frac{15 \cdot 0.9365}{0.4881} = 28.5$, the sines of the angles being taken from a table of natural sines. Therefore AB is 28.5 chain lengths.

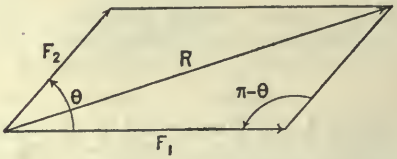


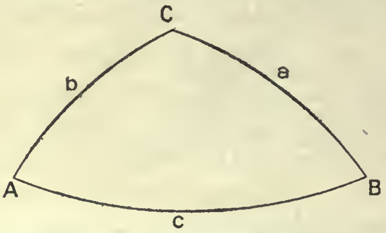


From the expressions of e^x, $\sin x$, $\cos x$ (see SERIES), it follows that $e^{ix} = \cos x + i \sin x$ (see COMPLEX NUMBER), and that $e^{-ix} = \cos x - i \sin x$; whence by adding and subtracting, $\cos x = \frac{e^{ix} + e^{-ix}}{2}$, $\sin x = \frac{e^{ix} - e^{-ix}}{2i}$. Similarly the other functions may be expressed in terms of e^{ix}, e^{-ix}. These are the exponential expressions for the circular functions of x. If i is omitted from these exponentials, the resulting functions are called the *hyperbolic* cosine, *hyperbolic* sine of the angle x. Hyperbolic functions are so called because they have geometric relations with the equilateral hyperbola analogous to those between the circular functions and the circle. The common notation for such functions is $\sinh\theta$, $\cosh\theta$, $\tanh\theta$, corresponding to the circular function $\sin\theta$, $\cos\theta$, $\tan\theta$. The values of these functions have been tabulated and are of service in analytic trigonometry.

The spherical triangle, like the plane triangle, has six elements, the three sides *a*, *b*, *c*, and the angles A, B, C. But the three sides of the spherical triangle are angular as well as linear magnitudes. The triangle is completely determined when any three of its six elements are given, since there exist relations between the given and the sought parts by means of which the latter may be found. In the right-angled or quadrantal triangle, however, as in the case of the right-angled plane triangle, only two elements are necessary to determine the remaining parts. Thus, given *c*, A, in the right-angled triangle, ABC, the remaining parts are given by the formulas $\sin a, = \sin c, \sin A$, $\tan b = \tan c, \cos A$, $\cot B = \cos c, \tan A$. The corresponding formulas when any other two parts are given may be obtained by Napier's rules concerning the relations of the five circular parts (q.v.), viz. *a*, *b*, complement of A, complement of B, complement of *c*. In the case of oblique triangles no simple rules have been found, but each case is dependent upon the appropriate formula. Thus in the oblique triangle ABC, given *a*, *b*, and A, the formulas for the remaining parts are $\sin B = \frac{\sin A \sin b}{\sin a}$, $\tan\frac{1}{2} c = \tan\frac{1}{2} (a - b) \cdot \frac{\sin\frac{1}{2}(A+B)}{\sin\frac{1}{2}(A-B)}$, $\cot\frac{1}{2} C = \tan\frac{1}{2}(A-B) \cdot \frac{\sin(a+b)}{\sin(a-b)}$.







It is evident in spherical trigonometry, as well as in plane, that three elements taken at random may not satisfy the conditions for a triangle, or they may satisfy the conditions for more than one. The treatment of the *ambiguous cases* in spherical trigonometry is quite formidable, since every line intersects every other line in two points and multiplies the cases to be considered. The measurement of spherical polygons may be made to depend upon that of the triangle. For, if, by drawing diagonals, the polygons can be divided into triangles each of which contains three known or obtainable elements, then all the parts of the polygon can be determined. Since the elements of the spherical polygon measure the elements of the polyhedral angle whose vertex is at the centre of the sphere, the formulas of spherical trigonometry apply to problems involving the relations of the parts of such figures. E.g., given two face angles and the included dihedral angle of a trihedral angle, the remaining face and dihedral angle may be determined by the same formulas as apply to the corresponding case of the spherical triangle. By aid of the formulas of spherical trigonometry the theories of transversals, coaxal circles, poles and polars, may be developed for the figures of the sphere. Spherical trigonometry is of great importance also in the theory of power circles, stereographic projection, and geodesy. It is also the basis of the chief calculations of astronomy; e.g. the solution of the so-called astronomical triangle is involved in finding the latitude and longitude of a place, the time of day, the azimuth of a star, and various other data.

Some traces of trigonometry exist in the earliest known writings on mathematics. In the Papyrus of Ahmes (see AHMES) a ratio is mentioned called a *seqt*, and because of its relation to the methods of measuring the pyramids, this ratio seems to correspond to the cosine or the tangent of an angle. But to the Greeks are due the first scientific trigonometric investigations. The sexagesimal division of the circle was known to the Babylonians, but Hipparchus was the first to complete a table of chords. Heron (q.v.) computed the values of $\cot\frac{2\pi}{n}$, for $n = 3, 4, \ldots 11, 12$, and calculated the areas of regular polygons. Thirteen books of Ptolemy's *Almagest* were given to trigonometry and astronomy. The Hindus contributed an important advance by introducing the half chord for the whole chord as used in the Greek calculations. They were familiar with the sine and calculated ratios corresponding to the versine and cosine. The sine, however, first appears in the works of the Arab Al-Battani (q.v.), and to his influence is due the final substitution of the half for the whole chord. Al-Battani knew the theory of the right-angled triangle and gave the relation $\cos a = \cos b \cos c + \sin b \sin c \cos A$ for the spherical triangle. The celebrated astronomer Jabir ibn Aflah, or Geber, wrote a work confined chiefly to spherical trigonometry, and rigorous in its proofs, which was translated into Latin by Gerhard of Cremona. Regiomontanus (1436-1476) wrote a complete plane and spherical trigonometry. Vieta (1540-1603) made an important advance by the introduction of the idea of the reciprocal spherical triangle. To Napier are due the formulas since called the analogies. Gunter introduced the term *cosine* and Finck (1583) introduced *secant* and *tangent*. Growing out of the desire to construct more accurate tables and to simplify the methods of calculation for astronomical purposes, there was evolved by Napier and Byrgius (q.v.) the idea of the logarithm (q.v.). To Euler much is due for simplifying and classifying the treatment of the whole subject. Lagrange, Legendre, Carnot, Gauss, and others expanded the theory of polygonometry and polyhedrometry. The nineteenth century has contributed the so-called projective formulas, and made further generalization of formulas known before. A few leading works on the subject are: Casey, *A Treatise on Plane Trigonometry* (Dublin, 1888); id., *Treatise on Spherical Trigonometry* (ib., 1889); McClelland and Preston, *Spherical Trigonometry* (London, 1890); Helmes, *Die Trigonometrie* (Hanover, 1881); Wittstein, *Trigonometrie* (ib., 1887); Hobson, *Plane Trigonometry* (Cambridge, 1891); Chauvenet, *Plane and Spherical Trigonometry* (New York, various editions). For the history of the subject, consult Braunmühl, *Beiträge zur Geschichte der Trigonometrie* (Halle, 1897), and his *Vorlesungen über Geschichte der Trigonometrie* (Leipzig, vol. i., 1900; vol. ii., 1903). For reference to valuable tables, see the article on LOGARITHMS.

TRIISODON, trī'ī'sȯ-dŏn (Neo-Lat., from Gk. τρεῖs. *treis*, three + ἴσος, *isos*, equal + ὀδούs, *odous*, tooth). A fossil creodont mammal from the Puerco beds of New Mexico. The skull is the oldest known mammalian skull. Consult Matthew, "Additional Observations on the Creodonta," in *Bulletin of American Museum of Natural History*, vol. xiv. (New York, 1901). See CREODONTA; MAMMALIA.

TRIKALA, trē-kä'lȧ, or **TRIKKALA**. A town of Greece, capital of the Nomarchy of Trikala, situated on the Trikkalinos River, 37 miles northwest of Larissa and on the Volos-Kalabaka Railway (Map: Greece, C 2). It manufactures cotton, woolen stuffs, leather, and dye products. Its population in 1889 was 14.820, mostly Wallachs. Trikala is the ancient Trikka, which was celebrated for its temple of Æsculapius.

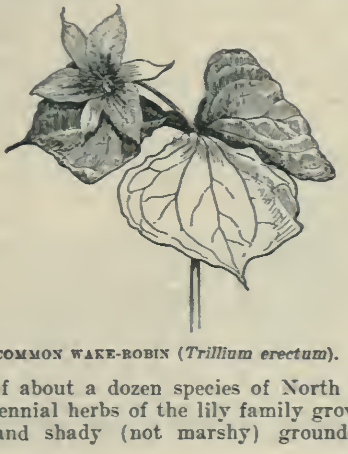
TRIKOUPIS, trē-kōō'pĭs, CHARILAOS (1832-96). A Greek statesman, son of Spiridon Trikoupis, born at Nauplia, July 23, 1832. He studied jurisprudence in Athens and Paris and in 1852 entered the diplomatic service as attaché to the legation at London, where in 1863 he became chargé d'affaires. In 1865 he conducted the negotiations with Great Britain regarding the cession of the Ionian Islands. Elected to the Boulé in the same year, he became an adherent of the radical party, was in 1866 appointed Minister of Foreign Affairs, became Premier in 1875. was once more Minister of Foreign Affairs under Canaris, in the coalition Ministry of 1877, and Premier again in 1880, 1882-85, 1886-90, 1891-93, and 1893-95, when, owing to the financial embarrassment of the Government, he met with a crushing defeat, losing even the seat in the Boulé, which he had held for thirty years. While on his death-bed he was reëlected by the District of Valtos. He died at Cannes, France, April 11, 1896. His endeavors to raise the economic conditions of the country, by the enactment of agrarian and tariff legislation and the building of railways, met with little success. For a number of years his party continued to bear the name of Trikoupists. A volume of his speeches, Λόγοι πολιτικοί, appeared at Athens in 1888. Compare Tsokopoulos, Βιογραφία Χαριλάου Τρικούπη (Athens, 1896).

TRIKOUPIS, SPIRIDON (1788-1873). A Greek author and statesman. He was the son of a primate of Missolonghi, where he was born, April 20, 1788. He studied in France and England, became secretary of the Earl of Guilford during his occupancy of the position of Governor of the Ionian Islands, and played an important part in the war for independence. After 1821 he was employed in administrative and diplomatic business, being a member of the provisional Government in 1826, and of the National Convention at Trœzen in the following year. He was president of the Council and Minister of Foreign Affairs in 1832, was thrice sent to London (1835-38, 1841-43, and 1850-61) as Ambassador; was Minister of Foreign Affairs and of Public Instruction in 1843; vice-president of the Senate (1844-49); and Envoy Extraordinary to Paris (1850) on the occasion of the blockade of the ports of Greece by England. He died February 24, 1873, at Athens. His funeral oration on Lord Byron (whose friend and comrade he had been), delivered in the Cathedral of Missolonghi, some days after the poet's death, was translated into several European languages. Many other orations, partly religious and partly political, were collected and published (Paris, 1836). His masterpiece is the history of the Greek revolution, 'Ιστρία τῆς 'Ελληνικῆς 'Επαναστάσεως (London, 1853-57).

TRIL'BY. (1) A romance by Charles Nodier (1822). (2) A novel by George du Maurier (1895) and its chief character, a beautiful artists' model, whose love for 'Little Billee' and domination by the hypnotic powers of Svengali form the plot of the story. The novel is full of reminiscences of Parisian artist life and gained a wide popularity.

TRILL (Fr. *triller*, It., ML. *trillare*, to trill, probably onomatopoetic in origin). In music, an embellishment produced by the continued and rapid repetition of one note alternately with another, either a whole tone of semitone above it. Its sign is *tr* placed over or under the principal note. The trill was known and used at the end of the sixteenth century, but its name was added considerably later.

TRILLIUM (Neo-Lat., from Lat. *tres*, three, so called from the symmetrical arrangement of the three outer and three inner segments). A genus of about a dozen species of North American perennial herbs of the lily family growing in moist and shady (not marshy) grounds from



COMMON WAKE-ROBIN (*Trillium erectum*).

Maine to Florida. They have a naked stem, 4 to 15 inches high, terminated by three ovate, pointed, broad, beautifully netted-veined leaves. *Trillium grandiflorum,* also called wake-robin, is a pretty wild flower, growing in rich woods from Vermont to Kentucky, Wisconsin, and northward. The flowers, which appear in spring, are at first nearly white, but change with age to rose-color. They are borne on a peduncle from 2 to 3 inches long.

TRILOBITA (Neo-Lat. nom. pl., from Gk. *τρεῖς, treis,* three + *λόβος, lobos,* lobe). An important group of extinct marine crab-like animals, whose fossil body shields are found in rocks of Paleozoic age in most parts of the world. The trilobites constitute a subclass of Crustacea, of which class they are very primitive members. The trilobite body was covered by a hard, calcareous dorsal shield and a thin ventral integument. The dorsal shield or carapace is of elliptical or oval outline and is divided by two dorsal furrows into three longitudinal lobes, the median axis and two lateral pleural lobes. This trilobate division, which characterizes this class of animals, gave the group its name. The shield is also divided into three transverse parts: the anterior head-shield or cephalon, the median thorax consisting of several movable segments, and the posterior abdominal shield or pygidium. The cephalon is generally of semicircular outline, and the posterior lateral corners, known as the genal angles, are often produced into spines. The more elevated median portion of the cephalon is the glabella, and this is separated from the cheeks or lateral portions by the usually well-marked dorsal furrows. The surface of the glabella is broken up into a series of lobes by three pairs of transverse furrows, called the lateral furrows. The paired lobes are called the lateral lobes and the unpaired anterior lobe, which is often very prominently developed, is known as the frontal lobe of the glabella. The cheeks are traversed in most trilobites by a sinuous line, the facial suture, along which the lateral portions or free cheeks break away from the fixed cheeks.

The eyes, which in most trilobites are of reniform shape, are situated upon the cheeks. In some species (as Acidaspis mira) the eyes are placed at the summits of high immovable peduncles; certain genera, as Agnostus, Microdiscus, and Ampyx, are totally blind; and other genera (as Trinucleus) have eye spots in their young stages and are totally blind when adult. Two types of eyes are present—compound, situated on the free cheeks, and simple eye spots, ocelli or stemmata. The compound eyes are made up of lenses, which may vary in number from 14 in Trimerocephalus to 15,000 in Remopleurides. The facial suture varies largely in its course across the cephalon, not only in the different species and genera, but also in the individuals that represent different stages of development of a single species. Its position in the adult furnishes an excellent diagnostic character. In most trilobites a groove, called the occipital furrow, runs near to and parallel with the posterior margin of the cephalon, and cuts off the occipital lobe from the glabella.

The thorax is made up of several transverse segments which articulate with one another in such manner that some trilobites were able to roll themselves up into a ball after the manner of the armadillo. The number of segments of the thorax is usually constant in the adults of each genus, but it varies within the subclass from two in Agnostus to 29 in Harpes. The pygidium, or caudal shield, is a solid plate formed by the union of several segments, of which traces are still evident in the ribs of its convex dorsal surface. The axis and the pleural ribs are usually present, but in some species of Asaphus and Illænus they are almost entirely suppressed. The trilobite carapace is generally ornamented by small tubercles. Many genera have smooth or punctate tests; others have the test marked by concentric wrinkles; and in other genera spines are developed.

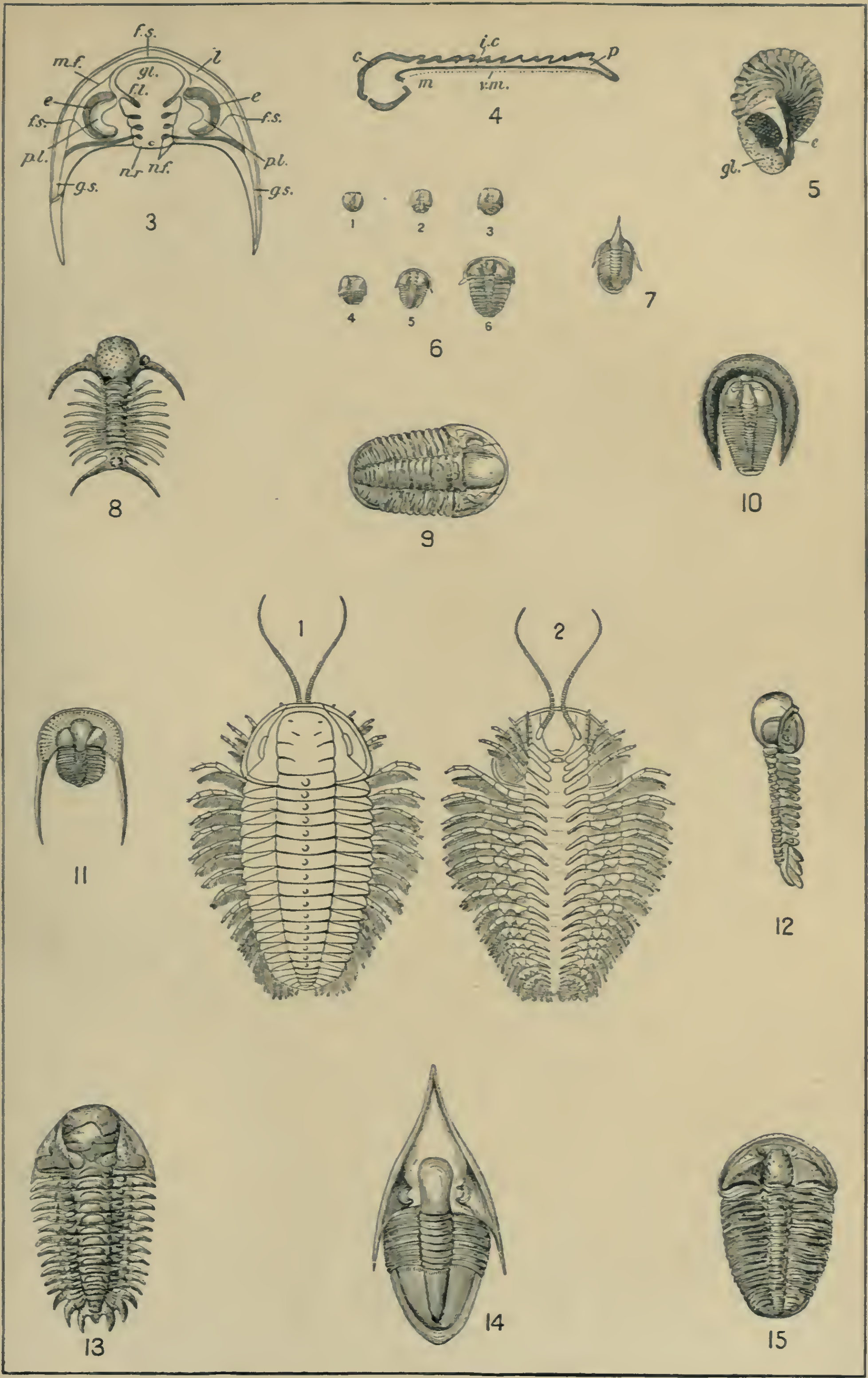
VENTRAL SURFACE. As a rule the ventral surface of the trilobite body is so closely united with the rock matrix that it is only through exceptionally favorable modes of fossilization that anything at all has been learned about the nature of the ventral integument and the appendages. The principal organ on the under side of the head is a rather prominent plate, the upper lip or hypostome, which articulates with the anterior margin of the cephalon, and which protected the small mouth opening situated at its posterior end. Each segment of the carapace, excepting the hindermost anal segment, bears a pair of appendages. The foremost pair, arising near the sides of the hypostome, are simple slender whip-like antennæ, much like those of the higher Crustacea. All the other appendages are biramous; their endopodites are six-jointed crawling legs, and their exopodites are many-jointed feathery organs that probably served both for swimming and respiration. The basal joint of the cephalic limbs form jaw-like organs about the mouth.

DEVELOPMENT. The ontogeny of several genera of trilobites is known. Small rounded bodies supposed to be the eggs of trilobites have been found. Those species of which continuous series of growth stages have been studied are found to originate in a minute 'protaspis' stage and to attain their adult shape through a series of progressive changes expressed in the successive molts, in much the same manner as do the

REPRESENTATIVE TRILOBITES.

1. Dorsal view of a trilobite (*Triarthus Becki*), a species whose perfect specimens preserved in the Utica slate (Ordovician), near Rome, N. Y., have yielded most of the known facts as to the external structure and appearance of these animals. 2. Ventral view of the same. 3. Cephalic shield (cephalon) of *Dalmanites Hausmanni* (Devonian): *l,* limb or border; *m.f.,* marginal furrow; *g.s.,* genal spines; *g.l.,* glabella; *f.l.,* frontal lobe, beneath which are seen the 'side lobes' and 'side furrows' of the glabella; *n.f.,* occipital furrow; *n.r.,* occipital ring; *f.s.,* facial suture; *e,* visual surface of eye; *p.l.,* palpebral lobe. 4. Median antero-posterior vertical section of a trilobite (*Ceraurus pleurexanthemus*); *c,* cephalon, with hypostoma below it; *p,* test of the abdomen (pygidium); *m,* mouth; *v.m.,* ventral membrane; *i.c.,* intestinal canal. 5. A trilobite (*Phacops latifrons:* Devonian), rolled up; *gl,* glabella; *e,* eye. 6. Development (ontogeny) of a trilobite (*Sao hirsuta;* Cambrian); 1, 1st larval stage (protaspis); 2-6, successive 'nepionic' stages of development. 7. *Ampyx nasuta* (Ordovician). 8. *Deiphon Forbesi* (Silurian). 9. *Proetus Bohemicus* (Silurian). 10. *Harpes nngula* (Ordovician). 11. *Trinculeus Goldfussi* (Ordovician). 12. Profile view of *Sphærexochus mirus* (Silurian). 13. *Cheirurus insignis* (Silurian). 14. *Megalaspis extenuata* (Ordovician). 15. *Conocoryphe Sulzeri* (Cambrian) without the free 'cheeks.' (After Zittel.)

REPRESENTATIVE TRILOBITES



For names and description, see text.

crabs, and other Crustacea. The protaspis is a circular or ovate shield, generally less than one millimeter in length, with a slightly segmented median axis and an indistinctly marked abdominal portion. Growth of the animal takes place through increase in the number of segments and through increase in size in the successive molts, and each new segment is intercalated between the cephalon or the last formed segment and the anterior edge of the pygidium.

Classification. The form and mode of development of the free cheeks are made the principal features of the classification proposed by Beecher, who divides the subclass into three orders: *Hypoparia* are the most primitive forms of trilobites, mostly small in size, without compound eyes, and with simple eye spots in the higher genera. They have the free cheeks ventral or overlapping on the dorsal surface and cutting therefrom a narrow margin together with the genal angles. To this order belong Agnostus and Microdiscus (Cambrian), Harpes (Ordovician to Devonian), Trinucleus (Ordovician), and Ampyx (Ordovician to Silurian). *Opisthoparia* have the free cheeks dorsal, separate and carrying the genal angles. This group includes a large number of genera ranging from Cambrian to Carboniferous, but the majority of them are found in the Cambrian and Ordovician rocks. The primitive genera of the family Conocoryphidæ have rudimentary eyes or are blind; in all others the compound eyes are usually well developed. The more primitive Conocoryphidæ present characters which are exhibited in the larval stages of the more specialized later members of the order. The families and principal genera are as follows: *Conocoryphidæ:* Conocoryphe, Ctenocephalus, Atops, Bathynotus (Cambrian). *Olenidæ:* Paradoxides, Olenellus, Eurycare, Olenus, Ptychoparia, Agraulos, Ellipsocephalus, Sao, Dikellocephalus (Cambrian); and Remopleurides and Triarthrus (Ordovician). *Asaphidæ:* Asaphus, Ogygia, Nileus, Æglina (Ordovocian), and Illænus (Ordovician to Silurian). *Proëtidæ:* Arethusina (Ordovician), Proëtus (Ordovician to Carboniferous), Phillipsia, and Griffithides (Carboniferous). *Bronteidæ:* Bronteus (Ordovician to Devonian), *Lichadidæ:* Lichas (Ordovician to Silurian) and some of its subgenera, ranging from Ordovician to Devonian. This family contains some of the most specialized as well as the largest trilobites. The family *Acidaspidæ* contains a number of species, mostly of small size, ranging from the Ordovician to the Devonian, which are remarkable because of their excessive development of spines. They are most abundant in the Silurian and Lower Devonian. The genera are: Acidaspis, Odontopleura, Selenopeltis, Dicranurus, Ancyropyge. In the order *Proparia* the free cheeks do not carry the general angles and they are often united in front of the glabella. The other orders had their origin in pre-Cambrian time, for they appear in the early Cambrian with their diagnostic features fully differentiated and with a considerable degree of evolution, but the Proparia originated during the late Cambrian and were initiated in the early Ordovician. The order reached its maximum evolution during the Ordovician and declined during the Silurian and Devonian. The members of the family *Encrinuridæ* recall in the form of their cephalon the more primitive members of the Opisthoparia, and like them they have narrow marginal free cheeks, which do not, however, include the genal angles. The principal genera are Encrinurus (Ordovician to Silurian), Placoparia, Cybele, and Dindymene (Ordovician). *Calymmenidæ* includes only Calymmene and Homalonotus (Ordovician to Devonian). *Cheiruridæ* is an interesting family that begins in the Ordovician and ranges into the Devonian and is represented by a large number of species. The principal genera are: Amphion (Ordovician), Ceraurus, Sphærexochus, Staurocephalus (Ordovician to Silurian), Deiphon and Onycopyge (Silurian). *Phacopidæ* is a large family containing perhaps the most highly organized members of the subclass. The frontal lobe of the glabella is large in all genera and in the successive species in each race there is a general tendency toward coalescence or obsolescence of the lateral lobes of the glabella, and an increased prominence of the frontal lobe. The eyes are well developed and have large distinct facets. The family includes Phacops (Silurian to Upper Devonian), Pterygometopus (Ordovician), Acaste and Chasmops (Ordovician to Silurian), Trimerocephalus (Silurian to Devonian), Dalmanites (Ordovician to Devonian), and a number of subgenera.

Habits. Trilobites appear to have been entirely marine animals, and to have enjoyed various modes of existence. Some were undoubtedly bottom crawlers, others buried themselves in the mud of the bottom, and still others were free swimmers or crawled about coral and hydroid masses after the manner of the modern isopods. The remains of trilobites are usually found in dismembered condition, and entire carapaces are quite rare. This is probably due to the fact that the majority of specimens are the discarded molts which have been broken in the process of shedding. Trilobites abound in all the Cambrian formations, during which period they were in fact the dominant forms of life, and they are abundant in some horizons of the Ordovician and Silurian. During the Devonian they declined rapidly, and only a few genera, represented by rare specimens, continued into the Carboniferous. They are entirely absent from all Mesozoic rocks, and they have no near relatives at the present day. They are one of the most important groups of fossil animals for purposes of correlation. In all about 2000 species and over 200 genera have been described, the majority of them from the Cambrian and Ordovician rocks.

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TRILOGY (from Gk. *τριλογία*, *trilogia*, group of three dramas, from *τρεῖς*, *treis*, three + *λόγος*, *logos*, word). The name given by the Greeks to a group of three tragedies, often connected by a common subject and representing different stages or phases of the same story. A satyric drama was customarily added as a termination, whence the whole was sometimes termed a *tetralogy*. A tragic poet who wished to take part in one of the Athenian poetic contests had to produce a trilogy along with a satyric drama at the great Dionysiac, Lenæan, or Anthesteriac festival. We possess only one perfect specimen of the classic trilogy—the *Oresteia* of Æschylus, which embraces the *Agamemnon*, the *Choephoræ*, and the *Eumenides*. Consult: Welcker, *Die Aeschyleische Trilogie*, etc. (Darmstadt, 1824); Franz, *Des Aeschylos Oresteia* (Leipzig, 1846); Campbell, *The Oresteia of Æschylus*, trans. and introd. (London, 1893).

TRIMBLE, trĭm'bl, Robert (1777-1828). An American jurist, born in Berkeley County, in Virginia. He was admitted to the Kentucky bar in 1803 and subsequently was elected to the Legislature. In 1808 he was appointed second judge of the Court of Appeals, in 1810 Chief Justice of Kentucky, and in 1813 United States district attorney. From 1816 to 1826 he was district judge of Kentucky and from 1826 until his death a justice of the United States Supreme Court.

TRIM, Corporal. The voluble and devoted servant and companion of Uncle Toby in Sterne's *Tristram Shandy*.

TRIMETHYLAMINE (from *tri-* + *methyl* + *amine*), $(CH_3)_3N$. An organic base with an extremely powerful and disagreeable fishy odor. It is obtained as a colorless gas, readily soluble in water, and having a strong alkaline reaction. With acids it readily forms soluble salts. It is obtained by distillation from ergot of rye, from guano, from the juice of the leaves of red beetroot, and from putrid yeast. It may be formed artifically by the action of methyl iodide on dimethylamine; but the source from which it may most readily be derived is herring brine. See Amines.

TRIM'MER, Mrs. Sarah (1741-1810). An English author, daughter of John Joshua Kirby of Ipswich, a close friend of Gainsborough. Settling with her parents in London, she met James Trimmer of Brentford, whom she married in 1762. Mrs. Trimmer was one of the pioneers in founding Sunday schools. Her first schools were opened at Brentford in 1786, and were so successful that she was summoned by the Queen to Windsor to help start others there. In 1787 she also established at Brentford a school of industry for girls. Soon after this she introduced into the Sunday school the plan of teaching by prints now in almost universal use. Among her books are *Easy Introduction to the Knowledge of Nature* (1782; 11th ed. 1802); the books with pictures and explanations which after a large circulation were issued as *New and Comprehensive Lessons* (1814; 5th ed. 1830); and the *Abridgements of the Old and New Testaments*, which, issued separately by the Society for Promoting Christian Knowledge in 1793, reached a sale of a quarter of a million copies.

TRIMORPHOUS. See Isomorphism.

TRIMURTI, trê-mōōr'tê (Skt. *trimūrti*, triple form). The name of the Hindu triad of the gods Brahma (q.v.), Vishnu (q.v.), and Siva (q.v.), when regarded as an inseparable unity of creation, preservation, and destruction, though three in form. The concept is relatively late, and cannot be older than the fifth or sixth century A.D. It is probable that the gods Vishnu and Siva were first associated as representatives of the two great Hindu sects (see Saivas; Vaishnavas), and that Brahma was added at a later time, as he was a later philosophical concept. The basal idea of this triad must not be confused, as is sometimes the case, with that of the Christian Trinity (q.v.), since the three Hindu deities are entirely distinct from each other. In Indian art the Trimurti is one body with three heads: in the middle, that of Brahma; at the right, that of Vishnu; and at the left, that of Siva. The symbol of the Trimurti is the mystic syllable *ōm* (q.v.).

TRIN'COMALEE', or **TRINCOMALI**, trĭṉ'-kô-mä'lê. A seaport town on the northeastern coast of Ceylon, 99 miles northeast of Kandy (Map: India, D 7). It is situated on an elevated and precipitous peninsula on the north side of the fine harbor of Trincomalee, the best in Ceylon. Trincomalee is chiefly important as a naval station. The Temple of the Thousand Columns, now in ruins, was erected by the Malabars and destroyed by the Portuguese in 1622. It is still a famous place of pilgrimage of the Hindus. Near the ruins rises Fort Frederick, which was built by the Portuguese from the old material of the temple. Population, in 1901, 13,000. Trincomalee was one of the last towns to surrender to European authority. It was held successively by the Portuguese, Dutch, and French, and surrendered to the British forces after a naval siege of three weeks in 1795. Consult Cave, *The Ruined Cities of Ceylon* (London, 1900).

TRIN'IDAD', *Sp. pron.* trē'nê-dȧd'. A British West Indian island, belonging to the Windward group, situated close to the mouth of the Orinoco (Map: West Indies, R 9). Area, 1754 square miles. The surface is generally flat. The northern part, however, is traversed by several parallel mountain chains running from east to west and from 600 to over 3000 feet high. The island is well watered. In the southwestern part is the famous pitch lake of La Brea, which yields asphalt for export. The flora is remarkable for its variety and beauty. Trinidad may be considered agriculturally one of the most successful of the British possessions in the West Indies. Originally sugar was the leading product of the soil. With the decline of the sugar industry the planters of Trinidad turned their attention to the cultivation of cacao, which is at present the staple of the island. Sugar is still cultivated to a large extent, the exports of that article for 1901 being valued at £452,210. Besides cacao and sugar, Trinidad produces coffee, cocoanuts, and various kinds of fruit. Commercially it occupies the foremost position among the British West Indian Islands. In 1901 the total value of the trade exceeded the sum of £5,091,000, about equally divided between exports and imports. The island has about 80 miles of railway. Trinidad, together with Tobago (q.v.), is administered by a Governor assisted by an executive council of 7 members and a legislative council of 20 members, all nominated by the Governor. Education is largely subsidized by the Government. The finances of the island are in good condition, the budget balancing at about £650,000. The revenue is derived chiefly from customs receipts. The public debt of the colony amounted in 1902 to £992,286. The population was 255,148 in 1901. It consists chiefly of the descendants of the slaves imported from Africa by the sugar planters. There is also a considerable number of coolies, while the whites form an insignificant part of the population. Port of Spain, the capital of Trinidad, had a population in 1901 of 54,100. Trinidad was discovered by Columbus in 1498 and was originally colonized by the Spaniards, who, however, soon abandoned it. In the eighteenth century Spain renewed her interest in Trinidad, but was soon expelled by Great Britain, to whom it was formally ceded in 1802, in accordance with the Treaty of Amiens. Consult: Fraser, *History of Trinidad* (London, 1894); Eversley, *The Trinidad Reviewer* (ib., 1900); Fiske, *History of the West Indies* (New York, 1899); Root, *The British West Indies and the Sugar Industry* (London, 1899).

TRINIDAD. A small, rocky, and uninhabited island situated in the South Atlantic Ocean in latitude 20° 31′ S., longitude 29° 20′ W., about 750 miles east by north of Rio de Janeiro (Map: World, Western Hemisphere, M 18). It now belongs to Brazil.

TRINIDAD. A town in Cuba, in the Province of Santa Clara, situated about 45 miles southeast of Cienfuegos and 5 miles from its port, Casilda (Map: Cuba, F 5). It is within easy reach of three ports and is of considerable commercial importance. It is one of the most healthful places on the island. Coffee, formerly the chief article of export, is gradually giving place to sugar. Trinidad was founded by Velazquez in 1513, and on account of the repeated attacks by buccaneers was removed from the coast to its present site. Population (municipal district), in 1899, 24,271.

TRINIDAD. The county-seat of Las Animas County, Col., 90 miles south of Pueblo; on the Denver and Rio Grande, the Atchison, Topeka and Santa Fe, and the Colorado and Southern railroads (Map: Colorado, E 3). It has a public library, Saint Joseph's Academy, and Saint Raphael's Hospital. Trinidad is the centre of large cattle-raising and farming interests, and is extensively engaged in coal-mining. There are also railway shops and bottling works. The government is vested in a mayor, chosen every two years, and a unicameral council. The water-works are owned and operated by the municipality. Population, in 1890, 5523; in 1900, 5345.

TRINITARIANS (from *trinity*, Lat. *trinitas*, number three, trinity, from *trinus*, threefold, from *tres*, three). The name most commonly applied in English to the members of the Order of the Holy Trinity for the Redemption of Captives, a Roman Catholic religious society founded by Saint John de Matha (1160-1213) and Saint Felix of Valois (1127-1212). Devoted to the work of freeing Christian captives among the infidels, they soon received the approbation of Pope Innocent III. and the permission of Philip Augustus to settle in France. The headquarters of the Order were fixed at Cerfroy, near La Ferté-Milon, in the present Department of Aisne, and the Pope gave them a second convent in Rome. Their first journey resulted in the liberation of 186 captives, who were brought to Paris amid great rejoicings. While Felix remained at home, caring for the Order's development, John made numerous journeys to North Africa and the coast of Spain. Later, the Trinitarians erected houses for the care of penniless captives after their release, and some of them accompanied the Crusaders to minister to their spiritual needs; they penetrated even to India and Tartary in search of the objects of their charity. It is estimated that in six centuries at least 900,000 prisoners recovered their freedom through the work of this Order.

The Order spread rapidly, first through France and Spain, until in the fifteenth century it counted 880 houses; the number diminished from various causes until at the beginning of the eighteenth century there were only 250. The present members are chiefly occupied with other works of mercy, especially the care of the sick, although in the nineteenth century they devoted considerable labor to the work for negro slaves. Besides several branches, due to various reforms, among the male Trinitarians, there were also two female branches, and a third Order of associates who labored for the cause and had a simple rule of life adapted to persons living in the world. Consult: Carlier, *Les Trinitaires de la rédemption* (Lille, 1866); Père Calixte de la Providence, *Vie de Saint Félix de Valois* (3d ed., Paris, 1878); id., *Vie de Saint Jean de Matha* (2d ed., ib., 1884); id., *Corsaires et Rédempteurs* (Lille, 1884).

TRINITY. A port of entry on Trinity Bay, Newfoundland, the capital of Trinity District, 61 miles northwest of Saint John (Map: Newfoundland, G 4). It has important fishing industries and a fine harbor. The bay is the landing point of the Atlantic cables. Population, in 1901, 1459.

TRINITY. A river of Texas, formed by the union, near Dallas, of the two forks which rise near the northern boundary of the State (Map: Texas, G 4). It flows southeast through a fertile and well-timbered region, and empties into Galveston Bay about 40 miles north of the city of Galveston. It is over 550 miles long and navigable at high water for 300 miles.

TRINITY, Doctrine of the. A doctrine of theology which declares that there are three persons in the Godhead, or divine nature—the Father, the Son, and the Holy Ghost—and that "these three are one true eternal God, the same in substance, equal in power and glory—although distinguished by their personal properties." The most elaborate statement of the doctrine is to be found in the Athanasian Creed, which asserts that "the Catholic faith is this: That we worship one God in Trinity, and Trinity in Unity—neither confounding the persons nor dividing the substance—for there is one person of the Father, another of the Son, and another of the Holy Ghost. But the Godhead of the Father, and of the Son, and of the Holy Ghost is all one; the glory equal; the majesty co-eternal."

The doctrine is not found in its fully developed form in the Scriptures; but it is supposed to be clearly revealed in its elements in the New Testament, and also to be indicated in many of the statements and revelations of the Old Testament. The form of expression in speaking of God in the Old Testament Scriptures—the plural *Elohim*, coupled with a singular verb; the apparent distinction recognized in the revelations to the patriarchs and Moses between Jehovah and 'the angel of Jehovah;' the mode in which 'the Spirit' and 'word' of God, and 'wisdom' (Proverbs viii.) are spoken of; and the gradual unfolding of the doctrine of a 'Messiah,' have all been taken as indications from the earliest times of the truth of a plurality of persons in the Godhead; and in the New Testament Scriptures the doctrine is represented as clearly taught in the Trinitarian formula of baptism—the general character of the claims and prerogatives of Jesus Christ by which His true deity is established, and in the functions attributed to the Holy Spirit. The evidence is held conclusive of the equal divine nature and yet distinct personality of the Son and the Spirit along with God the Father. It is generally conceded, however, that the Christians of the second and even of the third century did not treat the subject with the same definiteness and accuracy of expression as later writers. They were content for the most part to use Scriptural expressions in speaking of the Father, and the Son, and the Spirit, without defining articulately their relation to one another. It was not until the progress of opposing parties sought, on the one hand, to degrade the divine dignity of Christ (Ebionitism in its various forms, and Arianism); or, on the other hand, to confound the personality of Christ with God the Father (see Monarchians), that the Church was led to define in the Nicene Creed the relation of the Son of the Father, and further, in the Nicæno-Constantinopolitan Creed, the relation of the Spirit to the Father. This creed (see Nicene Creed; Filioque) was specially directed against the opinions of Arius (q.v.).

The evidence, here briefly sketched in outline, has been accepted as satisfactory, not only by the Roman Catholic and Oriental communions, but also by all the great Protestant communions. The only exception in modern times to the reception of the doctrine is in the case of the Socinians or Unitarians (qq.v.), who occupy in their teaching very much the position of the ancient Humanitarians (Ebionites). Consult the various treatises on systematic theology; Bauer, *Die christliche Lehre von der Dreieinigkeit* (3 vols., Tübingen, 1841-43); Meier, *Die Lehre von der Trinität* (Hamburg, 1844); Dorner, *The History of the Development of the Doctrine of the Person of Christ* (Eng. trans., Edinburgh, 1861-63); id., *History of Protestant Theology* ib., 1871); Burris, *The Trinity* (Chicago, 1874); Steenstra, *The Being of God as Unity and Trinity* (Boston, 1891); on the antitrinitarian side, Norton, *A Statement of Reasons for Not Believing the Doctrines of Trinitarians* (2d ed., Boston, 1856); Clarke, *Orthodoxy, Its Truths and Errors* (ib., 1866).

TRINITY COLLEGE. A college at Cambridge, England, the largest and most splendid collegiate foundation in the realm. It was founded by Henry VIII., in 1546, by the consolidation of several earlier foundations, with considerable additional endowments from other sources for a master and sixty fellows and scholars. Edward VI. issued the statutes, Mary added twenty scholars and increased the endowment, and Elizabeth interested herself in the college. It is governed by a council, consisting of the master and four other *ex-officio* members, and eight elective members. The buildings are large and imposing; the great court is the largest in either university, comprising more than two acres. The gateway is striking and characteristic, the Hall one of the finest in England. The chapel, though of great size, is not so fine as that of King's. The library is a large and important collection, comprising about 90,000 books and 1900 manuscripts. The list of Trinity worthies is almost endless. Of these may be mentioned Bacon, Newton, Barrow, Coke, Dryden, Cowley, Byron, Tennyson, Edward FitzGerald, Thackeray, Macaulay, Richard Porson, Peacock, Sedgwick, Pearson, Munro, Lightfoot, and Bentley. Among the more distinguished masters of the college may be named William Bill, John Whitgift, Thomas Nevile, Barrow, Bentley, and William Whewell. The master of Trinity is appointed by the Crown, and the college has apartments for the occupancy of royalty when on a visit to Cambridge, as well as for the judges on assize. Consult Mullinger, *History of Cambridge University* (Cambridge University Press, 1884).

TRINITY COLLEGE, Dublin. See Dublin, University of.

TRINITY COLLEGE. A college at Oxford, England, founded in 1554 by Sir Thomas Pope, Privy Councilor to Henry VIII. and Queen Mary. The college occupied the site and buildings of a Benedictine 'mansion' called Durham College, which had been founded in 1290 by Richard de Hoton, Prior of Durham, for the education of the monks of that diocese. At the dissolution of the monasteries, this passed into the hands of the newly constituted chapter of Durham, and thence to Sir Thomas Pope. Trinity College was the first college founded by a layman since Balliol, and consisted at first of a president, twelve fellows, and twelve scholars. Pope was a Roman Catholic, and his charter was obtained from Philip and Mary. By the changes made in 17 and 18 Victoria, the college consists of a president, twelve fellowships, of which nine are occupied, several honorary fellows and lecturers, a chaplain, college officers, sixteen scholars, three Millard scholars in natural science, nine exhibitioners, and four Ford students, and in all about 190 undergraduates. The buildings are of various dates and are arranged in a most attractive open quadrangle. The college presents to ten livings. Among the distinguished men who have been connected with Trinity may be mentioned Archbishop Sheldon, Bishop Seth Ward, Ludlow and Ireton of Civil War fame, Thomas Warton the poet and critic, Cardinal Newman, the elder Pitt, Lord North, Landor, Stubbs, Freeman, George Rawlinson, and Bryce.

TRINITY COLLEGE. An institution at Hartford, Conn., founded by members of the Protestant Episcopal Church in 1823 as Washington College, the present name being assumed in 1845. The college offers four courses, leading to the degrees of B.A., B.S., and B.L. It also offers graduate courses leading to the degree of M.A. and M.S. There is a system of alternative and elective studies, most of the work of the last three years being elective. It has no professional schools, but offers courses in civil engineering. The productive endowment in 1903 was $760,000, with a gross income of $135,000. The library in that year contained 45,130 volumes and 28,185 pamphlets. The students numbered 126 and the faculty 23. The total value of buildings and grounds is about $1,250,000.

TRINITY COLLEGE. An institution at Durham, N. C., founded in 1859, affiliated with the Methodist Episcopal Church, South. The college confers but two degrees, Bachelor of Arts and Master of Arts. The courses are arranged according to the group system with partially elective studies. The teachers and officers in 1903 numbered 25 and there were 231 academic students. The college grounds of 73 acres, with the buildings and equipment, were valued in 1903 at $534,000. The total college property was valued at $975,750, the endowment was $441,750, and the income $40,000.

TRINITY HALL. A college at Cambridge, England. It was founded in 1350 by William Bateman, Bishop of Norwich, and co-founder of Gonville and Caius College, under the name of the College of the Scholars of the Holy Trinity of Norwich, for a master and thirty scholars, devoted to the canon and civil law. It continues to be the peculiarly legal college of the university. By the new statutes in force since 1882, the college consists of a master, thirteen foundation fellows, and one professorial fellow. There are also college officials, two law students, seven scholars, and three exhibitioners, and, in all, about two hundred undergraduates. The college presents to seven livings. Among the distinguished members of the college have been Bishop Stephen Gardiner (Master); Glisson, the anatomist; Lord Howard of Effingham; Chesterfield; Thomas Bilney; and Chief Justice Cockburn.

TRINITY SUNDAY. The Sunday immediately following Whitsunday, so called as being set aside for the special honor of the Trinity. No such festival was known to the early centuries; the general establishment of Trinity Sunday as a common festival of the whole Western Church dates from a decree of John XXII., who died in 1334. Nevertheless, the mass and office peculiar to the day are of much greater antiquity, and may be traced, at least in part, in several liturgical books of the earlier centuries.

TRINO'DA NECES'SITAS (ML., threefold necessity). Three forms of assessment of lands for public purposes during the Anglo-Saxon era. No lands, either in secular or religious hands, were exempt from these three duties, which were known as *bridge-bot*, for the maintenance of bridges and highways; *burg-bot*, for the erection of and keeping fortresses in repair; and *fyrd*, for the support of the King's military and naval forces. Blackstone mentions that in the time of Henry II. no less than 1115 castles were in existence as a result of the tax for the establishment and maintenance of strongholds. Consult Blackstone, *Commentaries*.

TRINUCLEUS, trī'nū'klē-ŭs (Neo-Lat., from Lat. *tres*, three + *nucleus*, little nut, kernel, nucleus). A genus of trilobites characteristic of the middle and upper Ordovician rocks of North America and Europe. The body is small, seldom exceeding an inch in length, with a relatively large and broad horseshoe-shaped head-shield. The glabella is convex and consists of a prominent median and two less elevated lateral lobes, and the head is bordered by a wide pitted margin and provided with long, sometimes bifurcated, genal spines. The creature was blind in its adult stages, though in some forms the young were provided with simple eyes (ocelli), and compound eyes, such as are seen in most trilobites, are entirely absent. The thorax has six segments with narrow axis, and the pygidium is small and of broadly triangular form. Trinucleus concentricus is very common in the Trenton series of North America. See TRILOBITE.

TRINUM'MUS. A comedy by Plautus (about B.C.194), founded on Philemon's *Thesauros*. It introduces no female characters. The play was imitated by Lessing in his *Schatz*.

TRIO (It., musical composition in three parts). In music, in a general sense, a composition for three voices or for three instruments. In instrumental music a trio is usually understood to mean a composition written for piano, 'cello, and violin. But it is better to apply the name piano trio. A string trio is generally written for violin, viola, and 'cello, or two violins and 'cello. In a specific sense the term trio is used to denote a middle section in minuets, marches, or scherzi. It derived its name from the fact that the older composers employed three-part writing in this middle section.

TRIONAL $(CH_3)(C_2H_5)C(SO_2C_2H_5)_2$. A white crystalline compound used as a hypnotic. It is prepared by the action of methyl-ethyl ketone (a substance similar to acetone) upon mercaptan (q.v.) and the oxidation of the resulting product by permanganate of potassium. It is readily soluble in alcohol, but sparingly in water. It is an excellent and harmless hypnotic, and especially if administered in connection with a mild purgative is sure to have no injurious after effects. Its advantage over other hypnotics lies principally in the fact that its use does not lead to an organic habit and that its dose does not have to be gradually increased. Like sulphonal (q.v.), it is best administered with hot milk. It is prompter in its action and safer than sulphonal.

TRIPITAKA. See PITAKA.

TRIPLE ALLIANCE. The name by which three different European leagues are known: (1) The alliance concluded in 1668 at The Hague between England, Holland, and Sweden, having for its object the checking of the conquests of Louis XIV. (2) An alliance concluded in 1717 between England, France, and Holland against Spain. With the accession of Austria in 1718 it became the Quadruple Alliance. (3) The *Dreibund* between Germany, Austria-Hungary, and Italy, which has existed since the beginning of 1883. An alliance between Germany and Austria-Hungary was formed on October 7, 1879, on the terms of mutual assistance in the case of an attack by Russia on either party to the alliance, and friendly neutrality in case of an attack by any other power. This dual alliance became a triple alliance about three years later with the accession of Italy. The treaty between Italy and Germany provided for common action in case of French encroachments on either power, and that between Italy and Austria-Hungary for the maintenance of a friendly neutrality in the event of hostilities between France and Italy or between Russia and Austria-Hungary.

TRIPLET (from *triple*, Fr. *triple*, from Lat. *triplus*, threefold). In music, a group of three equal notes, to be performed in the time of two of like value, in the regular rhythm. For instance, when a quarter note is divided into *three* eighth notes, the group is called a triplet, and it is usual to place the figure 3 over it.

TRIP'OLI. A vilayet of the Ottoman Empire, situated on the northern coast of Africa, and bounded by Barca and the Libyan desert on the east, Tunis on the west, and the desert of Sahara on the south, on which side the boundary is very indefinite (Map: Africa, F 2). The northern half is the country called Tripoli and the southern half is Fezzan (q.v.). The area of *Tripolitania*, including Barca (the mutessarriflik of Bengazi), is in round numbers about 400,000 square miles. The interior of Tripoli is elevated and sandy, with fertile spots along the wadis. The country is exposed to the clouds of sand from the deserts. The coasts are mostly low and sandy, with the exception of the northeastern part, where some of the mountains attain an altitude of nearly 2000 feet. Tripoli has no permanent rivers, but there are a considerable number of springs, and the dry river courses fill up during the rainy season. The climate is hot during the summer, but it has more of a Mediterranean than African character. During the winter the coasts are occasionally covered with snow, while in the interior the winter is marked by copious rains. In its flora and fauna Tripoli resembles the rest of the countries on the northern coast of Africa. Owing to the scarcity of productive land and its small population, Tripoli is very little developed.

Agriculture is carried on only to a limited extent. More attention is paid to stock-raising. The chief agricultural products are wheat, dates, grapes, and olives. Sheep are raised on a large scale, and cattle are also to some extent. Some sulphur and salt are obtained near the coast, and there are small sponge fisheries. The commerce was formerly very considerable, and the port of Tripoli was once an important outlet for the products of the interior, with which it is connected by numerous caravan routes. The chief domestic exports are wool, oil, and cattle, while from the interior of Africa come gold, ostrich feathers, ivory, rubber, and a few other African products. The imports from Europe consist chiefly of manufactures. The centre of foreign commerce is Tripoli, the capital (q.v.). The annual value of the commerce is in the neighborhood of $4,000,000 annually.

Tripoli, including Barca, is divided into four provinces, administered by beys, who are appointed by the Governor. The latter is appointed by the Sultan, and is intrusted with extensive powers. The Turkish Government maintains a considerable military force, necessitated by the frequent political outbreaks. The population is estimated at from 800,000 to 1,000,000. It consists largely of Berbers and Moors, the latter living mostly in the cities. The Turkish element outside of the official circles is very limited. The official language is Arabic.

HISTORY. Tripoli appears early to have formed a portion of the territory of the Carthaginians. It next passed to the Romans, who included it within the Province of Africa, and gave it the name of *Regio Syrtica*. About the beginning of the third century A.D. it became known as the *Regio Tripolitana* (on account of its three principal cities, Œa, Sabrata, and Leptis, which were leagued together; whence its present name Tripoli), and was probably raised to the rank of a separate province by Septimius Severus, who was a native of Leptis. Later it passed into possession of the Vandals and Greeks. In the seventh century it was conquered by the Arabs (see BARBARY STATES), and the feeble Christianity of the natives was supplanted by a vigorous and fanatical Mohammedanism. In 1510 the city of Tripoli was captured by Ferdinand the Catholic, from 1530 to 1551 it was in possession of the Knights of Saint John. Since 1551 the country has formed part of the Turkish Empire, though the authority of the Sultan, down to 1835, had been virtually at zero for more than a century. During this period Tripoli was a piratical stronghold. In consequence it was attacked by successive expeditions of the English and the French. In 1801-5 it was involved in an unsuccessful war with the United States, and in 1815 an American expedition exacted reparation for injuries done to American commerce. (See BARBARY POWERS, WARS WITH THE.) In 1835 an expedition was dispatched from Constantinople; the ruling bey, Karamanli (in whose family the sovereignty had continued uninterrupted since 1714), was overthrown and imprisoned; a new Turkish pasha, with viceregal powers, was appointed, and the State made a vilayet of the Ottoman Empire. Several rebellions have since taken place (notably in 1842 and 1844), but they have always been suppressed.

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Vilayet of Tripoli," in *Great Britain Diplomatic and Consular Reports, Series 527* (ib., 1900); Minutelli, *La Tripolitania* (Turin, 1902).

TRIPOLI. The capital of the Turkish Vilayet of Tripoli, in Africa, on a promontory in the Mediterranean Sea, which forms a small bay, in latitude 32° 53′ N., longitude 13° 11′ E. Sahara approaches within a short distance. The town, whose high walls are dilapidated, lies in a fertile plain. It is typically Oriental, with its slender minarets and domed mosques. The castle of the beys is handsome. There is a splendid Roman triumphal arch, erected to Marcus Aurelius. Tripoli owes its importance as the commercial centre of the country to the three historic caravan routes of which it is the terminus. The first of these runs south across the desert of Sahara to Lake Chad; the second, southwest to Timbuktu; and the third, south by east to Wadai and points in Darfur. The city manufactures carpets, scarfs, and Spanish leather. The harbor is inaccessible to vessels drawing fourteen feet. It was visited in 1899 by 600 vessels. The trade is mostly in the hands of the Jews, who are congregated in a quarter of the town called Harra. Tripoli, one of the oldest cities of Africa, is the Œa of the Phœnicians. In February, 1804, the harbor was the scene of Lieutenant Decatur's brave exploit of recapturing and burning the American frigate *Philadelphia*. Population, in 1900, 30,000.

TRIPOLI, TRIPOLIS (the classical name), or **TARABULUS.** A town in Syria, Asiatic Turkey, the capital of a liwa in the Vilayet of Beirut, two and a half miles from El-Mina, its port, and 40 miles north-northeast of Beirut (Map: Turkey in Asia, F 5). The streets are well paved and covered in some places by arcades. The houses are built of a porous conglomerate, giving the town a picturesque Oriental aspect. There are fourteen churches, nearly equally divided between the Latin, Greek, and Maronite sects, an American mission station and girls' school, an orphanage and girls' home of the French Sisters of Charity, a synagogue, fourteen mosques, a monastery of dancing dervishes, a castle, and several large khâns. Tripoli is famous for its silk sashes. Silk, sugar-cane, ivory, ostrich feathers, wool, and sponges are exported. Mulberry trees are extensively cultivated for the silkworms. There is a large overland trade by camels with Aleppo. Population, 30,000, including El-Mina. Of the inhabitants, 24,000 are Moslems, 4500 Orthodox Greeks, 1500 Maronites. Tripoli was a member of the Phœnician league. At that time it lay on the coast. In 450 and in 550 it was destroyed by earthquakes. The Saracens took it in 638. It was several times captured by the Greeks. The Romans erected many fine buildings. After a siege of several years it was taken in 1109 by the Crusaders, under whom it enjoyed great prosperity. Destroyed by the Egyptian Sultan, Kalaun, in 1289, it was rebuilt on its present site.

TRIPOLITE (from *Tripoli*, in Africa), or **TRIPOLI.** A name sometimes applied to diatomaceous earth (q.v.), but also used to designate the siliceous residues left by the decay of impure limestones and schists. The last-named material is extensively mined in Newton County, Mo., and is employed as an abrasive and in water filters.

TRIPOLITZA, trē′pô-lyē′tsȧ, or **TRIP′OLIS.** The capital of the Nomarchy of Arcadia, Greece, 34 miles southwest of Argos, on the Argos-Kalamata Railway (Map: Greece, D 4). It is on a plain, 2000 feet above sea level, near the site of the ancient Tegea and Mantinea. Tapestries and leather goods are manufactured. Its population in 1896 was 10,465. Tripolitza is a modern city, and under the Turkish pashas was the capital of the Morea. It was captured and burned by the Greek patriot Kolokotronis (q.v.) October 17, 1821. In 1825 it was taken by Ibrahim Pasha.

TRIPOS (from Lat. *tripus*, from Gk. τρίπους, *tripous*, tripod). A term peculiar to Cambridge University, denoting the three honor classes composed of successful candidates in the final examinations in the various departments. In mathematics the first honor men are known as senior and junior wranglers. The term is also used of the examination itself.

TRIPPANT. In heraldry (q.v.), a term used of a beast of chase represented as walking.

TRIP′PEL, Alexander (1744-93). A Swiss sculptor, born at Schaffhausen. He studied in Copenhagen under Wiedevelt and Stanley, went in 1771 to Paris, and in 1776 to Rome, where, besides antique and some biblical subjects, distinguished by noble treatment of form, he executed a Monument of Count Tchernitcheff for Moscow, the excellent busts of Goethe (1788) and Herder (1789), both in the grand-ducal library at Weimar, and the Gessner Monument at Zurich.

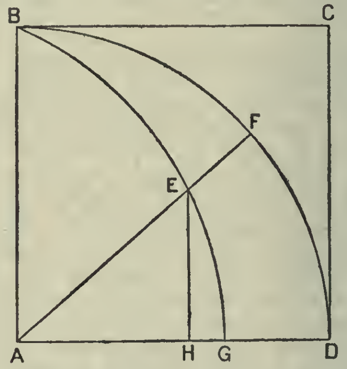
TRIPTOL′EMUS (Lat., from Gk. Τριπτόλεμος). In Greek legend, the bestower of grain upon mankind. In the Homeric Hymn to Demeter Triptolemus is merely one of the princes of Eleusis, to whom Demeter teaches her sacred rites, when she finally leaves her temple for Olympus. Later, however, he became the son of King Celeus and Meteneira, and a special favorite of Demeter, who gave him a winged chariot, or one drawn by winged dragons, and sent him forth to bear the knowledge of her gift of grain among mankind. This scene is frequently represented on Attic vases of the fifth century and later. Triptolemus had a temple at Eleusis, and was honored in Athens also in connection with the two goddesses Demeter and Kore. Attic belief also made him one of the judges in the lower world, apparently in place of Minos, who held an unfavorable place in local legends. The Greek type of Triptolemus was used by the Romans for *Bonus Eventus*, who seems to have had much resemblance to the Eleusinian hero.

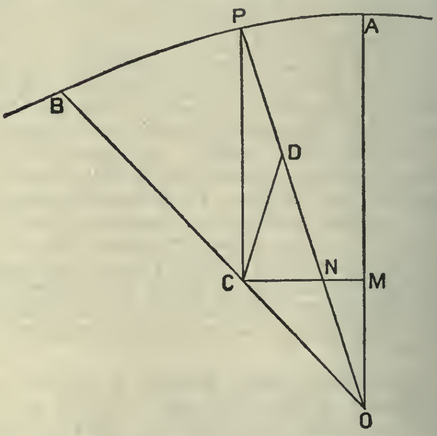
TRIP TO SCARBOROUGH, A. A comedy by Sheridan (1777), altered from Vanbrugh's *Relapse* (q.v.).

TRIPTYCH (from Gk. τρίπτυχος, *triptychos*, folded thrice, from τρεῖς, *treis*, three + πτυχή, *ptychē*, fold, from πτύσσειν, *ptyssein*, to fold). A set of three leaves, each painted with a distinct subject, but joined together by hinges, and capable of being folded so as to present a new face when closed. In ecclesiastical use, the triptych was usually a devotional picture, and was a form much in use for altar-pieces during the Gothic and early Renaissance periods. The three panels were usually of heavy wood, with an architectural framework, often in the form of a pointed arch, surrounding the painted or carved composition. Giotto, Orcagna, Gaddi, Fra Angelico, and many other famous artists painted triptychs. The German and Flemish wood-carvers and the Tuscan stuccoists of the Renaissance often retained the form, which vanished completely, however, in the sixteenth century.

TRIREME (Lat. *triremis*, galley with three banks of oars, from *tres*, three + *remus*, oar). In ancient times, a galley with three banks of oars; the common form of the ancient ship of war in the fifth and fourth centuries B.C. The credit of the invention was given to the Corinthians, who were said to have used triremes in their war with Corcyra in the seventh century B.C. The details of the structure of the Athenian trireme are still uncertain, as the statements of the ancient writers leave many points obscure, and the testimony of works of art is likewise full of uncertainties. It seems clear that the banks of oars were arranged one above the other, though not perpendicularly, that there was only one man to an oar, and that all the oars could be, and in battle were, used at the same time. For ordinary purposes the crew was, of course, divided into watches. The ancient trireme was of light draught, and could be easily hauled on shore, so that a high freeboard seems improbable, for reasons of stability; while the difficulty of keeping an effective stroke with oars of widely different lengths also speaks against any such mode of construction. The trireme was provided with a mainmast which carried a large square sail, that was lowered with its yard, or if possible left on shore, before going into action. In the latter case the mast also was unstepped and laid along the deck. There was also a small foremast, which seems to have projected somewhat like a bowsprit and likewise carried a square sail. The Attic trireme of the fourth century carried 170 oars, but probably not over 150 were actually used, the rest being a reserve equipment. Officers, sailors, and ten or twelve hoplites brought the total crew up to about 200 men. The ship was steered by large paddles on either side of the stern, connected inboard so that they could be handled by a single man. The time was given to the rowers by a special officer, the *keleustes*. The lowest rank of rowers were called *thalamitæ*, the second *zeugitæ*, and the uppermost *thranitæ*, and these received the highest pay, as handling the longest oars. In the early battles, such as Salamis, the chief endeavor was to lay the ships aboard and fight from the decks, trusting little to manœuvring, in which the Greeks seem to have felt themselves inferior. Later the Athenians developed a high degree of skill in handling their long, light vessels, and preferred to regard the trireme as the weapon, and to aim at disabling or sinking the enemy by the use of the ram, which projected at the water line or below. The attack was aimed at the quarter or side of the hostile ship, and to meet bows on was held unskillful and even dangerous, as the bow was not strongly built. Against the Carthaginians the Romans used boarding bridges in order to neutralize the seamanship of their opponents, and bring about a conflict of soldiers. Consult: Graser, *De Veterum Re Navali* (Berlin, 1864), and in *Philologus*, Sppl. Bd. iii.; Serre, *Les marines de guerre de l'antiquité et du moyen-âge* (Paris, 1885, 1891); Breusing, *Die Nautik der Alten* (Bremen, 1886), and *Die Lösung des Trierenrätsels* (Bremen, 1889); Assmann, s. v. "Seewesen," in Baumeister's *Denkmäler des klassischen Altertums* (Munich, 1889); Luebeck, *Das Seewesen, der Griechen und Römer* (Hamburg, 1890, 1891); C. Torr, *Ancient Ships* (Cambridge, 1894).

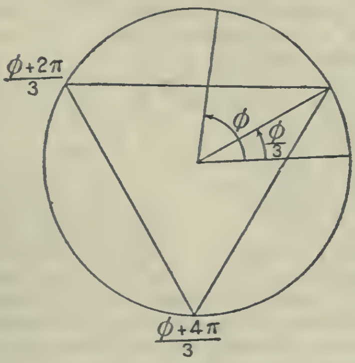
TRISECTION OF AN ANGLE (from *trisect*, from Lat. *tres*, three + *sectus*, p. p. of *secare*, to cut). One of the three famous problems of antiquity, the others being the duplication of the cube (q.v.) and the squaring of the circle. (See CIRCLE; QUADRATURE.) This problem, like the quadrature of the circle, is almost as old as geometry itself, but first received thorough investigation at the hands of the Sophists (B.C. 400). Hippias of this school invented the quadratrix (see QUADRATURE), by which any angle may be trisected. In the figure BD is a quadrant of a circle, BG is an arc of the quadratrix, and the construction involves the relation $\frac{DB}{FD}=\frac{BA}{EH}$. Hence by dividing BA into segments having any given ratio, the quadrant or any arc BD can be divided into arcs having the same ratio. If the arc is to be trisected the line corresponding to BA is trisected.





The trisection of an angle is also accomplished by means of the conchoid (q.v.) of Nicomedes (B.C. 180). If AOB in the figure is the angle to be trisected, C any point on OB, CM $\perp$ OA and CP $\parallel$ OA, it is easily seen that if P can be found so that PN=2CO then PO is a trisection line of angle AOB. But the trammel of the conchoid with its directrix resting on CM, parameter AM=CB=2CO, its pole at O, will describe a curve cutting CP in the required point. Many other methods have been devised for the solution of this problem. Viète (1591) showed its relation to the solution of the cubic equation. Gauss (1801) showed its relation to cyclotomic equations. Other mathematicians of the nineteenth century have declared its solution impossible by means of the straight edge and compasses (that is, by the postulates of Euclidean geometry). But the real reason for the failure of this method to solve the problem and also its associates was set forth by Klein.

The argument may be briefly stated as follows: (1) According to the formula of De Moivre (q.v.) the roots of the equation $x^3 = \cos\phi + i\sin\phi$ are $x_1 = \text{cis}\,\frac{\phi}{3}$ $x_2 = \text{cis}\,\frac{\phi + 2\pi}{3}$, $x_3 = \text{cis}\,\frac{\phi + 4\pi}{3}$. (2) These roots are represented geometrically by the vertices of an equilateral triangle inscribed in the unit circle with its centre at the origin. The figure shows that to the root x_1 corresponds the argument $\frac{\phi}{3}$. Hence the equation $x^3 = \cos\phi + i\sin\phi$ is the analytic expression of the problem of the trisection of the angle. No root of the equation can be expressed as a rational function of $\cos\phi$ and $\sin\phi$. That is, the equation is irreducible and can be solved by the aid of a finite number of square roots only for special values of ϕ. Hence the trisection of an arbitrary angle cannot be effected with straight edge and compasses. Consult: Klein, *Famous Problems of Elementary Geometry* (1896, Eng. ed., Boston, 1897).



TRIS′MEGIS′TUS. See Hermetic.

TRIS′MUS NASCEN′TIUM (Neo-Lat., lockjaw of the new born). A form of lockjaw occurring in newly born children a few days after birth. In consequence of it the children cannot nurse or cry, and they usually die in forty-eight hours. In some cases the attack comes in eight or ten days after birth. The cause is infection with the tetanus poison, probably always through the wound in the umbilical cord. See Tetanus.

TRISSINO, trĕs-sē′nō, Giovanni Giorgio (1478-1550). An Italian author, born at Vicenza. Excluded from his native territory by the Signoria of Venice, he spent some time in Germany, at Ferrara, and at Florence, and in 1514 went to Rome, where he was received with favor by Pope Leo X., who sent him on missions to the Emperor Maximilian and to the Signoria of Venice. At the instance of Leo X., the ban of proscription was taken off. He enjoyed the esteem of Popes Clement VII. and Paul III., and passed some time at Venice as nuncio of the former pontiff. He died in Rome December 8, 1550. Trissino sought to revive the epic in his mother tongue; he gave to the Italian stage its first regular tragedy, and he made the first large use of the hendecasyllable in blank verse. His attempt to produce an epic poem resulted in the *Italia liberata dai Goti*, a work of twenty-seven cantos in eleven-syllabled blank verse, completed in 1548. Blank verse and the hendecasyllable are used also in Trissino's *Sofonisba* (1515), which, although it has not the conventional division into acts, is regarded as the first regular tragedy in the modern languages of Europe. In a comedy, *I Simillimi*, which is a free imitation of the *Menæchmi* of Plautus, Trissino adopted his favorite eleven-syllabled blank verse and introduced certain lyrical strophes like those employed in the Greek comedy. Some Latin poems, a *Canzone a Clemente VII.*, and various *Rime* make up the rest of his compositions in verse. Trissino gave new life to the already mooted question of the proper Italian tongue with his edition of the *De Vulgari Eloquio* of Dante in 1529; and his treatise, *Il Castellano*, advocated the doctrine of a general Italian tongue as opposed to a merely Tuscan standard. Of his remaining works there may be mentioned the *Poetica*. Consult: Morsolin, *Giangiorgio Trissino, monografia di un letterato del secolo XVI.* (2d ed., Florence, 1894); Ciampolini, *La prima tragedia regolare nella letteratura italiana* (Lucca, 1884).

TRISSOTIN, trē′sō′tăN′. A poet in Molière's *Femmes savantes*, satirizing a gallant preacher, Abbé Cotin.

TRIST, Nicholas Philip (1800-74). An American lawyer and diplomatic agent, born at Charlottesville, Va. He was educated at the United States Military Academy, but did not graduate. He studied law under the direction of Thomas Jefferson, whose granddaughter he married, and of whose household he was a member, but became a clerk in the United States Treasury Department in 1824, and was private secretary to President Jackson in 1829. In 1834-36 he was United States Consul at Havana, and in 1845 he was chief clerk in the Department of State. During the Mexican War, after the American successes at Buena Vista and Vera Cruz, President Polk, on April 15, 1847, appointed Trist a special agent to negotiate for peace, but without notifying General Scott. On the arrival of Trist a violent quarrel ensued between him and Scott. Negotiations, however, were fruitless until after the capture of the City of Mexico and the resignation of Santa Anna as President. The succeeding Government wished to make terms and Trist, though his powers had been withdrawn, feeling that the strong desire for peace in the United States would excuse the irregularity, proceeded with the negotiations, by the advice of General Scott, who had now become his friend. The Treaty of Guadalupe Hidalgo was signed February 2, 1848, and was ratified by the United States Senate.

TRIS′TAN. See Tristram.

TRISTAN DA CUNHA, trĭs-tän′ dȧ ko͞on′yȧ. A group of three small volcanic islands in the South Atlantic Ocean, situated in 37° 6′ south latitude, 12° 1′ west longitude, 1500 miles south-southwest of Saint Helena, and nearly midway between Cape Town and Buenos Ayres (Map: World, Eastern Hemisphere, N 19). Total area, 44 square miles. The largest and only inhabited island consists of an extinct volcano 8500 feet high. The climate is equable and healthful. The inhabitants numbered over 100 in 1880, but only 64 in 1897. They are chiefly the descendants of the British soldiers stationed there during Napoleon's captivity at Saint Helena, and of settlers from whaling ships. They are supported by agriculture and have a considerable number of cattle. The islands were discovered in 1506 by the Portuguese navigator Tristan da Cunha, and were taken by Great Britain in 1816.

TRIS′TIA (Lat., laments). Five books of short poems, in the elegiac metre, written by Ovid between 9 and 12 A.D. during his banishment at Tomi. The poems are letters to friends at home, recalling his former life, describing his present surroundings, and appealing for a mitigation of his harsh lot.

TRIS′TRAM, TRISTREM, or **TRISTAN.** The hero of a Welsh or Armorican romance originally distinct from the Arthurian cycle, but early incorporated with it. Tristram was the son of Roland of Ermonie by Blanchefleur, sister to King Mark of Cornwall. His father slain, his mother dead of grief (which she expressed in the child's very name), Tristram was reared by a faithful steward. At the age of fifteen he drifted to the Court of his uncle, King Mark, whose favor he won by his skill in the chase and in minstrelsy. He slew in mortal combat Moraunt, brother of the Queen of Ireland, who had come to demand tribute from King Mark. After suffering for three years from severe wounds, he sailed to Ireland, where they were healed by Iseult (variously spelled), daughter of the Queen. On his return to Cornwall, Tristram told his uncle of the marvelous beauty of the Irish princess, and was sent back to Ireland to ask her hand in marriage for the King. On the voyage from Ireland to Cornwall, Tristram and Iseult drank of a love-potion intended for King Mark and ever after loved each other. Iseult married Mark, but contrived, with the aid of her clever maid, to have many secret interviews with Tristram. At length the lovers were discovered, and Tristram fled to Wales, and later to Brittany, where he married another Iseult, the White-handed, daughter to Duke Florentine; but he never forgot Iseult of Ireland. Desperately wounded, he sent a messenger to Cornwall to summon her to heal him once more. He directed the messenger to hoist a white sail on the return voyage if the princess were on board; if not, a black sail. The Queen of Cornwall hastened to save her lover. As the vessel neared the shores of Brittany, Iseult of the White Hand saw the white sail; but, fired with jealous hate for her rival, she told her husband that the sail was black. Tristram sank back and died. Iseult of Ireland fell prostrate over the body of Tristram and died of a broken heart. King Mark subsequently learned the story of the love-potion, and buried the lovers in one grave, planting over Iseult a rose and over Tristram a vine, growing so intertwined that no one could separate them

This passionate story, having some basis in Celtic myth, got into literature in the twelfth century and spread through Western Europe. It may be traced back to a poem, now existing only in fragments, by an Anglo-Norman trouvère named Béroul (about 1150). A little later than this (about 1160), the theme was treated by Chrestien de Troyes (q.v.) in a poem now lost. So far as has been determined, the source of the many later Tristrams is a very prolix poem by an Anglo-Norman named Thomas (about 1170). Before the close of the twelfth century Tristram and Iseult were among the favorite themes of the troubadours. From the French the romance passed into the German *Tristrant* (about 1175) by Eilhard of Oberge and the *Tristant und Isolde* (between 1200 and 1225) by Gottfried of Strassburg. Gottfried's poem, extending to 19,573 lines, is the most beautiful of all early versions. Left incomplete, it was continued by Ulric of Türheim and by Henry of Freiburg. The great popularity of the romance in Germany is further attested by numerous chapbooks. To the year 1226 belongs a Scandinavian version, *Tristram Saga ok Isondar*, and this in turn was put into Icelandic prose. The earliest extant English version is known as *Sir Tristrem*. The only extant manuscript belongs to the middle of the fifteenth century. It was composed in the last part of the thirteenth century, and has been ascribed to Thomas the Rhymer (q.v.). In 1469 was published at Rouen an immense prose *Tristram* in French, which was translated into German, Spanish, and Italian. It was also used by Sir Thomas Malory (q.v.) for his *Morte D'Arthur* (1485). In the nineteenth century Tristram and Iseult became a favorite theme in England and Germany. Following Malory, Tennyson wove the story into the *Idylls of the King* ("The Last Tournament"). In his noble *Tristram and Iseult*, Matthew Arnold awakened pity for Iseult of Brittany. But Swinburne in his *Tristram of Lyonesse* best expressed the tremendous passion of the mediæval tale. The theme was also treated by Karl Immermann (1841), and splendidly by Wagner in his operatic poem *Tristan und Isolde* (1859). Consult the English *Sir Tristrem* as edited by G. P. McNeill for the "Scottish Text Society" (Edinburgh, 1886), and by E. Kölbing in *Die nordische und die englische Version der Tristansage* (Heilbronn, 1878-82); also Golther, *Die Sage von Tristan und Isolde* (Münich, 1887). A charming version of the Tristram story is that of J. Bédier, *Le roman de Tristan et Iseut* (5th ed., Paris, 1902).

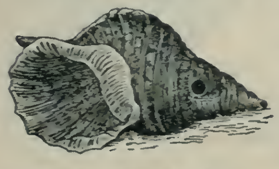
TRISTRAM, Henry Baker (1822—). An English clergyman, traveler, and author, born at Eglingham, Northumberland. He graduated at Lincoln College, Oxford, in 1844, and in 1880 became rural dean of Durham. He traveled extensively in biblical lands and elsewhere, and published, among other works: *The Great Sahara* (1860); *Land of Israel* (1865; 2d ed. 1882); *Natural History of the Bible* (1867; 5th ed. 1880); *Bible Places, or Topography of the Holy Land* (1872-97); *Land of Moab* (1873; 2d ed.

1874); *Pathways of Palestine* (2 vols., 1882); *Fauna and Flora of Palestine* (1884); and *Eastern Customs in Bible Lands* (1894).

TRISTRAM SHANDY, The Life and Opinions of. A novel by Laurence Sterne in 9 volumes (1759-67). The plot is slight and without continuity. The chief interest of the work is in its painting of individual characters: Walter Shandy, the father of the nominal hero, a man of varied and useless learning; Captain Shandy (Uncle Toby), the real hero of the story; Corporal Trim, and Yorick, whose figures stand out from a background of satire, drollery, and philosophical disquisitions.

TRITHE'MIUS, Johannes (1462-1516). A German Catholic theologian and historian. His real name was Heidenberg, but he was called Tritheim or Trithemius from his birthplace, Trittenheim. In 1482 he entered the Benedictine monastery at Sponheim, near Kreuznach, and in 1483 became its abbot. Here he collected a library which made the house famous. His rule was strict, and his monks resented his long absence in the neighboring country, so in 1506 he exchanged Sponheim for the Scotch monastery of Saint James at Würzburg, and there he died. His writings are very numerous; the principal ones are his sermons to monks (1576), but of greater value are his familiar letters (published 1536). He was also a pioneer author in German Church history, and invented a popular system of shorthand, *Steganographia* (Frankfort, 1606, n. e. 1635), for which see Bailey, *John Dee and the Steganographia of Trithemius* (London, 1879). Consult his *Life* by L. Silbernagel (2d ed., Landshut, 1868); Schneefarn, *Abt Johannes Trithemius und Kloster Sponheim* (Kreuznach, 1882).

TRI'TON (Lat., from Gk. Τρίτων). In Greek mythology, a son of Poseidon and Amphitrite, who dwells with his parents in a golden palace at the bottom of the sea. He seems especially connected with Bœotia, and was perhaps originally a local divinity of Alalkamenæ or Tanagra. In this region took place the conflict of Hercules with Triton, which was a favorite subject in early works of art. In the fourth century B.C. and later, we find a whole race of Tritons, to be compared with Panes, Sileni, and similar multiplications. In art they are at first human to the breast or waist, ending in the tail of a sea-serpent or fish. In later art we find the legs replaced by fishes' tails, or else the figure that of a sea-centaur, with the head and trunk of a man, the fore legs and body of a horse, and passing into a serpent with a fish's tail. Characteristic is Triton's conch-shell, on which he is represented as blowing stormily or gently. Pausanias (ix. 22) describes a Triton exhibited in Rome, which differed from the representations in art, and seems to have been the ingenious fabrication of some ancient showman.



TRITON CONVERTED INTO A WAR-TRUMPET.

TRITON. (1) A genus of aquatic amphibians, the newts (q.v.). (2) Any of several large gastropod shells, especially a large species (*Triton Tritonis*), having a spiral shell more than a foot long, which is used as a war-trumpet by natives of the South Sea Islands, the example illustrated being one from the Admiralty Islands.

TRITONE (from Gk. τρίτονος, *tritonos*, having three tones, from τρεῖς, *treis*, three + τόνος, *tonos*, tone, sound, tension, strength, cord). In music, a term denoting the augmented fourth which is a succession of three whole tones, as F—B. A progression by the interval of the tritone was strictly forbidden by the older theorists. Even in modern music it is used but sparingly.

TRITYL'ODON (Neo-Lat., from Gk. τρεῖς, *treis*, three + τύλος, *tylos*, knob, knot, callus + ὀδούς, *odous*, tooth). A small extinct reptile of the suborder Theriodontia, known by its skull, which has a remarkably mammalian expression and which is found in the Karoo beds of South Africa. See Theromorpha.

TRIUMPH (Lat. *triumphus*, OLat. *triumpus*, triumph, victory, shout of joy, Gk. θρίαμβος. *thriambos*, procession at the feast of Bacchus, name of Bacchus; of uncertain etymology). The name given in ancient Rome to the highest public honor bestowed on a general who had been successful in war. The victor, after having pronounced a eulogy on the bravery of his soldiers, ascended his triumphal car and passed through the Porta Triumphalis (which probably stood on the Campus Martius), where the senate met him, and the procession was organized and entered the city, passing by the *Via Sacra* to the Capitol. First marched the senate, headed by the magistrates; next came a body of trumpeters; then a train of carriages and frames laden with the spoils of the vanquished; then a body of flute-players, followed by the oxen to be sacrificed, and the sacrificing priests; then the distinguished captives with bands of inferior prisoners in chains; after whom walked the lictors of the imperator, having the fasces wreathed with laurel. Next came the hero of the day—the imperator—in a circular chariot. He was attired in an embroidered robe and flowered tunic, bearing in his right hand a laurel bough, in his left a sceptre, and having his brows garlanded with Delphic laurel. He was accompanied by his children and his intimate friends. His grown-up sons, the legates, tribunes, and equites, rode behind; and the rear was brought up by the rest of the soldiery, singing or jesting at their pleasure, for it was a day of carnival and license. When the procession had reached the foot of the Capitoline some of the captive chiefs were put to death; the procession, after waiting to hear their death announced, mounted to the Temple of Jupiter Capitolinus, where the oxen were sacrificed, and the laurel wreath placed in the lap of Jupiter. In the evening the imperator was publicly feasted, and it was customary to provide him a site for a house at the public expense. Under the Empire generals serving abroad were considered to be the Emperor's lieutenants, and therefore, however successful in their wars, they had no claim to a triumph. They received instead *triumphal decorations* and other rewards.

The *ovation*, or lesser triumph, differed from the greater chiefly in these respects: that the imperator entered the city on foot, clad in the simple *toga prætexta* of a magistrate, and wearing a wreath, not of laurel, but of myrtle; that he bore no sceptre, was not preceded by the senate and flourish of trumpets, nor followed by his victorious troops, but only by the equites and the populace, and that the ceremonies were concluded by the sacrifice of a sheep instead of a bull, whence, doubtless, the name *ovation* (from *ovis*, a sheep). Some variations of these ceremonies are found in various authorities and on various monuments.

TRIUMVIRATE (Lat. *triumviratus*, office of a triumvir, union of three men, from *triumvir*, one of a board of three men associated in a public office, from *trium*, gen. pl. of *tres*, three + *vir*, man). The name given in Roman history to the private league entered into between Pompey, Cæsar, and Crassus—the three most powerful men of their time. This compact was not a triumvirate, in the proper sense of the term; it had no legally constituted existence. The term is also applied to the division of government between Octavian (Augustus), Antonius, and Lepidus in the civil wars that followed the murder of Cæsar—an arrangement sanctioned, and therefore legalized, by the senate. The former is usually called the *first*, the latter the *second* triumvirate.

TRIVAN′DRUM. A military cantonment and the capital of the native State of Travancore (q.v.), Madras, India, 53 miles southwest of Tinnevelli and about 2 miles from the Arabian Sea (Map: India, C 7). Among the features are the fort with its Maharaja palaces, the temple to Vishnu, the observatory, and the Napier Museum. The Maharaja College here is one of the leading institutions for higher education in India. There is also a Sanskrit college. Wood-carving is the principal industry. Population, in 1901, including cantonment, 57,882.

TRIV′ET (or **TREVET**), Nicholas (c.1258-1328). An English historian, belonging probably to a Somerset family. He is said to have studied at Oxford and at Paris, and to have been a Dominican friar in London, becoming eventually the prior of his house. He wrote extensively on theology and Latin literature, but he is chiefly known for his *Annales sex Regum Angliæ qui a Comitibus Andegavensibus Originem Traxerunt* (ed. by T. Hog for the English Historical Society, 1845). This chronicle history of the Angevins is particularly valuable for the reign of Edward I., the period in which the author flourished. The entire period covered by the *Annales* is from 1136 to 1307.

TRIVIER, trē′vyȧ′, Elisée Camille Ernest (1842—). A French explorer, born at Rochefort. He served in the expedition sent out by Napoleon III. to Mexico, and afterwards spent several years in Argentina. In 1888 he was sent out by the journal *La Gironde* of Bordeaux to search for the explorer Stanley. With a single white companion and two Sengalis he started from Loango on the west coast in December of 1888, and a little less than a year afterwards reached Zanzibar. Upon his return to France he published *Mon voyage au continent noir.*

TRIV′IUM (Lat., meeting of three roads). In the curriculum of the early universities, the lower section of the Seven Liberal Arts. It embraced grammar, logic, and rhetoric.

TROADES, trō′ȧ-dēz (Lat., from Gk. Τρῳάδες, the Trojan Women). A play by Euripides (B.C. 455), the scene of which is laid at Troy in the Grecian camp, where the captured would have been allotted to their conquerors. The play is made up of wonderful scenes of the fall of Troy, but lacks unity, and is marred by rhetorical display.

TROCADERO, trô′kȧ′dȧ′rô′. An elevation on the right bank of the Seine, opposite the Pont d' Iéna, named after a Spanish fort near Cadiz taken by the French in 1823. The ground was laid out in terraces for the Exhibition of 1867, and for that of 1878 the present Palais du Trocadéro was erected. The building, an immense structure in Oriental style, consists of a central portion flanked by curving wings each 220 yards in length. In the middle façade is a balcony with six allegorical bronze figures; below it a large cascade falls into a basin 196 feet in diameter. The building is surrounded by a small park with an aquarium, and contains a hall for concerts seating 6000, and important museums of comparative sculpture and ethnography.

TROCHEE, trō′kē (Lat. *trochæus*, from Gk. τροχαῖος, *trochaios*, trochee, tribrach, running, from τροχός, *trochos*, a running, from τρέχειν, *trechein*, to run). The name of a foot, or measure, in Greek and Latin verse, consisting of a long and a short syllable (— ⌣). This rapid measure was employed both in tragedy and in comedy. By analogy the term is used in modern verse to designate a dissyllabic measure consisting of a stressed and an unstressed syllable; for example:

Whén shall wé three meét again′?

See Versification.

TROCHILIDÆ, trô-kĭl′ĭ-dê. The family of the humming-birds (q.v.).

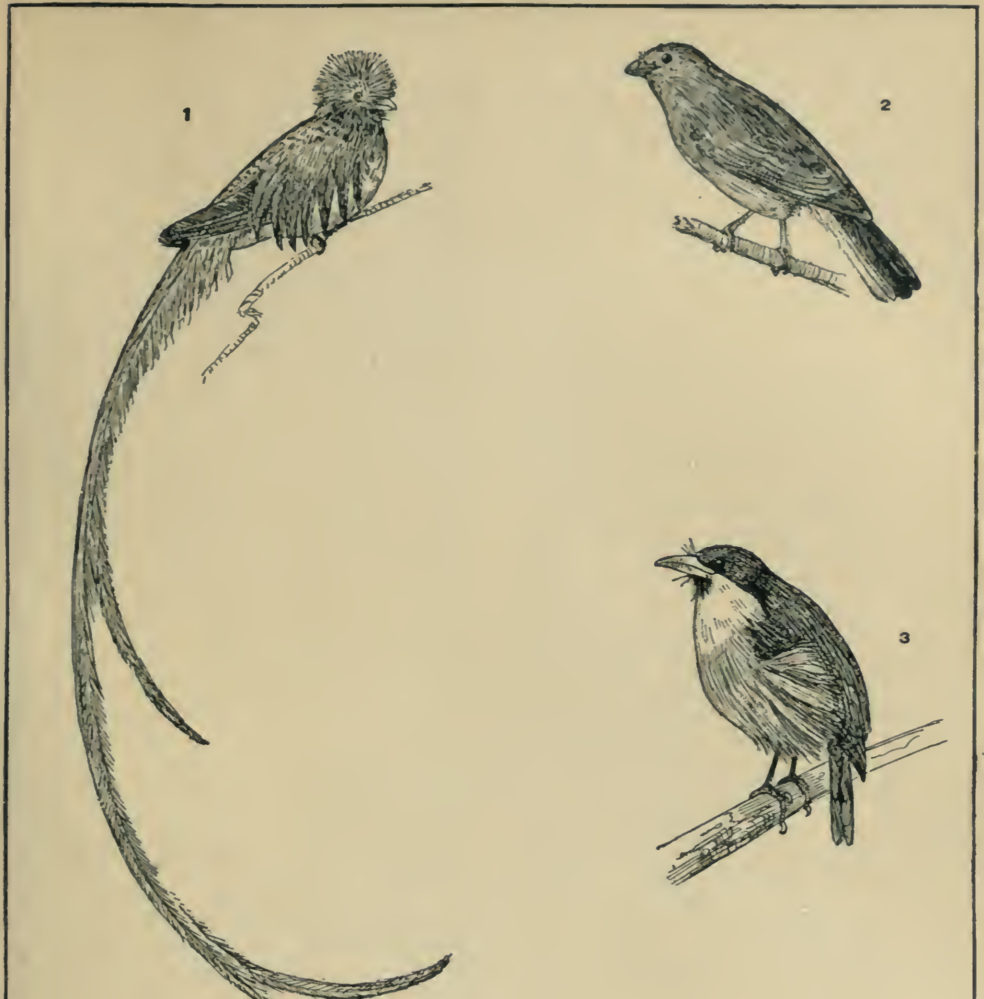
TROCHILUS, trō′kĭ-lŭs. (1) The typical genus of humming-birds (q.v.). (2) the Ancient name of a certain plover. See Crocodile-Bird.

TROCHOID, trō′koid. See Cycloid.

TROCHOSPHERE, or Trochophore. A larval form common to many of the lower invertebrates, which consists of an oval or pearlike body of miscroscopic minuteness, with a broader and a narrower end, and a distinct bilateral symmetry. The body is encircled by a double zone of strong cilia. The mouth, just behind this circlet, leads into an alimentary which winds toward the small end, where an anal aperture opens. The broader end exhibits sense-organs varying in different species in number and character. From this kind of larva the adult forms of the higher groups (many worms, polyzoans, mollusks, etc.) are developed by some sort of true metamorphosis, resulting in an animal utterly different; but in certain very lowly groups, such as the wheel-animalcules (Rotifera) and certain closely allied microscopic aquatic forms, no metamorphosis occurs, and the adult may be looked upon as a somewhat modified trochosphere. These groups have therefore been associated by some zoölogists into a phylum termed Trochelminthes. Consult Parker and Haswell, *Text-book of Zoölogy* (New York, 1897).

TROCHU, trô′shụ′, Louis Jules (1815-96). A French general, born at Palais, in the Department of Morbihan. After studying in the General Staff Academy, he fought, after 1846, with great distinction in Algeria, and in 1851 became head of

TROGON, HOOPOE, ETC.



1. GREEN TROGON or QUETZAL (Pharomacrus mocinno).
2. LESSER HONEY-GUIDE (Indicator minor).
3. YELLOW-THROATED BARBET (Capito Richardsoni).
4. CAYENNE PUFF-BIRD (Bucco Ordi).
5. MADAGASCAR HOOPOE (Upupa marginata).

a bureau in the Ministry of War. During the Crimean War he served as aid to Saint-Arnaud and Canrobert, was made a general of brigade, and at Sebastopol distinguished himself in the storming of the Malakoff bastion, September 8, 1855. As general of division during the Austro-Italian war of 1859 he did excellent service at Solferino, assuming, after the conclusion of peace, an important post in the War Department. In 1867 he published, anonymously, *L'armée française en 1867*, in which he criticised severely the defects in the French army organization, thereby losing favor at Court. After the outbreak of the war with Germany, he became, August, 1870, Governor of Paris, and on the downfall of the Second Empire, after Sedan, was made head of the Government of National Defense, remaining at the same time in command of the military forces of the city. His half-hearted defense of the capital subjected him to bitter criticism, and when further resistance to the besieging forces had become impossible, he laid down the office of Governor, January 22, 1871, a week before the capitulation of the city. He remained at the head of the Government till the meeting of the National Assembly, of which he was a member. In 1873 he resigned from the army and retired to private life. He died at Tours October 7, 1896. In defense of his conduct during the siege of Paris, he published *L'empire et la défense de Paris devant le jury de la Seine* (1872); *Pour la vérite et pour la justice* (1873); *La politique et le siège de Paris* (1874).

TROCTOLITE (from Gk. *τρωκτός*, *trōktos*, that which can be gnawed, from *τρώγειν*, *trōgein*, to gnaw + *λίθος*, *lithos*, stone). An olivine gabbro (q.v.), especially rich in serpentinized olivine, in Germany called *Forellenstein* (troutstone.)

TRŒ'ZEN (Lat., from Gk. *Τροιζήν*, *Troizēn*). An ancient city of Greece in Argolis, about 2 miles from the Saronic Gulf, nearly opposite Calauria. It played some part in Greek legend, being closely associated with Attica, as the birthplace of Theseus, whose mother, Æthra, was daughter of King Pittheus. Here also was localized the story of the fatal love of Phædra (q.v.) for her stepson Hippolytus (q.v.). In historic times it was a Dorian city. During the invasion of Xerxes it took a prominent part in the defense of Greece, sending ships to the Greek fleet, and receiving with great kindness the Athenian women and children when driven from their city by the Persian advance. It was later a faithful ally of Sparta during the Peloponnesian and Corinthian wars. Under the Macedonian supremacy it changed masters frequently, now being in the hands of Macedon, again under Sparta, and again brought by Aratus into the Achæan League. In Roman times it seems to have continued to flourish, for Pausanias (q.v.) gives a somewhat detailed account of the objects of interest in the place. The site near the modern village of Damala is marked by few ruins, and excavations undertaken by the French School at Athens have brought to light little beyond the foundations of some large buildings of rather uncertain use.

TROGLODYTES, trŏg'lô-dī'tēz (Lat. *troglodyta*. from Gk. *τρωγλοδύτης*, *trōglodytēs*, cave-dweller, one who creeps into holes, from *τρώγλη*, *trōglē*, cave, hole + *δύειν*, *dyein*, to enter, creep into). The name given by the Greeks to tribes or races of uncivilized men, who dwelt either in natural caverns, or in holes which they had dug for themselves in the earth. They are mentioned by Strabo as existing as far west as Mauretania, and as far east as the Caucasus. Perhaps the best-known troglodytes of ancient times were those of Southern Egypt and Ethiopia, where a considerable extent of country was called *Regio Troglodytica*. According to the Greek accounts they could not speak articulately, but shrieked or screamed like the lower animals. Their chief occupation was herding cattle, and their habits of life were rude and debased. They are reported to have eaten not only the flesh, but the bones and hides of their cattle; their drink is said to have been a mixture of milk and blood; and they had a community of wives. They went almost naked, and put to death the aged and infirm. The name is occasionally applied loosely to any class of cave-dwellers (q.v.).

TROGON (Neo-Lat., from Gk. *τρώγων*, pres. part. of *τρώγειν*, *trōgein*, to gnaw). A bird of the family Trogonidæ, including about 50 species remarkable for the beauty of their plumage, which is soft, full, and brightly colored. The bill is short, strong, with a wide gape; the tail generally long, in some species very long; the feet small, and frequently feathered almost to the toes. The toes are two in front and two behind, but, unlike all other zygodactylous birds, the reversed toes are the first and second instead of the first and fourth. All the trogons are tropical. They abound most of all in South America, but a number occur in Asia and a few in Africa. One species, the copper-tailed trogon (*Trogon ambiguus*), is found as far north as the valley of the Rio Grande. It is 11 inches long, bright metallic golden green, throat white, breast and belly carmine, middle tail feathers coppery green, the rest of the tail white and black. The most gorgeous of the trogons is the quetzal (q.v.). Trogons are usually seen singly or in small flocks, and are unsuspicious. They remain most of the time in the thick forest, resting quietly during the heat of the day. The Old World species feed principally on insects, but American trogons eat much fruit, and also catch insects, crabs, crayfish, small lizards, snails, and the like, getting most of this food on the wing or by clinging to the branches of trees, like woodpeckers or mouse-birds. Their notes are loud, rather discordant cries, varied by clucking, whistling, and other strange notes. No nest is made, the round whitish eggs being laid in a hole excavated in a rotting tree-stub. The group is ancient, as is known by fossil examples, and sufficiently distinct to be ranked as a suborder. Extended accounts of the American trogons are given by Sclater and Salvin in *Biologia Centrali-Americana*, vol. iii. (London, 1896). See Plate of TROGON, HOOPOE, ETC.

TRO'GUS POMPE'IUS. A Roman historian of Gallic origin who lived during the reign of Augustus, son of one of Cæsar's secretaries. He was the author of *Historiæ Philippicæ* (in 44 books), a universal history from the time of Ninus, King of Assyria, down to A.D. 5. The original work, which was drawn from some of the best Greek historical writers, is lost, but an epitome of it by Justin is still extant. In addition to the historical narrative, the work is said to have contained interesting accounts relating to geography, ethnography, and natural science. Trogus is said to have written several zoölogical and botanical works, based largely on the works of Aristotle and Theophrastus. Consult: Heeren, *Commentationes de Trogi Pompeii ejusque Epitomatoris Justini Fontibus et Auctoritate*, printed in Frotscher's edition of Justinus (Leipzig, 1827-30); and Crohn, *De Trogi apud Antiquos Auctoritate* (Strassburg, 1882).

TRO′ILUS (Lat., from Gk. Τρωιλος). A son of Priam, or of Apollo, who was slain by Achilles.

TROILUS AND CRES′SIDA. A drama by Shakespeare, probably originally written about 1602 and revised before 1609, when it was printed in two editions. The sources were probably Chaucer, Le Fèvre's *Recuyen of the Histories of Troye*, Lydgate's *Troy-Book*, and perhaps Chapman's *Homer*, partly translated in 1597.

TROIS MOUSQUETAIRES, trwä mụs'ke-târ′, Les (Fr., The Three Musketeers). A romance by Dumas (1844). The scene is laid in the time of Richelieu, in whose affairs the three famous guardsmen Athos, Porthos, and Aramis and their companion D'Artagnan take part.

TROITZK, trō′ĭtsk. A town in the Government of Orenburg, Russia, on the Uya, 394 miles northeast of Orenburg (Map: Russia, K 4). It has a 'barter court,' where an extensive barter trade with the Kirghizes and other tribes is transacted. Population, in 1897, 23,100.

TROJAN WAR. A famous legendary war, generally placed about the beginning of the twelfth century B.C.; undertaken by the Greeks for the recovery of Helen, wife of King Menelaus of Sparta, who had been carried off by Paris, son of the Trojan King, Priam. At the marriage of Peleus and Thetis, Paris had adjudged the golden apple thrown by Eris, and inscribed "For the Fairest," to Aphrodite, thereby securing Helen by her favor and bringing down on the Trojans the lasting wrath of the slighted Hera and Athene. The expedition to avenge the injury to Menelaus was placed under the command of his brother, Agamemnon, King of Argos, and was joined by the Greek heroes, including Achilles, Patroclus, the two Ajaxes, Teucer, Nestor, Odysseus, Diomedes, and Idomeneus. They assembled at Aulis with 100,000 men and 1186 ships and proceeded to Troy, where their demand for the return of Helen was refused. The siege was then begun. It lasted ten years and terminated only by treachery, when the Greek warriors were introduced into the city in the interior of a great wooden horse. The sack and burning of Troy follow, with the escape of Æneas, whose progeny were to be the founders of Rome.

The story of the war is told in various classical epic poems, of which the *Iliad* is the most famous. It terminates with the death of Hector, the principal hero of the Trojans. The *Little Iliad*, ascribed to Lesches of Lesbos, was composed about B.C. 660. In four books it gave the story of the contest of Odysseus and Ajax, son of Telamon, for the armor of Achilles, the deaths of Ajax, Paris, and Eurypylus, the stealing of the Palladium, and the construction of the wooden horse. At this point the legend was taken up by the *Iliou Persis* or *Sack of Troy*, by Arctinus, in two books, ending with the escape of Polyxena at the tomb of Achilles. The *Nostoi* (Returns), attributed to Agias of Trœzen, in five books, told of the wanderings of Menelaus, Calchas, and Neoptolemus, and the murder of Agamemnon. The *Telegonia*, by Eugammon of Cyrene, related various adventures of Odysseus after the slaying of the suitors, his death at the hands of his son Telegonus, and the latter's marriage to Penelope.

The legendary history of Troy before the Trojan War, like other Greek myths, varied much in details. It was said that the place owed its name to Ilus, son of Tros, son of Dardanus. Its walls were built by Poseidon for Laomedon, who, however, cheated the god of his promised reward. Hercules rescued Hesione, the daughter of Laomedon, from the sea-monster to which she had been exposed, but was likewise cheated by the King, whereupon he and Telamon attacked and captured the city.

The Trojan legend was very popular in the Middle Ages, and formed, with the Charlemagne story and the Arthurian traditions, one of the three great divisions into which the work of the French romance-writers falls. Celtic legends tell of a certain Brutus who, driven from Troy, founded Brutannia or Britannia. Geoffrey of Monmouth calls him a great-grandson of Æneas. The spread of the legend is due mainly to Benoît de Sainte-More. The gist of the *Iliad* was used in the Latin of Dictys of Crete and by Dares the Phrygian. Benoît knew both Dictys and Dares, but preferred the drier account of the latter, in which the people of the West were reported to descend from the Trojans. This was used about 1200 by Herbart von Fritzlar, and about 1250 by Konrad von Würzburg; before 1288 Guido della Colonna had recast it in Latin prose. Benoît's version may also be traced in Boccaccio's *Filostrato* (1344). This is the main source of Chaucer's *Troylus and Cryseyde* (c. 1369), as that is of Shakespeare's play. Consult: Dunger, *Die Sage vom trojanischen Kriege in den Bearbeitungen des Mittelalters* (Dresden, 1869); Saintsbury, *The Flourishing of Romance and the Rise of Allegory* (London, 1897).

TROLLEY (from *troll*, from OF. *troller, trauler, troler*, Fr. *trôler*, to ramble, stroll, drag about, probably from MHG., Ger. *trollen*, to roll, run, and connected with Welsh *troell*, wheel, pulley, Bret. *trôel*, winding plant, *trô*, circle). A word first coined in England, and there used in the sense of a handcart and then of a truck. In the United States it means a sort of pulley in contact with an overhead wire and connected with a rod or flexible conductor, by which an electric current is transmitted to the motor of a street-car or electric locomotive. See Electric Railways.

TROLLING. A form of angling. Some trolling is from a boat, the rowing of which gives impulse to the line; others troll from the river or lake bank, winding in the bait with the reel, and still others troll in the surf, where the current of tides or undertow of the sea carries the bait. Whichever form is adopted the lure is a spoon-bait, or live or artificial fish or frog. The bait spins in passing through the water, and a swivel at each end of the leader is always necessary to prevent the twisting of the line. The heaviest fish trolled for in fresh water is the maskinonge, the standard bait for which is a frog alive or imitation, but the surest is the spoon, preferably showing a golden hue, size No. 8, the feathers at the head of which should be bright scarlet, and a single hook. The bluefish is taken by trolling from a boat in motion, or from a stationary boat, into the waters around which have been thrown small pieces of menhaden. The Spanish mackerel is taken by trolling, and many other fish of the Atlantic and Pacific and of the Gulf. Off the Florida coast and in the Gulf the tarpon is taken by trolling from a slowly rowed boat. About 100 feet of line is trailed from the rod; the line has a piano-wire snell and a fish line at the outer end. On the California coast the tuna, the yellow-tail, and barracuda have been taken on hook. See ANGLING; FLY-CASTING; BAIT-FISHING.

TROLLIUS. See GLOBE-FLOWER.

TROLLOPE, trŏl'lŭp, ANTHONY (1815-82). An English novelist, born in London, April 24, 1815, son of Frances Trollope (q.v.). Educated at Winchester and at Harrow, he proved a dull scholar, and his poverty made his school days most unhappy. About 1835 he obtained an official position in the General Post-Office in London. While connected with that department he found time to amuse the public with a long series of novels of remarkable merit. The first work which attracted serious attention to him, *The Warden* (1855), was followed by a continuation entitled *Barchester Towers* (1857), which remains, perhaps, the most widely read of all his books. In rapid succession to these came *Dr. Thorne* (1858), *The Three Clerks* (1858), *The Bertrams* (1859), *Castle Richmond* (1860), *Framley Parsonage* (1861), *Orley Farm* (1862), *The Small House at Allington* (1864), *Can You Forgive Her?* (1864-65), *Phineas Finn* (1869), *The Eustace Diamonds* (1873), *Phineas Redux* (1874), *The Way We Live Now* (1875), *Is He Popenjoy?* (1878), and other novels. Trollope also published several pleasant volumes of travel, among them being *North America* (1862), *Australia and New Zealand* (1874), and *South Africa* (1878). In biography, he wrote a *Life* of Cæsar (1870), and one of Cicero (1880), besides sketches of Thackeray (1879) and Palmerston (1882). He died at Harting, Sussex, December 6, 1882.

Trollope is one of the most admirable of the English realists. He delineates the English society of his time with wonderful penetration, and with an equal command of humor and of pathos. Hawthorne wrote of his novels: "They precisely suit my taste—solid and substantial . . . and just as real as if some giant had hewn a great lump out of the earth and put it under a glass case with all the inhabitants going about their daily business and not suspecting that they were being made a show of." He particularly excels in depicting life in the cathedral towns; and his portraits of bishops, archdeacons, and the minor clergy are remarkable for their truth and humor. His Mrs. Proudie, who appears in *Barchester Towers* and again in *The Last Chronicle of Barset* (1867). is the finest shrew since Shakespeare's Katherine. Very attractive, too, are his young girls, as Lily Dale, Mary Thorne, and Grace Crawley. Trollope did not himself lay any especial claim to psychological insight; yet it would be hard to find in English fiction anything more true and delicate than his analysis of the conscience of Septimus Harding, in *The Warden;* or anything more poignant than his study of jealousy in *He Knew He Was Right.* His Lizzie Eustace, in *The Eustace Diamonds,* is a type of insincerity and selfishness worthy to be set beside Thackeray's Becky Sharp. His snobs, his rustics, and his husband-hunting young women are all drawn with surprising vividness. On the whole, Trollope's best work is contained in *The Chronicles of Barsetshire* (13 vols., New York, 1892); yet many of his less read novels, such as *The Way We Live Now, The American Senator,* and *The Claverings,* are very little inferior. Curious facts concerning his life and methods of composition may be found in his *Autobiography* (New York, 1883). For critical estimates of Trollope, the reader is referred to a paper by Henry James in *Partial Portraits* (London and New York, 1883); and to H. T. Peck's Introduction to vol. i. of the 'Royal' edition of Trollope's best known novels (Philadelphia, 1900). Consult also Cross, *Development of the English Novel* (New York, 1899).

TROLLOPE, EDWARD (1817-93). An English clergyman and antiquary, educated at Eton and Oxford, graduating B.A. from Saint Mary Hall in 1839. Ordained priest in the Anglican Church (1841), he held various preferments, becoming Bishop of Nottingham in 1877. As secretary and as president of the Associated Architectural Societies, he took an active and judicious part in the work of church restoration. Among his works are *Illustrations of Ancient Art, selected from Objects discovered at Pompeii and Herculaneum* (1854); *Life of Pope Adrian IV.* (1856); *Handbook of the Paintings and Engravings Exhibited at Nottingham, Illustrating the Caroline Civil War* (1864); and *Notices of Ancient and Mediæval Labyrinths* (1866).

TROLLOPE, MRS. FRANCES (1780-1863). An English novelist and miscellaneous writer, born at Stapleton, near Bristol, March 10, 1780. Her father, William Milton, was subsequently vicar of Heckfield in Hampshire. In 1809 she was married to Thomas Anthony Trollope, a barrister. In 1827 she went to America, and during a three years' residence in the United States gathered the materials of her first book, *Domestic Manners of the Americans* (1832). This work attracted great attention, and the severity of certain of its strictures was much resented in the United States. Indeed, in 1833 appeared a pamphlet entitled *American Criticisms.* After the death of her husband (1835) Mrs. Trollope had to turn to literature for a living. For twenty years book after book came from her pen. Of her novels perhaps the best were *The Vicar of Wrexhill* (1837), *The Widow Barnaby* (1838), and the sequels of the latter, *The Widow Married* (1840) and *The Barnabys in America* (1843). Mrs. Trollope's last years were passed in Florence with her eldest son, Thomas Adolphus Trollope (q.v.). She died at Florence October 6, 1863. *The Domestic Manners of the Americans* was edited by H. T. Peck (New York, 1896). Consult *Frances Trollope*, by her daughter-in-law, Frances Eleanor Trollope (London, 1895).

TROLLOPE, Thomas Adolphus (1810-92). An English author, born in London April 29, 1810. His mother was Frances Trollope (q.v.), and Anthony Trollope (q.v.) was a younger brother. He was educated at Winchester and at Oxford. In 1843 he settled at Florence, where his house on the Piazza Maria Antonia became the gathering place of English and American authors traveling in Italy. To his hospitable wife Landor addressed the lines, "To Theodosia." Like his mother and brother, Trollope wielded a ready pen. Not reckoning a prodigious number of articles contributed to newspapers and other periodicals, he published fully sixty volumes. And, it is said, he was always interesting. His most conspicuous works were connected with Italy. Among them are: *Impressions of a Wanderer in Italy* (1850); *The Girlhood of Catherine de' Medici* (1856); *A Decade of Italian Women* (1859); *Filippo Strozzi, a History of the Last Days of the Old Italian Liberty* (1860); *A Lenten Journey in Umbria and the Marches of Ancona* (1862); *A History of the Commonwealth of Florence to the Fall of the Republic in 1531* (1865); and *The Story of the Life of Pius IX.* (1877). Trollope also wrote many novels. His last years were passed in England. He died at Clifton November 11, 1892. His second wife, Frances Eleanor Trollope, wrote *Black Spirits and White* (1877); *That Unfortunate Marriage* (1888); and *Frances Trollope, Her Life and Literary Work* (2 vols., 1895). Consult Trollope's autobiography under the titles *What I Remember* (2 vols., 1887) and *Further Reminiscences* (1889).

TROLLS (Icel., Swed. *troll*, troll; connected with Ger. *Droll, Troll*, troll, Eng. *droll*). In mythology, misshapen dwarfs. They inhabited hills and mounds, had abnormal thieving propensities, stole children and substituted their own offspring for them. They were peculiarly sensitive to noise, which was their especial aversion, as it reminded them of the hammer of Thor, which he was accustomed to throw after them. They were called 'the hill-people.' Though strong, they were easily outwitted by men.

TROMBONE (It. *trombone*, augmentative of *tromba*, trumpet, probably from OHG. *trumba, trumpa*, Ger. *Tromme*, drum, perhaps corrupted from Lat. *triumphus*, triumph; ultimately connected with Eng. *drum*). A musical instrument of the trumpet family, the tones of which are produced by means of a slide-mechanism. In its present form it was known as early as the beginning of the sixteenth century. To-day the trombone is made in four different sizes, known as the alto, tenor, bass, and contra-bass trombone. The compass of the alto trombone is from A to $e\flat^2$; that of the tenor trombone from E to $b\flat^1$; that of the bass trombone from $_1B$ to f^1; and that of the contra-bass trombone from $_1E$ to d^1. Besides this regular compass each trombone is capable of producing seven *pedal-tones*, descending chromatically and beginning a tritone (q.v.) below the lowest tone of the compass of the instrument. The intermediate tones between the highest pedal-tone and the lowest regular tone are wanting. The trombones are non-transposing instruments and the notes all sound as written. In playing this instrument seven positions are used. The first position is when the slide is completely pushed in. Taking the tenor trombone for the purpose of illustration, the lowest tone that can be produced in the first position is $B\flat$. In every position all the partial tones from 2 to 8 (see Acoustics) can be produced. Thus in the first position on the tenor trombone the following tones are produced: $B\flat$, f, $b\flat$, d^1, f^1, $a\flat^1$, $b\flat^1$. The second position is obtained by drawing out the slide so far that A is produced. The partial tones for this position are A, e, a, $c\sharp^1$, e^1, g^1, f^1. The third position begins on $A\flat$ and so on, descending by semitones till the seventh position beginning with E is reached.

Recently trombones have been constructed in which the sliding mechanism is replaced by piston or rotary valves. These instruments permit more rapid execution than the sliding trombones, but are much inferior to the latter in purity of intonation. See Orchestra.

TROMP, trŏmp, Cornelis (1629-91). A Dutch admiral, second son of Martin Tromp. He was born at Rotterdam. As a youth he led a squadron against the Barbary pirates. He became rear-admiral in 1653. With Opdam he commanded the Dutch forces in the disastrous battle of Lowestoft (June 13, 1665) and in the rout succeeded in saving a part of the fleet. In June, 1666, he was with De Ruyter in a desperate four days' battle in the Downs against an English fleet under Monk and Prince Rupert, the combat resulting in victory for neither side. In August his conduct in the battle of Dunkirk led De Ruyter to prefer charges against him, which caused his removal. When war broke out in 1672 between Holland and the allied English and French, Tromp was restored to his command and fought with consummate bravery on June 7 and 14, 1673, against the combined English and French fleets, under Prince Rupert and D'Estrées, driving the enemy into the Thames. On August 21st a third great battle was fought near the Zealand coast. After the conclusion of peace Charles II. made Tromp a baron (1675). Tromp subsequently fought in the employ of the Danes against the Swedes, and after De Ruyter's death was made commander-in-chief of the naval forces of the Dutch. He died May 29, 1691, and was buried at Delft by his father's side.

TROMP, Martin Harpertzoon (incorrectly, Van Tromp) (1597-1653). A celebrated Dutch admiral, born at Brielle. He went to sea at a very early age, was made prisoner in an engagement with an English frigate, in which his father was killed, and for more than two years was held in confinement on board an English vessel. For some time after this his history is obscure, but in 1624 he appears as captain of a frigate in the Dutch navy, and in 1637 was made vice-admiral. In 1639 he won a brilliant victory over a Spanish fleet off Gravelines in the Straits of Dover, destroying 49 of the enemy's ships with the loss of only one vessel. His greatest fame, however, was gained in the war against England which broke out in 1652. In May of that year he was worsted by Blake and was compelled to yield the command to De Ruyter, but, restored to his post in November, he inflicted a severe defeat on Blake off the Goodwin Sands and for a time was master of the Channel. In February, 1653, while convoying a large merchant fleet through the Channel, he made a gallant running fight against a superior English fleet under Blake, Penn, and Monk. In June he encountered the English in the Channel and was compelled to seek refuge in the Texel, after losing seventeen of his ships. In the first days of August he once more took to the sea, and in a battle against the English fleet, under Monk, off Ter Heyde, which raged from August 8th to August 10th (old style, July 29th-31st), he lost twenty-six of his ships and his life. He was buried at Delft, and a splendid monument marks the grave of the victor in thirty-three naval combats.

TROMPETER VON SÄKKINGEN, trŏm-pā'tēr fŏn zĕk'ĭng-en, Der (Ger., The Trumpeter of Säkkingen). An extraordinarily popular poem by Joseph Viktor von Scheffel (1853). The story is a legend connected with a seventeenth-century tombstone in the churchyard of Säkkingen which records the death of Werner Kirchhofer and Maria Ursula, daughter of the Baron of Säkkingen. Werner, a musician, loved the Baron's daughter, whom her father therefore sent to the Viennese Court. Werner followed, was made leader of the Court band, and finally, through the intervention of the Emperor, received the reward of his constancy. Scheffel adheres closely to the original legend, weaving about it experiences of his own life. The poem is one of the most perfect expressions in literature of German sentiment.

TRONDHJEM, trŏn'yĕm, **THRONDHJEM**, or **DRONTHEIM**. A city of Norway, situated at the mouth of the Nid River, on the south shore of the Trondhjemsfjord, 240 miles north of Christiania (Map: Norway, D 5). Although it is so far north, its climate is remarkably mild, and the fjord never freezes. On one of the surrounding picturesque hills stands the fortress of Christiansten. Another fort is on the small island of Munkholm in the fjord opposite the city, celebrated as the place of imprisonment of the Danish Minister Griffenfeld (q.v.). The town is regularly laid out with wide streets. Many of the houses are built of wood. The principal building is the large cathedral, probably the finest church in Scandinavia. It was founded in the eleventh century over the tomb of Saint Olaf, and consists of a Gothic nave and choir with a Romanesque transept. It has latterly been restored. By the present Constitution of the country the kings of Sweden and Norway must be crowned in the Cathedral of Trondhjem. Noteworthy also are the arsenal in the old Kongsgaard and the fisheries museum and the leading library. The industries are represented by sawmills, wood-pulp factories, fish-curing establishments, machine shops, and shipyards. The commerce is very considerble. It amounts to over $9,000,000 annually, while the shipping entries in 1900 amounted to 277,743 tons. The chief exports are copper ore from the Röros mines, also iron and pyrites, timber, wood-pulp, and fish. Population, in 1891, 29,162; in 1901, 38,156. Trondhjem was founded by Olaf Tryggvason, who built a palace there in 996. Its early name was Nidaros. During the Middle Ages it was an important city and a goal of pilgrimage.

TROOP. See Army Organization.

TROOPIAL (Fr. *troupial*, from *troupe*, troop). A book name for the American hang-nests and blackbirds of the family Icteridæ.

TROOST, trōst, Gerard (1776-1850). A Dutch-American geologist and mineralogist. He studied at the universities of Leyden and Amsterdam. In 1809, while on his way to Java as a member of a naval expedition, he was captured by an English privateer and carried to Dunkirk. Soon after his return to Paris, where he had studied mineralogy under Haüy, he undertook a voyage to the East Indies by way of America. But on account of political changes in Java he decided to remain in the United States. He was one of the founders and the first president of the Academy of Natural Sciences at Philadelphia. He was professor of mineralogy and chemistry at the College of Pharmacy and at the Philadelphia Museum, and in 1828 became professor of chemistry, geology, and mineralogy at the University of Nashville. His published works include contributions to scientific journals and a *Geological Survey of the Environs of Philadelphia* (1826). In 1814 he established the first alum factory in the United States at Cape Sable, Md.

TROPÆ'OLUM (Neo-Lat., from Gk. *τροπαῖος*, *tropaios*, relating to turning or change, from *τροπή*, *tropē*, a turning, from *τρέπειν*, *trepein*, to turn), Nasturtium, Indian Cress, Yellow Larkspur. A genus of the order Geraniaceæ, containing about 35 South American species of beautiful twining or spreading annuals and perennials, producing orange-yellow and sometimes very dark purple or blue flowers in summer. Many are cultivated for ornamental purposes upon arbors, walls, and trellises. The pickled fruits are sometimes employed as a substitute for capers and the fleshy rootstock of several species as a human food. The best known spe-

TROPÆOLUM MAJUS, GARDEN NASTURTIUM.

cies is *Tropæolum majus,* a climbing annual in northern climates, which has long been grown in the United States as an ornamental plant. Dwarf varieties of this species are commonly grown in beds and borders. *Tropæolum minus* resembles the foregoing species, but is of weaker growth and produces smaller flowers. *Tropæolum Lobbianum,* a native of Colombia, is a vigorous climbing species, of which several beautiful varieties are in cultivation. *Tropæolum peregrinum,* sometimes called canary-bird flower, is grown as an annual in outdoor culture and as a perennial in conservatories. *Tropæolum tuberosum,* which produces scarlet and yellow flowers in the late summer, yields edible tubers, which are used as food in Peru. In northern climates the tubers are taken up in the fall and kept in a dry place during the winter. The annual species are grown from seeds sown in the spring in ordinary garden soil. The perennial species are propagated by the tubers or by cuttings of the young shoots grown under glass or by seeds. The perennials prefer a richer soil than the annuals, and they require plenty of moisture.

TROPE. A figure of speech. See Rhetoric, Figures of.

TROPHO'NIUS (Lat., from Gk. Τροφώνιος). An ancient god of the earth, worshiped at Lebadea, in Bœotia, where he had a famous oracle in a subterranean cavern. He who wished to consult the oracle prepared himself by fasting, sacrifices, and purifications in a building dedicated to Tyche (Fortune) and Agathodæmon (Good Luck). After the due rites a sheep was sacrificed to Agamedes, brother of Trophonius, water from two springs, Forgetfulness and Memory, was drunk, and the consultor descended by a ladder to a vault, in the side of which was an opening. Through this the feet were inserted, a honey-cake to appease the spirits was grasped in each hand, and then some hidden force swept the visitor into the inner recesses, where he saw visions or heard voices, and finally returned feet foremost through the same opening by which he had descended. He was then seated on the stone of Remembrance and questioned by the priests, who interpreted his visions. Legend also told how Agamedes and Trophonius were sons of Erginos and famous architects of the early time, who built the temple at Delphi, a treasury for King Hyrieus of Hyria in Bœotia, and other buildings. According to the story, they left a stone loose in the treasury, and thus were enabled to avail themselevs of the King's riches at their pleasure. At length Agamedes was caught in a trap, whereupon Trophonius cut off his brother's head and escaped, but at Lebadea was swallowed up by the earth. Another version laid the scene with King Augeas in Elis, and represented Agamedes as the father of Trophonius and Cercyon. Trophonius cut off his father's head to escape detection, and, while Cercyon went to Athens, retired to Bœotia, where he built himself an underground chamber. The same story is told by Herodotus of King Rhampsinitus in Egypt, and is a widely diffused folktale.

TROPHY (OF. *trophee,* Fr. *trophée,* from Lat. *trophæum, tropæum,* from Gk. τρόπαιον, *tropaion,* monument of an enemy's defeat, neu. sg. of τροπαῖος, *tropaios,* relating to turning or change). A memorial of victory erected on the spot where the enemy had turned to flight. Among the Greeks (with the exception of the Macedonians, who erected no trophies) one or two shields and helmets of the routed enemy, placed upon the trunk of a tree, served as the sign and memorial of victory. After a sea-fight the trophy consisted of the beaks and stern ornaments of the captured vessels, set up on the nearest coast. It was considered wrong to destroy such a trophy, and equally wrong to repair it, when it had fallen down through time, for animosity ought not to be perpetual.

TROPIC (from Lat. *tropicus,* from Gk. τροπικός, *tropikos,* relating to a turn or change, or to the solstice, from τροπή, *tropē,* a turning). One of two parallels of latitude on the terrestrial globe, passing through the most northerly and southerly points on the earth's surface at which the sun can ever be directly overhead. The tropic north of the equator is called the tropic of *Cancer,* because the sun at the summer solstice (at which time it is vertically over the tropic) enters the constellation of Cancer; and the southern one is, for a similar reason, denominated the tropic of *Capricorn.* The distance of the tropics from the equator, corresponding to the obliquity of the ecliptic, is about 23½ degrees. They are not absolutely fixed at a uniform distance from the equator, but the limits of their variation are extremely narrow. See Perturbations.

TROPIC BIRD, or Boatswain Bird. A seabird of the family Phaëtonidæ, related to the gannets, having very long wings and the two central tail-quills very long and slender. Only three species are known, all tropical and often wandering hundreds of miles from land, where they hover about vessels. Their flight is extremely swift and graceful, and they capture the fish upon which they subsist by plunging in the water, often from a great height. They breed upon rocky cliffs, making no nests, and laying a single pale-brown, much spotted egg. They are nearly helpless on land, and are often caught at their breeding-places and robbed of the long tail-feathers, which are prized among savages as decorations. The yellow-billed tropic bird (*Phaëton flavirostris*) breeds in the Bermudas and West Indies, and is white, with black on the wings. The other species belong mainly to the Indian and South Pacific oceans. See Plate of Fishing Birds.

TROPISM (from *trope,* from Gk. τροπή, *tropē,* a turning). The act of turning toward or being oriented by the stimulus of light, gravity, wind, food, and so on. Thus heliotropism, the first to be used of the many terms ending in *tropism,* means turning to the light. At first the term was restricted to such plants as the sunflower, which turns after or follows the sun, owing to the stimulus of the sun's rays. It was then found that animals were heliotropic, and further studies on the acts of animals in response to different physical stimuli have resulted in a somewhat extensive nomenclature. Tropism may be positive or negative. Certain plants, as plasmodia, and animals, as the sea-cucumber, the starfish, and even the lady-beetle, which are positively geotropic, are forced when on vertical surfaces to crawl upward: this is negative geotropism. The investigation of tropism has most important bearings on comparative psychology and the explanation of instinctive acts.

ANEMOTROPISM. An orientation of the body with respect to the wind, seen in flies (*Bibio ophyra*, etc.), which poise in swarms in the air, heading directly toward the wind, all the swarms of a given locality oriented in the same direction like weather-cocks. On the other hand, the locusts move with the wind and head away from it; i.e. they are negatively anemotropic (Wheeler).

CHEMOTROPISM. The orientation of an organism by molecules emanating from a centre of diffusion. As the name indicates, it means response to orders or tastes emanating from food, decaying substances, and other matters. Thus the maggot of the flesh and other flies are positively chemotropic toward certain chemical substances formed in decaying meat and cheese. The female fly is led not so much by a special instinct to these substances as by the stimulus of the rankly smelling meat. As soon, says Loeb, as the fly is seated on the meat chemical stimuli seem to throw into activity the muscles concerned in egg-laying and the eggs are deposited on the meat. Negative chemotropism is forcibly illustrated by the use of the oil of pennyroyal, of tobacco smoke, or kerosene oil in driving away flies and mosquitoes. For the botanical aspect of this tropism, see CHEMOTROPISM.

GALVANOTROPISM. When certain shrimps, crayfish, and salamanders are subjected to the effect of a galvanic current such changes of tension take place in the muscles of the appendages that movement toward the anode becomes easier and toward the cathode more difficult. The result is, says Loeb, that if the current is continued long enough all the animals collect at the positive pole. It differs from heliotropism chiefly in that the curves of the current take the place of the rays of light.

GEOTROPISM. As the result of the action of gravity, plants and certain animals tend to descend into or toward the earth. The act of righting in a starfish or sea-urchin, or in a polyp (sea-anemone), is the result of geotropic irritability, i.e. of positive geotropism. The effects of geotropism are seen in any moth or butterfly which has just emerged from the pupa-case. It is restless till it finds a perpendicular surface on which to support itself with its abdomen hanging down until the wings are fully expanded. A fly orients its body head downward, a position assumed by many web-weaving spiders. Geotropism plays a part in the depth-migrations of pelagic animals. See also GEOTROPISM IN PLANTS.

HELIOTROPISM or PHOTOTROPISM. Originally applied to the property certain plants possess of turning to the light. It has been found that many animals also are oriented toward the light. Loeb claims that in the case of animals which possess nerves "the movements of orientation toward light are governed by exactly the same external conditions and depend in the same way upon the external form of the body, as in the case of plants which possess no nerves." Many young or larval pelagic animals undergo periodic depth-migrations. They begin to migrate vertically upward toward the surface of the ocean in the evening, descending in the morning, but since they never sink beyond a depth of about 1200 feet below, where light does not penetrate, this fact suggests that the light is the controlling power in their depth-migrations. Loeb finds that the free-swimming animals at the surface of the sea are all permanently or for a short period positively heliotropic. There is a negative as well as a positive heliotropism. If light strikes one side of a positively heliotropic animal, an increase takes place in the tension of those muscles which turn the head to the source of light, while in the negatively heliotropic animal under the influence of one-sided illumination a decrease takes place in the tension of the same muscles, with the result that the negatively heliotropic animal is forced to move away from the source of light. The flight of moths toward a light is a case of heliotropism. Being a rapid flyer, the moth gets into the flame before the heat can check it.

PARAHELIOTROPISM. This is defined by Darwin as the movement by which some leaves temporarily direct their edges to the source of light.

HYDROTROPISM. If a king-crab is placed on shore a few feet from the water's edge it will seek the water, perhaps oriented by the moisture not far away. Ants exhibit a reaction to heat (thermotropism) and also hydrotropism, in the care with which they move the eggs, young, and old larvæ and pupæ, as the nest becomes too warm or cold, moist or dry, at different times. For its influence on plants, see HYDROTROPISM.

RHEOTROPISM. This is illustrated by the action of fish in heading up stream and by the slime protozoan in creeping against the current.

STEREOTROPISM. This form of tropism is contact-irritability, which forces the animal to bring the ventral side of the body in contact with solid bodies. Thus the ventral side of the starfish is positively stereotropic; in other words, the starfish, off the bottom, becomes restless if its ambulacral feet are not in contact with solid bodies. If earthworms are placed in a transparent closed vessel they appear to be positively stereotropic. As soon, says Loeb, as they reach an angle in the aquarium they remain there, crawling along where the glass can touch them on two sides. This form of tropism plays, says Loeb, a very important part in the processes of pairing and in the formation of organs. The tendency of many animals to creep into cracks and crevices has, he claims, "nothing to do with self-concealment, but only with the necessity of bringing the body on every side in contact with solid bodies." The eel is positively stereotropic. It is forced to bring every part of its body, as far as possible, in contact with solid bodies. Every segment of the eel's body is stereotropic, and if touched with the finger on one side there result positively stereotropic curvatures toward the finger. There is in such an act no more consciousness than in the boring of a root in the sand (Loeb). Stereotropism is called 'thigmotropism' by some authors. Another form of tropism is traumatotropism.

Consult Loeb, *Comparative Physiology of the Brain and Comparative Psychology* (New York, 1902); also Wheeler, "Anemotropism and Other Tropisms in Insects," in *Archiv für Entwickelungsmechanik der Organismen*, vol. viii. (Leipzig, 1899).

TROPPAU, trŏp′pou. The capital of Austrian Silesia, on the right bank of the Oppa, 37 miles northeast of Olmütz (Map: Austria, F 2). It has a Gothic church, a castle, a library of 35,000 volumes, and a museum of natural history and antiquities; also the Franz-Josef Museum of art and industry, the provincial insane asylum, etc. Troppau manufactures large quantities of cloth for army use; also stoves, machines, etc. It was founded in the thirteenth century. At Troppau, in the fall and winter of 1820, a congress of European monarchs assembled for the purpose of dealing with the revolutionary disturbances in Italy. It was one of the series of European congresses which under the inspiration of Metternich (q.v.) sought to check the spread of liberal ideas and to carry out the policy of the Holy Alliance (q.v.). Population, in 1900, 26,725.

TROS′SACHS. A picturesque and well-wooded valley in Perthshire, Scotland, between Lochs Acray and Katrine, eight miles southwest of Callander, amid hills rising from 1851 feet to 2390 feet in height (Map: Scotland, D 3). It has been a great tourist resort since its immortalization by Sir Walter Scott in *The Lady of the Lake* and *Rob Roy.*

TROTTING (from *trot*, from OF., Fr. *trotter*, probably from OHG. *trottōn*, to tread, MHG. *trotten*, to run, frequentative of OHG. *tretan*, Ger. *treten*, to tread, step). A gait of the horse. Notwithstanding that the foundation of America's trotting stock came from England, and that in Russia there are the celebrated "Orloff" trotters and another breed in Norway, the trotting racer of to-day is distinctly the product of America. The gait was known to the ancients, but was abominated by them. Trotting was a favorite gait among the English sportsmen of Suffolk and Lincolnshire at the end of the eighteenth century, and a special breed there performed wonders; "Locksmith's gray" trotted 72 miles in 6 hours in 1762. Ten years later, a Lincolnshire horse trotted 30 miles in 2 hours and 10 minutes, with a rider weighing 220 pounds, and "Phenomena" 17 miles in 53 minutes. Yet as an historical fact American trotters owe nothing to these fast English trotters, but everything to the thoroughbred. The modern trotter may be traced back to "Messenger," who was imported in 1788 by Thomas Benger, of Bristol, Pa. His father was "Blaze;" his grandsire "Flying Childers;" his great-grandsire the "Darley Barb." His mother's father was "Turf," who was directly descended from the "Godolphin Barb." So on both sides of his pedigree "Messenger" brought the most select thoroughbred blood into America. He was a running-bred horse, yet from him the American trotter derives its dominant characteristics, the grit of the Arab, the gentleness of the Barb, and the hardy endurance of the English thoroughbred. The Hambletonians, comprising 90 per cent. of the American trotters, are derived from "Messenger" on both sides through Rysdyk's "Hambletonian," "Abdallah," and "Mambrino Messenger." "Hambletonian's" dam was the Charles Kent mare, the daughter of "One Eye," and granddaughter of "Silver Tail," who was the daughter of "Messenger." Hambletonian's family includes "Dexter," 2m. 17½s.; "Goldsmith's Maid," 2m. 14s.; "Rarus," 2m. 13¾s.; "Saint Julien," 2m. 11¼s.; "Jay Eye See," 2m. 10s.; "Maud S.," 2m. 8¾s.; "Sunol," 2m. 8¼s.; "Nancy Hanks," 2m. 4s.; "Alix," 2m. 3¾s.; and "Directum," 2m. 5¼s. The second great trotting family, the Mambrinos, great for racing quality and beauty, is derived on the father's side from "Messenger," and on the mother's from imported "Paymaster." The mingling of the blood of the Hambletonians and "Mambrino Chief" has resulted in such ideal trotters as "Azota," 2m. 4¾s., and "Cresceus," 2m. 2¼s. The founder of the Ceay family was "Young Bashaw," by "Grand Bashaw," an imported Barb, but on the female side are "Messenger's" progeny. The Star family, too, on the mother's side came from the same horse.

In the early trotting days colts were never trained; only matured horses raced, and they were capable of feats of endurance which no modern horse is or could be called upon to perform. "Fanny Jenks" in 1845 trotted 101 miles in 9 hours, 57 minutes, drawing a sulky weighing 150 pounds. "Lady Suffolk" beat "Dutchman" two three-mile heats in 1m. 40½s. and 7m. 56s. respectively, and she trotted her fastest mile when twelve years old. "Goldsmith's Maid" trotted a mile in 2m. 14½s. when she was seventeen years old. She started 118 times and beat 2m. 30s. in 115 of them, and "Maud S." made her then world's record, 2m. 8¾s., when she was eleven years old. These times, too, were all before the days of the kite-shaped tracks, banked and rolled with scientific nicety, and long before the rubber-tired wheel sulky, both of which inventions have helped to reduce the mile record. On August 17, 1903, at the Brighton Beach (N. Y.) track, the trotting record was reduced by J. K. Billings's "Lou Dillon" to two minutes, but in October of the same year the stallion "Cresceus" lowered it to 1m. 59¾s. The weather conditions were perfect. A few days afterwards "Lou Dillon" regained her laurels by still further reducing the record to 1m. 58½s. Weather conditions were unfavorable, but the mare had the advantage of two pacemakers, one drawing a wire-net guard.

For pleasure driving and friendly road competitions a light wagon was in use as early as 1786, but not until after that did the trotter as a racer become prominent. In that year "Boston Blue" trotted a mile in little less than three minutes. By 1825 the New York Trotting Club was formed, and dashes of speed were daily indulged in on what is now Third Avenue, from the Bull's Head to Harlem. Up to 1898, however, the great bulk of the trotting of the country was done on tracks, 2000 of which were scattered over the continent. These tracks on which regular races are held are either exactly one mile or half a mile from start to finish, and a horse must win two heats to win the race. The courses are in the main elliptical, though some, built after 1890, are kite-shaped.

Since 1898 a great impetus has been given to trotting competitions by the creation of civic speedways, the first of which was constructed by the municipality of New York, along the banks of the Harlem River, from 155th Street to Fort George. Many great cities throughout the country have followed the example.

TROTWOOD, Betsy. In Dickens's *David Copperfield*, the hero's great-aunt, an eccentric but tender-hearted woman, with a special abhorrence for donkeys.

TROUBADOURS (Fr. *troubadour*, from Prov. *trobador*, troubadour, from *trobar*, OF. *trover*, *trouver*, Fr. *trouver*, to find, compose). The mediæval poets of Southern France, who flourished from about 1100 to about 1400, singers of war and love, whose wandering lives, full of passion and adventure, have made them the typical romantic figures of their age. The feudal conditions of the region to which they belonged were particularly favorable to the development of this race of bards. Here, as elsewhere, society was divided into three classes, commons, clergy, and nobles, of whom the nobles alone possessed either the means or the desire liberally to reward literary and musical skill. The nobility, moreover, consisted of an agglomeration of petty independent barons, who tended to attach themselves to powerful local houses, such as that of the counts of Toulouse. There were, therefore, many courts, not too far distant from each other, to which the wandering minstrels could resort. Another social condition which had an important influence upon the character of Provençal poetry was the position of noble ladies. They received fiefs, sometimes by inheritance, sometimes as dowry, and there are instances in which they even governed and presided over a court. Usually married young and for social and political reasons rather than for love, they became queens of society, the objects often of fervent passion, always of conventional adoration.

With the accumulation of wealth and the progress of refinement, delight in life became conspicuous. The love of splendor manifested itself in gorgeousness of dress and magnificence of entertainments. Prodigality was the fashion. The ideal prince was he who bestowed gifts lavishly. In addition to the chase and the tourney, one of the favorite amusements of this society was song, an amusement supplied by the jongleurs and the troubadours. The jongleurs (*joculatores*) were the successors of the Latin *mimi*. They wandered from town to town, from castle to castle, and supplied amusement to the commons at the fairs and in the market-place, and to the higher classes at their feasts. The meaner kind not only recited, sang, and played on musical instruments, but performed as jugglers, dancers, acrobats, and exhibitors of trained animals. Members of this class were also to be found in the following of every great lord, among his permanent domestic servants or *ministeriales*. They fulfilled the function of Court minstrels and entertainers.

From such singers sprang the troubadours. In general, it may be said that the jongleur was one who made a trade of poetry and music; the troubadour one who devoted himself to the production of artistic Court poetry, whether he did this for gain or not. The jongleurs were, therefore, always poor, either by origin or by fate, whereas the troubadours, though largely belonging to the humble or the middle class, included knights, barons, counts, and even kings.

Most of the troubadours led a wandering life, though they often lingered for several years at the Court of some patron, praising the mistress of the mansion in extravagant terms, and supporting the policy of its master by vigorous exhortations to his friends or by bitter denunciation of his enemies. War and lady service were the chief themes of their songs. (See PROVENÇAL LITERATURE.) Conventional as this poetry was, there were no schools in which the art was taught. Each troubadour learned from his predecessors, and handed down the tradition to the next generation. Even the art of writing was not necessary, for the pieces were not prepared for readers, but for hearers. They were almost always sung by the composer himself, to his own accompaniment, but those masters who could not sing taught the words and music to their jongleurs. This was also the natural mode of publishing a poem destined for a wider audience than could be reached by the individual author. Poets of high rank, moreover, had their pieces performed by servants, and whenever a lyric was sent to some friend at a distance it was not intrusted to writing, but to the voice of a messenger. This poetry, therefore, required a pleasure-loving aristocracy for its audience, and wealthy and generous patrons for its support. It mirrored the soul of chivalry, an ideal of heroism, generosity, courtesy, and love. For flattering the vanity of the nobles and lending his talent to their taste for pleasure, the singer was rewarded with gifts of money, weapons, horses, or garments. Generosity was naturally praised as the chief of princely virtues, and growing avarice was a sign of the hopeless degeneracy of the times. Richard Cœur de Lion, was considered the mirror of knighthood, and the practical statesmanship of Philip Augustus of France was judged low and unworthy. With the disappearance of the society they represented, the troubadours also vanished.

The first troubadour whose lyrics have been preserved was William IX., Count of Poitou and Duke of Aquitaine, but he must have had a long line of humble forerunners. His daughter, Eleanor, the quick-witted but licentious wife of Louis VII. and Henry Plantagenet, was the theme of the impassioned songs of Bernart de Ventadour. Ermengarde of Narbonne was another celebrated patroness of poetry, with many adorers in verse. This was, indeed, the flourishing period of the troubadours. Among their chief patrons were the counts of Provence, the counts of Toulouse, and several kings of Aragon and Castile, the most notable of whom was Alfonso II. of Aragon. In Italy the lords of Este and the Emperor Frederick II. harbored the singers of Languedoc. At these courts minstrels were kindly received and lavishly rewarded, taking part, apparently, in the social pleasures mirrored in their songs. This gay life, however, was not without its bitterness, and many a troubadour retired to a convent to pass his declining years in repentance.

Much of the romantic interest that has gathered about the careers of these poets is derived from the Provençal biographies and *razos* which are found in some of the manuscripts containing their works. Many of these are merely imaginative tales in which elements of folk-lore, combined with a fanciful interpretation of the poems, have been set down as fact. Growing up among the later jongleurs and other lovers of poetry, they represent the conception which the succeeding age had formed of the heroes of Provençal song. Another fact has tended to give a romantic coloring to the lives of the troubadours: the fact that their poems deal so largely with the subject of love. This love was, it is true, chiefly factitious and conventional, rather than personal, and the formulas in which it was expressed are exceedingly monotonous; but the modern imagination has built up for these wandering minstrels a sort of butterfly existence of poetry and passion, to which is added the excitement of constant adventures. That such a picture does not represent the truth is obvious, but it is intensely fascinating, and the troubadours will probably long continue to be regarded as sentimental heroes.

Bibliography. The best work on the subject for English readers is Justin H. Smith, *The Troubadours at Home*, with bibliography (New York, 1899), a popular view of the troubadour country, stories of their adventures, and translations of their poems, together with copious and scholarly notes. Less exact and scholarly are Hueffer, *The Troubadours* (London, 1878); Rutherford, *The Troubadours; Their Loves and Their Lyrics* (ib., 1873); Rowbotham, *The Troubadours and the Courts of Love* (ib., 1895). The best edition of *Les biographies des troubadours* in Provençal is that by Chabaneau (Toulouse, 1885). Most of these biographies have been translated by Ida Farnell, *Lives of the Troubadours from the Mediæval Provençal* (London, 1896). Consult also the authorities referred to under Provençal Literature.

TROUBETZ′KOY, Princess Amélie (Rives). See Rives, Amélie.

TROUP, George McIntosh (1780-1856). An American politician, born in the present Washington County, Ala. He graduated at the College of New Jersey (Princeton) in 1797, was admitted to the bar in 1800, and began to practice in Savannah. From 1801 to 1804 he was a member of the Legislature; was a member of the United States House of Representatives from 1807 to 1815; was chairman of the Military Committee during the War of 1812, and opposed vigorously the Yazoo compromise. From 1816 to 1818 he was in the United States Senate, and from 1823 to 1827 was Governor of Georgia. During the dispute which arose between the agents of the general Government and the State in regard to the extinguishment of the Creek title to lands in Georgia, he did not hesitate to defy the Federal Government. From 1829 to 1833 he was again a member of the United States Senate. He was a strong defender of States' rights, and in 1833 presided over the Georgia States' Rights Convention.

TROUS-DE-LOUP, tro͞o′ de-lo͞o′, or Wolf-holes. A device formerly much used in military fortifications. It consisted of funnel-shaped holes, 6 feet deep, with an exterior diameter of 4½ feet, having one or more pointed stakes at the bottom. They were placed near the approaches and the glacis, and were designed to break the ranks of the attacking force. The principle is still retained in the modern shallow military pits, and other forms of military obstacles, wire entanglements, etc.

TROUT (AS. *truht*, from OF. *truite*, from Lat. *tructa*, *tructus*, from Gk. *τρώκτης*, *trōktēs*, sort of sea-fish, from *τρώγειν*, *trōgein*, to gnaw). Any of many fishes of the family Salmonidæ. (See Salmon.) Some are partly anadromous, but most of the species live exclusively in fresh waters, and occur in most of the lakes and streams of northern regions. They are all voracious and more or less gamy. Their food consists of almost any sort of fresh animal matter—smaller fishes, crustaceans, insect larvæ, and the like. The trout, like the salmon, spawn during the colder months of the year, varying with the latitude and the species.

Trout may be classed into two main groups. The one group, belonging to the genus Salmo, has a flat vomer, supplied with teeth, the body with larger scales than the other group, which has a boat-shaped vomer, the shaft destitute of teeth. The latter group is more perfectly restricted to fresh waters than the former. The former group includes the salmon-trout, and the latter the chars, such as the brook trout. The salmon-trout of European waters (*Salmo trutta*) resides in salt water, and enters the rivers to spawn. Its fresh-water variety, the brown trout (*Salmo fario*), occurs in the lakes of Europe, and has been extensively domesticated in English and North American waters. Another Scottish variety, the Lochleven trout, differs from the brown trout in the greater growth of the pectoral and caudal fins, in the greater number of cæcal appendages, and in other minor characters.

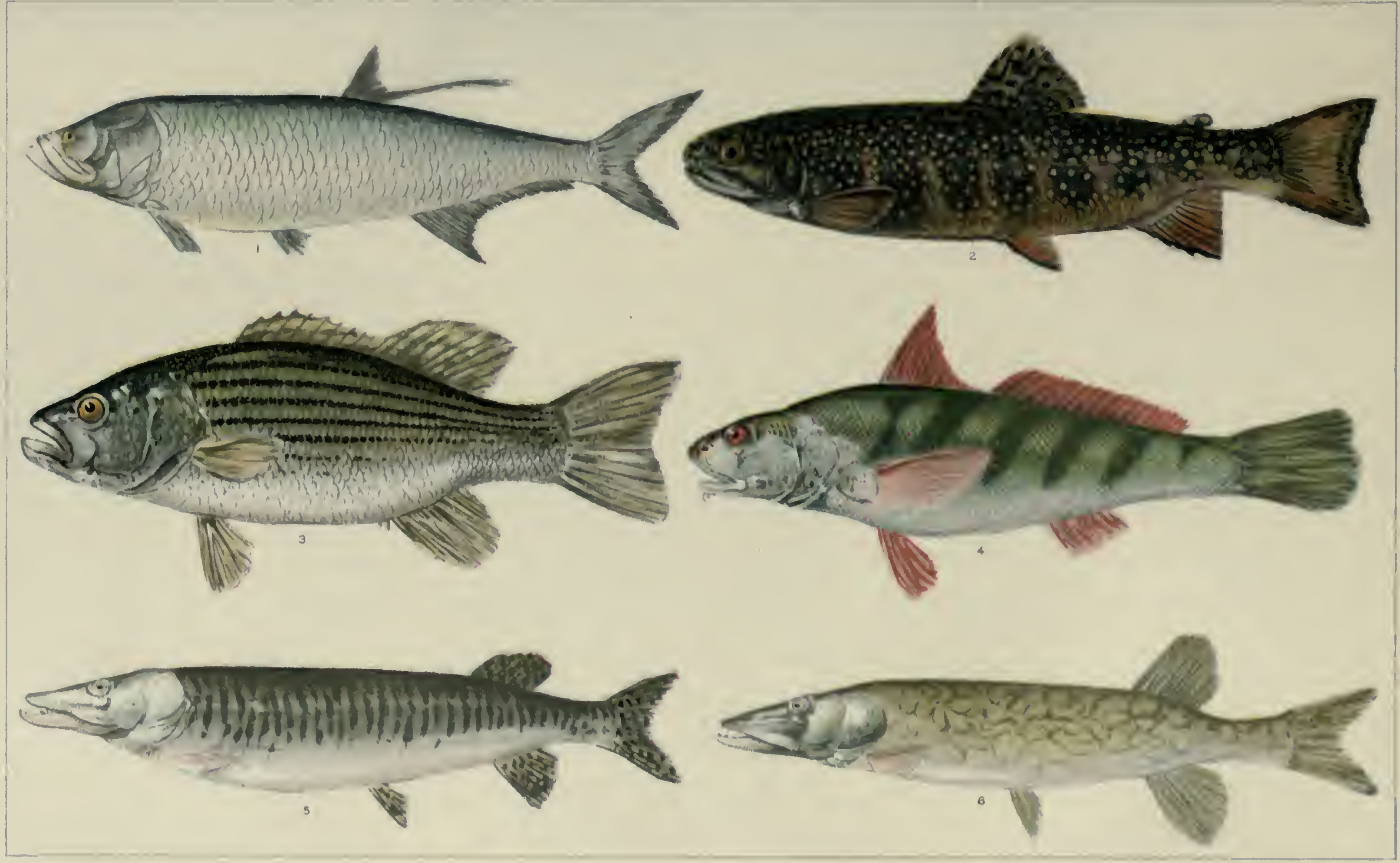
The American salmon-trout (*Salmo Gairdneri*) is a large trout, abundant in the Columbia and other rivers flowing to the Pacific coast. (See Steelhead.) A variety of it, the Kamloops trout, or 'stit-tse,' occupies the lakes of British Columbia and northern Washington.

The rainbow or Coast Range trout (*Salmo irideus*) is smaller than the preceding, has larger scales and brighter colors. It is native in the mountain streams of the Pacific Coast, and probably enters the sea. It is very variable, presents many geographical varieties, such as the brook trout of western Nevada, the trout of Mt. Shasta, golden trout of Mt. Whitney, the McCloud River trout, and others. It has been transplanted successfully into the mountain streams of the Eastern United States, and has been domesticated to some degree. The 'cut-throat' or Rocky Mountain trout (*Salmo mykiss*) is a common trout of very wide distribution in all the clear streams of the Rocky Mountains and Sierra Nevada, from Kamtchatka and Alaska to Northern Mexico. Its scales are smaller than in the nearly related species, hyoid teeth are usually present, and it is very closely related to *Salmo Gairdneri*. This species often enters the sea, and is very variable, many geographical races being recognized, one of which, 'Clarke's trout' of the Columbia River, is illustrated on the Plate of Salmon.

The Great Lakes trout, 'longe,' 'togue,' or 'namaycush,' differs from *Salmo* in the absence of teeth on the shaft of the vomer, and from the brook trout in its larger size and well-developed teeth on the hyoid bone. It inhabits all the larger lakes of Eastern North America, and is one of the more important food-fishes of the Great Lakes region. The variety 'siscowet,' found only in the deep waters of Lake Superior, has excessively fat flesh, and is not prized as food. See Namaycush.

The principal chars of American waters are the common brook or speckled trout, the Dolly Varden, the oquassa, and the European brook

AMERICAN GAME FISHES



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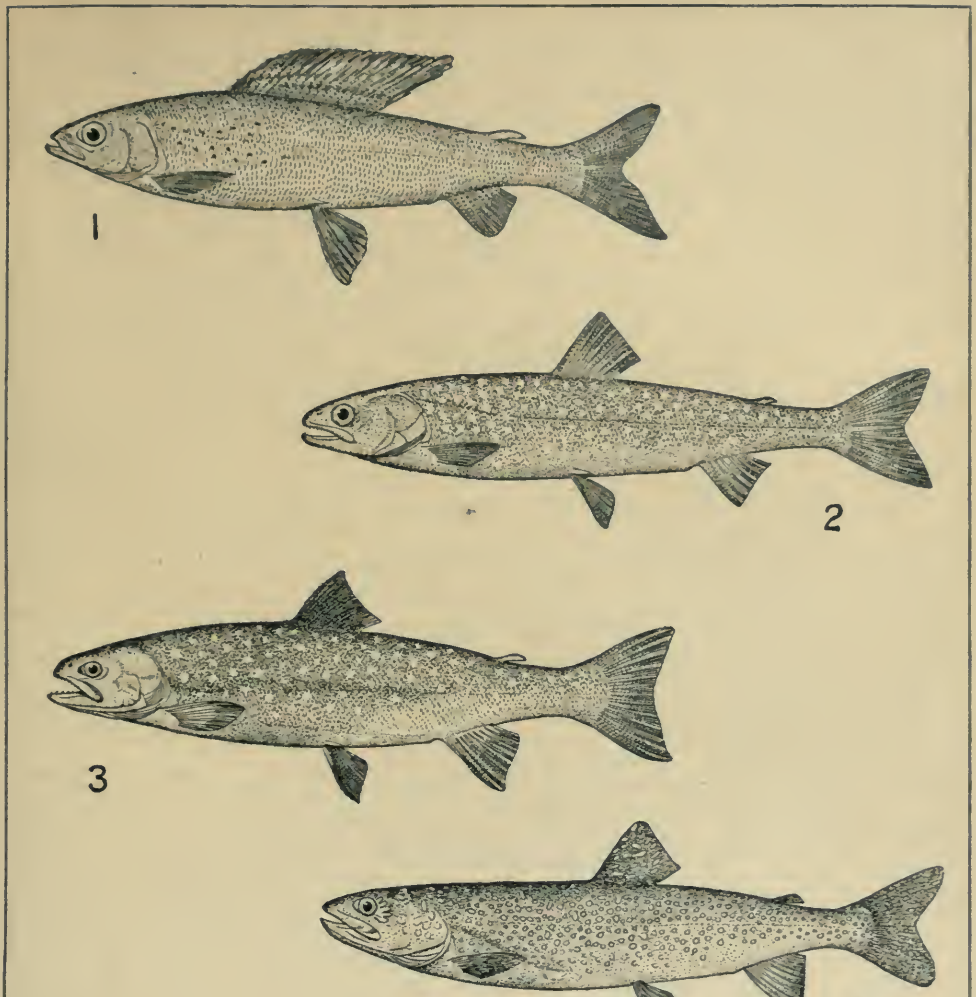
1 TARPON	1/15 NATURAL SIZE		MEGALOPS THRISSOIDES
2 TROUT	1/4 " "	–	SALVELINUS FONTINALIS
3 BASS	1/6 " "	–	MORONE LINEATA
4 KING FISH	1/15 NATURAL SIZE	–	LAMPRIS GUTTATUS
5 MASKINONGE	1/12 " "	–	ESOX NOBILIOR
6 PICKEREL	1/4 " "	–	LUCIUS AMERICANA

TROUT AND GRAYLING



1. MICHIGAN GRAYLING (Thymallus tricolor).
2. OQUASSA TROUT (Salvelinus oquassa).
3. DOLLY VARDEN TROUT (Salvelinus malma).
4. NAMAYCUSH (Cristivomer namaycush).
5. RAINBOW TROUT (Salmo irideus).
6. SUNAPEE TROUT (Salvelinus alpinus, var. aureolus).

trout. The brook trout (*Salvelinus fontinalis*) is the best known, abundant in all clear, cold streams of Eastern North America south to the headwaters of the Savannah. It differs from the other species of the genus in its back being strongly marbled with olive and black. It has been introduced into the Western streams; and many hybrids between this and the rainbow trout and other species exist. Its extreme length may be 18 inches, but it is usually much smaller. It is a favorite for its gamy qualities and for its flavor. See Colored Plate of GAME FISHES.

The Dolly Varden trout (q.v.), or malma, is a native of Northwestern America, and has red spots on both back and sides. The oquassa trout (*Salvelinus oquassa*), 'quasky' or 'blueback,' is a small trout of the Rangeley group of lakes in western Maine, dark blue, with small red spots, usually confined to the sides. Similar and still smaller varieties of this most beautiful of the trout exist in the lakes of Quebec and in those of subarctic America.

The European brook trout (*Salvelinus alpinus*) has the red spots only on the sides, and the mouth is rather smaller than in the preceding. It occurs in the cold lakes and mountain streams of Northern Europe and Asia, and in Northeastern North America. It is variable and is represented by several varieties—such as the Greenland char, the long-finned char, and the sunapee or golden trout. The last named is very local in its distribution, having been taken in Sunapee Lake and a few other lakes in New Hampshire and Maine. It is highly prized because of its brilliant colors and graceful form. Much uncertainty remains as to its origin and relationship. It has strong affinities with the European form and by some is considered to have been introduced from there. Much pains is being taken to increase this species by artificial propagation and transplantation. See FISH-CULTURE.

There are other species of trout of minor importance both in America and Europe and Asia; and many fishes not truly trout are locally so called. Compare SALMON; GRAYLING. Consult authorities cited under ANGLING; FISH; SALMON; and Jordan and Evermann, *American Food and Game Fishes* (New York, 1902).

See Plates of AMERICAN GAME FISHES; SALMON; TROUT AND GRAYLING.

TROUT FISHING. With the possible exception of the black bass, there is no fish that affords more sport to the angler or that is found over a greater range of country than the brook trout. It may be taken with the fly or with bait, but the former method is considered generally the more sportsmanlike. In bait fishing, the trout is likely to be killed or badly injured, whereas in fly fishing the fish generally is hooked in the lip and can be returned to the water unharmed. In lakes and ponds in summer time, when the surface of the water becomes warm, trout make for deep water, and bait must be used. It is impossible to do more than give the general rules controlling the selection of flies: In size, the fly should be selected to meet the condition of the water rather than the size of the fish; thus, if late in the season and the water of a clear stream is low, sober-colored flies on No. 10 or 12 hooks are usually the best. See FISHING; FLY-CASTING.

TROUT-PERCH. One of the small fishes of the North American family Percopsidæ, represented abundantly in the Great Lakes by the 'sand-roller' (*Percopsis guttatus*) and by a second genus and species in Oregon. This family constitutes the suborder Salmopercæ; the form of the body and the head and mouth are perch-like, while the fins are salmon-like. These fishes are of particular interest because of their relationship with generalized archaic forms, of which they seem to be the survivors. Consult Jordan and Evermann, *Fishes of North and Middle America* (Washington, 1896).

TROUVÈRE, trōō'vâr' (Fr., from *trouver*, to find, compose). The Northern French term answering to the Provençal troubadour (q.v.), applied usually to the original poets who composed the works which the jongleur performed. The distinction, however, is not absolute, as there are instances of trouvères who performed their own works, and occasionally of jongleurs who aspired to composition. The trouvère was usually a man of some rank and standing, either priest or knight. See JONGLEUR; FRENCH LITERATURE.

TROUVILLE, trōō'vēl'. A fishing town and seaside resort of the Department of Calvados, France, at the mouth of the Touques, 136 miles by rail west-northwest of Paris, and 9 miles south of Havre. It has risen from a humble fishing village to the rank of the most fashionable watering-place in France. Its equable climate, agreeable situation, remarkably fine beach, and many handsome villas make it an ideal resort during the summer and autumn months. There are a Louis XIII. Hôtel de Ville and a large and well-appointed casino. The harbor is thronged with fishing boats, and there is some trade. Population, in 1900, 6137. The port is shared with Deauville, a small but well-known sea-bathing resort, a short distance southwest, with a casino. The August races here are attended by the leading circles of Parisian society.

TROVER (OF. *trover, trouver*, to find, compose). One of the old forms of action in common-law pleading, employed to recover damages for the wrongful conversion of personal property. It is based upon a fiction that the plaintiff has lost his chattels and that the defendant has casually found them, but refuses to deliver them to the plaintiff. Although this fictitious statement must be made in the declaration, it need not be proved, and the plaintiff may recover damages on proof of a conversion of his property. Any interest which will entitle a person to the possession of goods is sufficient to maintain this action. See FORMS OF ACTION; COMMON FORMS.

TROW'BRIDGE. A market town in Wiltshire, England, on a rocky eminence in the valley of the Biss, 10 miles southeast of Bath (Map: England, D 5). Cassimeres, kerseys, tweeds, and woolen cloths of the best qualities are manufactured. The parish church of Saint James, which dates from the fourteenth century, contains the remains of Crabbe, the poet, who officiated as clergyman from 1814 to 1832. There are a fine modern town hall and many handsome villas, the residences of wealthy manufacturers. The town owes its origin to an ancient castle, built on the mound called Courthill, which held out for Matilda against Stephen. It was demolished before the reign of Henry VIII., and all traces of it have disappeared. Population, in 1891, 12,046; in 1901, 11,562.

TROWBRIDGE, Edmund (1709-93). An American lawyer, born in Newton, Mass. He graduated at Harvard in 1728, and soon rose to eminence as a lawyer. He became Attorney-General of the State in 1749, was for several years a member of the council, and in 1767 was appointed a justice of the Massachusetts Supreme Court, presiding with great ability and fairness at the trial of Captain Preston and his men after the Boston massacre. In 1772 he retired to private life. Though not in full sympathy with the Patriot Party, he was strongly opposed to the policy of the British Ministry. He has been regarded as the most profound jurist in New England before the Revolution.

TROWBRIDGE, John (1843—). An American physicist. He was born in 1843 and was educated at the Lawrence Scientific School of Harvard University, graduating in 1866 and then serving for three years as tutor. After occupying a chair at the Massachusetts Institute of Technology, he returned to Harvard in 1880 and was made professor of experimental physics, and was appointed in 1888 to the Rumford professorship of the application of science to the useful arts. He established a laboratory course in physics and was one of the pioneers in introducing laboratory work as an essential part of instruction in elementary science. Trowbridge carried on many important investigations in physics, particularly in electricity, and later investigated the various phenomena connected with the Roentgen rays. Many of his communications were issued under the title of *Contributions from the Physical Laboratory of Harvard College.* Besides these, he wrote *The New Physics* (1884).

TROWBRIDGE, John Townsend (1827—). An American novelist, juvenile writer, and poet, born in Ogden, N. Y. After a common school education, supplemented at home, Trowbridge taught school for a year in Illinois and afterwards worked as a journalist in New York and Boston. His first work of distinction, *Neighbor Jackwood* (1857), was one of the first realistic novels of New England life. The more noteworthy of his many stories, which include some of the most wholesome of American fiction for boys, are *Father Bright Hopes* (1853); *The Drummer Boy* (1863); *Cudjo's Cave* (1863); *The Three Scouts* (1865); *Neighbors' Wives* (1867); *Coupon Bonds and Other Stories* (1872); *The Jack Hazard Series; The Toby Trafford Series; The Start in Life Series; The Tide Mill Series.* Noteworthy collections of verse are: *The Vagabonds and Other Poems* (1869); *The Emigrant's Story and Other Poems* (1875); *The Book of Gold and Other Poems* (1877); *A Home Idyl and Other Poems* (1881); *The Lost Earl and Other Poems* (1888); *Poetical Works* (1903), a collected edition. His autobiography, *My Own Story* (1903), throws much light on American literature and life during the second half of the nineteenth century.

TROWBRIDGE, William Petit (1828-92). An American engineer, born in Oakland County, Mich. He graduated, first in his class, at West Point in 1848; was assigned to the Corps of Engineers as a brevet second lieutenant; was engaged in making astronomical observations at the Military Academy Observatory in 1848-50, and from 1850 to 1856, when he resigned from the army, was engaged in important work on the United States Coast Survey. In 1856-57 he was professor of mathematics at the University of Michigan; and in 1857-61 was scientific secretary of the Superintendent of the United States Coast Survey. From 1861 to 1865, during the Civil War, he was in charge of the Engineer Agency at New York City. Subsequently he was professor of dynamic engineering in the Sheffield Scientific School of Yale College from 1870 to 1877; was adjutant-general of the State of Connecticut from 1872 to 1876; and from 1877 until his death was professor of engineering in the Columbia School of Mines. He is credited by some with having first suggested the idea of the cantilever bridge. Besides numerous magazine articles, he published *Heat as a Source of Power* (1874).

TROY (Lat. *Troia,* from Gk. *Τροία*). The most famous city of Greek legend. It was situated in the northwestern corner of Asia Minor, in a small plain through which, from the southeast, flows to the Hellespont the ancient Scamander (now Mendere), entered a short distance from its mouth by a small stream from the east, the ancient Simoïs (now Dumbrek Su). In the angle once formed by these streams (the modern courses have altered greatly) lies a low hill, jutting from the range of Mount Ida, which was known in Roman times as *Ilium Novum,* and was regarded by many as the successor of the Homeric Troy. Near by is the modern village of Hissarlik. The claims of this site had always found defenders, but since the work of Le Chevalier at the end of the eighteenth century there had been a strong trend of scholarly opinion in favor of the ruins near Bunarbashi on the Bali Dagh, a steep cliff over the Scamander, south of its entrance to the plain. The presence of warm springs near by also served to strengthen this identification. The site, as well as the summit on the opposite side of the valley, was certainly fortified in very early times as a protection against incursions from the south, but excavation has shown conclusively that the capital of the district lay on the hill of Hissarlik, rather less than four miles from both the Ægean and Hellespont, and corresponding far more closely than could have been reasonably expected with the topographical indications of the *Iliad.* The credit for the exploration of this site belongs to Henry Schliemann (q.v.), who began excavations in 1870, and in the three following years had laid bare enough to show that underneath the Roman and later Greek ruins which crowned the hill were remains of a settlement of unknown antiquity, even though the names "Scæan Gate" and "Priam's Palace" seemed extravagant. In 1878-79 another campaign with scientific coadjutors led to more definite results, which were still further increased by the excavations of 1882 by Schliemann and Dörpfeld. Another visit in 1890 led to further important modifications of previous results, and though the death of Schliemann in December, 1890, prevented the immediate continuation of the work, it was resumed in 1893 by Dörpfeld.

The history of the hill as read in the excavations and later writers is that of a series of at least nine successive settlements, many of which were only small collections of wretched huts, though a convenient terminology has dignified them all as 'cities.' The first (1) settlement is a small group of dwellings surrounded by a wall, belonging to the end of the Neolithic Period. The second (2) city, held by Schliemann to be the Homeric Troy, was defended by a strong wall of rough stone, topped by crude brick, and seems to have extended its circuit twice, the second time with marked alterations in the situation of the gates. Within were several houses, consisting of a great hall and vestibule, of the type found later in Mycenæ and Tiryns, and apparently described in the Homeric poems. The civilization indicated by the pottery and lesser finds shows that the inhabitants were at the beginning of the Bronze Age, belonging to the period of the so-called "Island" civilization. (See ARCHÆOLOGY.) The rulers were evidently of some wealth and power, but their identity seems lost forever. The continuity of tradition in the pottery and general type of building, and the similarity with much found in Phrygia, seem to warrant the belief that there was no change of race from the second to the sixth city, and that this people were kindred of the Indo-European Phrygians. Yet they were not at peace with their neighbors, as is shown by the fact that the second city was burned, and the site left desolate. The place was resettled, however, and the houses of the third (3) city were built on the rubbish which concealed their predecessors; the wall also was repaired, and the gates narrowed for greater security. This city, too, was destroyed, or perhaps abandoned, but was again resettled (4), as an open village. To this succeeded (5) another village of little huts, defended by a wall of no very great strength. The next city (6) was, however, of a very different sort. It was defended by a strong wall of smoothed stone, of far greater circuit than that of the city No. 2, and of such workmanship that a bit discovered by Schliemann was attributed to the Hellenistic period. This wall was pierced by gates, provided with strong flanking towers. Within were houses of considerable size, but of the same simple plan as those in the second city. Owing to a great terrace built by the Romans, which cut down the top of the hill, the remains of this city are only preserved around the edge, while the centre, which doubtless contained the royal palace, has vanished. As Schliemann's excavations were almost entirely confined to the centre of the hill, it was possible for him to miss this city, which belonged to the Mycenæan period, and certainly corresponds to the Homeric Troy. It seems clear from the objects found, that the kings of Troy, though powerful enough to build strong walls, ruled over a people less advanced in artistic work. The old plain pottery continued in general use, and the Trojan imitations of the imported Mycenæan ware, while good in form and color, show conspicuous deficiency in the characteristic graceful decoration. The remains clearly show that this royal castle was destroyed by fire, and also that after no very long period another settlement (7) covered the hill. Mycenæan vases have been found in its lower strata, but whether the inhabitants were survivors of the Trojans, or the first wave of Greek settlers, cannot with certainty be determined. It is clear, however, that the Cimmerian invasion in the eighth century B.C. reached this hill, and after destroying the inhabitants, either Treres or Cimmerians took up their abode on the site, till in the seventh century they were driven forth and Troja or Ilion was occupied by Greeks (8). The settlers seem to have been a small band of Æolian colonists, who were cut off from the sea by other Greek towns, and seem to have lived with little to recall the ancient glory of the place. The prosperity of the place (9) began with the visit of Alexander in B.C. 334, and the Temple of Athena Ilias became after his death the centre of a league of free cities of the Troad. Near the end of the fourth century Lysimachus fortified it with a wall some five miles in circumference, and also built on the hill a marble Temple of Athena. Later the town was under the control of Seleucus, but its history during this time is obscure. It passed under the Roman protection B.C. 189, and was honored as the city of Æneas, and thus the parent of Rome. In the first civil war, about B.C. 85, it was stormed and sacked by the Marian Fimbria. New prosperity came with Julius Cæsar, for the Julian family traced their descent from Ascanius, and Augustus rebuilt the Temple of Athena and surrounded it with courts and porticoes. Later emperors favored it, and Constantine planned to make it the seat of his new capital. It was for a long time the seat of a bishopric, but was plundered about 1306 by the Turks and since then has lain in ruins.

For the legendary history of Troy, see TROJAN WAR.

BIBLIOGRAPHY. The excavations of Schliemann and Dörpfeld are published in *Trojan Antiquities* (London, 1874), *Ilios* (ib., 1881), *Troja* (ib., 1884); *Bericht über die Ausgrabungen in Troja in Jahre 1890*, von H. Schliemann und Dörpfeld (Leipzig, 1891); Dörpfeld, *Troja, 1893* (ib., 1894); and finally in the definitive work by Dörpfeld and others, *Troja und Ilion* (Athens, [illegible]). Consult also Schuchhardt, *Schliemann's Excavations*, trans. by E. Sellers (London, 1891).

TROY. The county-seat of Pike County, Ala., 52 miles south by east of Montgomery, on the Plant System and the Central of Georgia railroads (Map: Alabama, D 4). It is the seat of a State normal school. Troy is the shipping centre for large cotton interests, and has some manufactures, of which fertilizers are the most important. The government, under the charter of 1870, is vested in a mayor, chosen every two years, and a unicameral council. The water-works and the electric light plant are owned and operated by the municipality. Troy was settled in 1843 and incorporated the same year. Population, in 1890, 3449; in 1900, 4097.

TROY. An important manufacturing city and the county-seat of Rensselaer County, N. Y., on the Hudson River, at the head of steam navigation, 6 miles above Albany, and 151 miles north of New York City (Map: New York, G 3). It is on the New York Central and Hudson River, the Delaware and Hudson, the Boston and Maine, and the Rutland railroads; and additional means of transportation is afforded by the Erie and the Champlain canals on the opposite side of the river. Four bridges here span the Hudson, including that of the Delaware and Hudson Railroad and the Congress Street Bridge; also the Waterford Bridge, finished in 1804, the oldest wooden covered bridge in the United States.

Troy is situated partly on level ground along the river front, the site rising to the east in a range of hills, the highest elevation being Mount Ida. The city is regularly laid out. There are 140 acres in the parks open to the public, of which Beman Park is the most important. Besides this, the city has acquired a new park site on Warren's Hill overlooking the Hudson. Lagoon Island, in the Hudson, midway between Troy and Albany, is a popular resort, with bath houses, athletic grounds, and other features. The Soldiers' and Sailors' Monument is in Washington Square. Oakwood Cemetery is of interest for its natural beauty; it has also a number of fine monuments and the Earl Memorial Chapel, one of the finest crematories in the world. Among edifices of note are the court house, post-office, the savings bank building with the music hall, the Rowe Memorial building, and the Hart Memorial building. Troy is the seat of the Rensselaer Polytechnic Institute (q.v.), one of the leading schools of its class in the country, and of the Emma Willard Seminary, one of the first schools established for the higher education of women. There are several libraries in the city. The Troy Hospital and the Samaritan Hospital are important charitable institutions; there is a fine orphan asylum in the English style of the fifteenth century; the Gurley Memorial and the Sage Memorial may also be noted.

Industrially, Troy ranks fifth among the cities of the State, its manufacturing establishments in the census year 1900 having had $23,532,000 capital and an output valued at $28,209,000. It enjoys the advantages of good water power, obtained partly from the State dam across the Hudson above the city, and of excellent transportation facilities, its railroad lines being supplemented by two great waterways, the Hudson River and the Erie Canal. The city is well known for the manufacture of shirts, collars, and cuffs, having been long the principal centre in the United States for the production of these goods. Other important manufactures are iron and steel, foundry and machine shop products, laundry machinery, engineering instruments, bells, malt liquors, hosiery and knit goods, paper and wood pulp, paints, brick and terra cotta products, and flouring and grist mill products. Among metal products stoves occupy a prominent place.

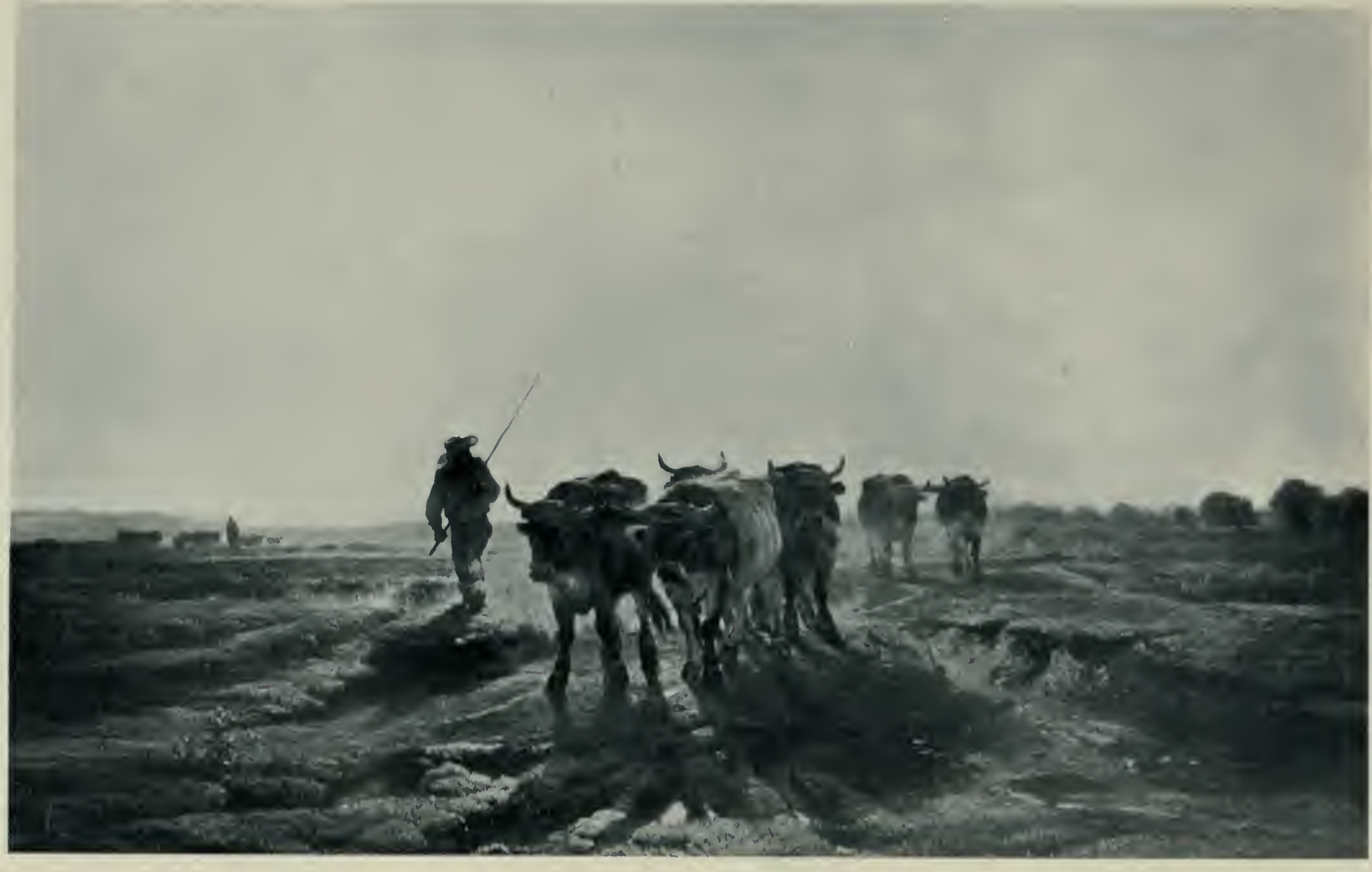
Troy is governed under the regular State charter for cities of the second class, which went into operation January 1, 1900. The government is vested in a mayor and common council, elected every two years, and in various administrative departments, for further explanation of which see paragraph on *Administration* under ALBANY. The comptroller, treasurer, police justices, and assessor are chosen by popular election; other officials are appointed by the mayor. The city clerk is elected by the common council. More than $1,000,000 is spent annually by the city for maintenance and operation, the principal items being: Schools, about $215,000; streets, $125,000; police department, $112,000; hospitals, asylums, and other charitable institutions, $89,000; municipal lighting, $83,000; interest on debt, $83,000; water-works, $77,000; fire department, $64,000. The water-works, which represent an outlay of $1,856,774, are the property of the municipality. The net debt of the city in 1902 was $2,078,534; the assessed valuation of real and personal property, $56,924,599. The population, in 1800, was 4926; in 1850, 28,785; in 1870, 46,465; in 1880, 56,747; in 1890, 60,956; in 1900, 60,651. The village of Lansingburg, which in 1900 had a population of 12,595, became a part of Troy on January 1, 1901.

The site now occupied by Troy was included in the Van Rensselaer grant of 1629, and in 1659, with the consent of the patroon, was bought from the Indians by Jan Barentsen Wemp. In 1720 Derick Van der Heyden obtained possession of a large farm here, and it was on this farm, still owned by the Van der Heyden family, that a town, most of whose early settlers were New Englanders, was laid out in 1787. The place was called Van der Heyden's Ferry and Ashley's Ferry until 1789, when the present name was adopted. In 1794 Troy was incorporated as a village, and in 1816 it was chartered as a city. Consult: Weise, *Troy's One Hundred Years* (Troy, 1891).

TROY. The county-seat of Miami County, O., 80 miles north by east of Cincinnati, on the Cincinnati, Hamilton and Dayton Railroad (Map: Ohio, B 5). Farming is the leading industry of the surrounding country. There are manufactures of carriages, wagons, bentwood, dashboards, and iron and lumber products. The water-works and the electric light plant are owned by the municipality. Population, in 1890, 4494; in 1900, 5881.

TROYES, trwä. The capital of the Department of Aube, France, on the left bank of the Seine, 104 miles by rail east-southeast of Paris (Map: France, K 3). It presents a quaint, mediæval appearance, most of the houses being of the timbered kind. The fine Cathedral of Saint Pierre (thirteenth to sixteenth century), with a splendid rose window, is in the Flamboyant style. The small Church of Saint Urbain, founded by Pope Urban IV., is a charming example of the thirteenth-century Gothic. La Madeleine has a superb rood screen. Saint Jean (fourteenth to sixteenth century) is noteworthy for its stained glass and its two paintings by Mignard. Saint Nicolas and Saint Pantaléon are both in the Gothic style of the sixteenth century. In the old Abbey of Saint Lupus are the public library (110,000 volumes and 2800 manuscripts) and an interesting museum. The monument to the children of Aube, in commemoration of the Franco-German War, was erected in 1900. The chief industry is the manufacture of cotton and woolen stockings. There is a school of hosiery. The Seine is canalized here and divides into several arms in the city. Population, in 1901, 53,146.

The capital of the Celtic *Tricasses,* Troyes was the Roman *Augustobona* (later *Trecæ*). The town was the capital of the counts of Champagne, and early rose to importance as a centre of trade. The treaty of 1420, which provided for the succession of Henry V. of England to the French throne, was signed here. Jeanne d'Arc took the town in 1429, and a century later it was partly destroyed by Charles V. The revoca-



TROYON

"OXEN GOING TO WORK," FROM THE PAINTING IN THE LOUVRE

tion of the Edict of Nantes reduced the population, which was largely Protestant, to less than one-fourth of its former numbers. Consult Boutiot, *Histoire de la ville de Troyes* (Paris, 1870-80).

TRO'YLUS AND CRY'SEYDE. A poem by Chaucer, written about 1380, probably largely a translation of Boccaccio's *Filostrato*, though Chaucer may have drawn directly from Benoît de Sainte-More's *Roman de Troyes* of the twelfth century, in which the episode is first introduced, or from Guido della Colonna's prose novel based on it.

TROYON, trwä'yôN', Constant (1810-65). A French landscape and animal painter of the Fontainebleau-Barbison school. He was born at Sèvres, August 25, 1810, and worked while a youth as a decorator in the porcelain factory, receiving meanwhile lessons in design from Riocruz and later from Poupart. At the age of twenty he began as a landscape painter by making studies in the fields. His first Salon pictures, exhibited in 1833, were mediocre in character. A fortunate acquaintance with the romanticist Roqueplan modified his style and brought him the acquaintance of Rousseau, and a closer association with Diaz and Dupré, his fellow-workers at the Sèvres factory. (See Barbison School.) Of great importance for his career was his visit, in 1847, to Holland, where his observation of the rich animal life of the fields, together with his study of Dutch art, gave a new direction to his own work. He found inspiration in Potter and Cuyp, and modified his technique after the example of Rembrandt. From 1848 he became distinctively an animal painter. His animals, however, were never detached studies, but an integral part of the landscape. Success and fortune came to him early; he received first class medals in 1846, 1852, and 1855, and the decoration of the Legion of Honor in 1849, after which orders multiplied rapidly and his rapidity of execution sometimes resulted in inferior workmanship. In consequence of overwork he lost his reason in 1863, and he died in Paris, February 21, 1865.

Troyon is the principal animal painter of the French school, the worthy compeer of Potter and Cuyp. No man has succeeded better in portraying the character of animals—the stolid indifference of the ox, the helplessness of the sheep. But more than any other cattle painter he is a consummate master of landscape, which he portrays with an epic simplicity equaled only by Rousseau. At first rather heavy, his execution speedily became broad and impressive; his poetic treatment of light and color is that of the Barbison school. His pictures often bear no distinctive names beyond the general designation of landscape and cattle. In the Louvre are "Return from the Farm" (1849) and "Oxen Going to Work in the Fields" (1855); other famous examples are "Valley of the Touques" (1853, Contesse Lehow), "Cart with Ass," "Sheep After Storm," "Cow Scratching Herself." There are good examples of his work in the provincial museums of France, and in the important private and public collections in the United States. Consult his biographies by Dumesnil (Paris, 1888); Hustin (ib., 1893); and Van Dyke, in *Modern French Masters* (New York, 1896).

TROY WEIGHT. See Weights and Measures.

TRÜBNER, trụb'nẽr, Nicholas (1817-1884). A London publisher, born in Heidelberg, Germany. After learning the bookseller's trade, he went to London in 1843, and was employed by the Longmans. In 1851 he entered into partnership with Thomas Delf, and soon became the head of the flourishing publishing house of Trübner & Co. One of his successful enterprises was a development of the American trade. In 1855 he published the admirable *Bibliographical Guide to American Literature*, which was greatly enlarged in 1859. He found time to study Sanskrit, Hebrew, and Basque, and wrote several learned books. He performed great services to scholarship by issuing works shunned by ordinary publishers. Two remarkable series of such works were *Trübner's Oriental Series* and the *British and Foreign Philosophical Library.* He was also the publisher of the Early English Text and other societies.

TRUCE (plur. of obsolete Eng. *true*, truce, true, AS. *trēowe*, *trywe*, Goth. *triggws*, Ger. *treu*, true; connected with OPruss. *druwis*, faith). In warfare, a truce closely resembles an armistice (q.v.), the two terms being frequently used as synonyms. Practically, the truce is a prelude to or the interval necessary to arrange for an armistice. In either case it is but a temporary cessation of hostilities, and may be merely local, arranged to afford safe conduct for the bearer of a message, or to permit the combatants to bury their dead; or, if general, to admit of peace pourparlers. International agreement as well as the unwritten law of the battlefield forbids either side taking advantage of a period of truce to improve their strategic advantage, by changes of position, disposition of troops, bringing up of reserves, or other reinforcements. A general truce is only made by the rulers or governments concerned, while a local truce may be arranged by the local commanders. During a truce a definite arrangement is made detailing the liberties permitted each combatant. It is understood, however, that each side is at liberty to carry out such operations as would have been possible during actual hostilities. Violation of a truce by either party, or any form of treachery regarding it, instantly terminates the truce. See Flag of Truce; War.

TRUCE OF GOD (ML. *treuga Dei*). In the Middle Ages private warfare was very common, and the Church synods, in order to limit what they could not wholly repress (see Peace of God), in the eleventh century and later, frequently passed decrees that there should be no such warfare during certain holy seasons and on certain days. The seasons during which peace was observed extended from Advent to Epiphany, and from Septuagesima to one week after Pentecost. In addition the time from Wednesday night to Monday morning of each week and all saints' days were included. By the end of the eleventh century only about eighty days in the year were left free for private warfare, but most of these days came in summer when the fighting would naturally be most common. These decrees of the councils, although frequently repeated, had little effect. Sometimes the King, too, lent the truce the weight of his authority and thus made it a peace of the land. Consult: Kluckhohn, *Geschichte des Gottesfriedens* (Leipzig, 1857); Huberti, *Studien zum Gottesfrieden und Landfrieden* (Anspach, 1892).

TRUCK FARMING. See AGRICULTURE.

TRUDEAU, EDWARD LIVINGSTON (1848—). An American physician, born in New York City, who received his preliminary education in Columbia College, and his medical degree in 1871 from the College of Physicians and Surgeons, now Columbia medical department. After a brief period of practice in New York City, he was obliged by pulmonary disease in 1873 to go to the Adirondack Mountains, where he has since resided. In 1884 he founded the Adirondack Cottage Sanitarium at Saranac Lake, N. Y., for the treatment of incipient tuberculosis in working men and women, the first American institution attempting the climatic and open-air method of treatment of this disease. In 1894 he founded the Saranac Laboratory for the Study of Tuberculosis, the first research laboratory for the purpose in America. Dr. Trudeau is a member of many medical and other learned associations. He has contributed a vast number of articles to medical periodicals.

TRUE, ALFRED CHARLES (1853—). An American educator and agriculturist, born at Middletown, Conn. He graduated at Wesleyan University in 1873, was principal of the high school at Essex, N. Y., in 1873-74, from 1875 to 1882 was an instructor in the State Normal School at Westfield, Mass., and in 1882-84 studied at Harvard. In 1884-88 he was an instructor in the Wesleyan University, in 1888 entered the office of Experiment Stations in the United States Department of Agriculture (q.v.), was editor there in 1889-90, vice-director in 1891-92, and became director in 1893. He was dean of the first graduate school of agriculture held in the United States (at Columbus, Ohio, 1902), and as chairman of the committee on methods of teaching agriculture of the Association of American Agricultural Colleges and Experiment Stations, was for years prominent in the movement for the improvement of college courses in agriculture, and the extension of agricultural instruction to the elementary and secondary schools. He organized agricultural investigations in Alaska, Hawaii, and Porto Rico, and the work of the Department of Agriculture relating to irrigation, agricultural engineering, and the farmers' institutes. He particularly studied the organization and management of institutions for agricultural education and research, and published several monographs on this subject, chiefly in the bulletins of the office, including: *Education and Research in Agriculture in the United States* (1894); *Agricultural Experiment Stations: Their Objects and Work* (1895); *The Agricultural Experiment Stations in the United States* (with V. A. Clark, 1900); *Agricultural Experiment Stations in Foreign Countries* (with D. J. Crosby, 1902); and *Progress in Agricultural Education* (1902). For ten years he was chief editor of the *Experiment Station Record.* He contributed articles on agriculture and horticulture to the *New International Encyclopædia* and *Webster's International Dictionary.*

TRUE, CHARLES KITTREDGE (1809-79). A Methodist Episcopal clergyman. He was born in Portland, Maine; graduated at Harvard University, 1832, and entered the New England Conference, 1833. He was agent of the New England Education Society, 1834; principal of Amenia Seminary, 1835; entered the New York Conference, 1836; was transferred to the New England Conference, 1838; was professor of intellectual and moral science in Wesleyan University, Middletown, Conn., 1849-61; and financial agent of Wesleyan University, 1870-73. He published: *The Elements of Logic* (1840); *Shawmut; or, the Settlement of Boston by the Puritan Pilgrims* (1845); *John Winthrop and the Great Colony* (1875); *The Life and Times of Sir Walter Raleigh* (1877); *The Life and Times of John Knox* (1878); *Memoirs of John Howard* (1878); *The Thirty Years' War* (1878); *Heroes of Holland* (1882); *Life of Captain John Smith* (1882).

TRUEBA Y COSIO, trōō-ā′Bȧ ê kō′sê-ȯ, TELESFORO DE (1798-1835). A Spanish and English author, born at Santander and educated in a Catholic college in England. His studies for a diplomatic career he made in London and in Paris, where he afterwards served as attaché to the Spanish legation until 1822. After his return to Spain he founded an academy uniting the entire younger generation of poets and presided over by Alberto Lista. The two comedies, *El veleta* and *Casarse con 60,000 duros,* which he wrote about this time, entitle him to be ranked with the best Spanish dramatists. In politics an ardent champion of the constitutional party, he took refuge in London on the restoration of the absolute régime and presently earned wide reputation as an English writer. Besides the novels *Gomez Arias* (1828) and *The Castilian* (1829), in imitation of Walter Scott, he published a *Life of Hernan Cortés* (1830); *History of the Conquest of Peru* (1830); *The Romance of History* (1830); *The Exquisites; Salvador de Guerilla; The Incognito* (1831); produced the comedies *Call Again To-Morrow* (1832), *The Exquisites, Mr. and Mrs. Pringle, The Man of Pleasure* (1832), and the historical drama *The Royal Fugitive* (1834); but won his greatest success with the descriptive picture of manners *Paris and London* (1831). Returning to Spain in 1834, he was elected to the Cortes and secretary of the Second Chamber. He died in Paris.

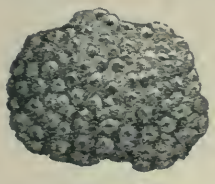
TRUEBA Y LA QUINTANA, ê lȧ kên-tä′-nȧ, ANTONIO DE (1821-89). A Spanish poet and novelist, born in the Basque region, of peasant stock. He went to Madrid, where he entered business, but devoted his leisure hours to study, and even succeeded in obtaining a university degree. He was made by Isabella II. historiographer of Biscay, but was deprived of his post of historiographer when the Queen was banished in 1868. His verse, contained in the two collections *El libro de los cantares* (1852) and *El libro de las montañas* (1868), is marked throughout by a tender melancholy natural to his native Basque region, of which he sings. His historical novels, such as *El Cid Campeador* and *Las hijas del Cid,* are dreary performances. In the short tale of manners, descriptive of his beloved Basque district, he succeeded. There are various collections of these tales, for example, the *Cuentos de color de rosa,* the *Cuentos cam-*

pesinos, the *Cuentos de varios colores*, the *Narraciones populares*, the *Cuentos de madres é hijos*.

TRUE BILL. See INDICTMENT.

TRUE INSPIRATION CONGREGATION. See COMMUNISTIC SOCIETIES.

TRUFFLE (OF. *trufle*, *trufe*, *truffe*, Fr. *truffe*, truffle, perhaps from Lat. *tubera*, neu. pl., but taken as fem. sg. of *tuber*, swelling, tumor, tuber), *Tuber*. A genus of ascomycetous fungi of the order Tuberales; globose, or nearly so, of a fleshy substance, with a distinct skin, the whole substance pervaded by a network of serpentine threads (*hymenium*) which bear the spore-cases in minute cavities. The species, which are not numerous, are very generally diffused in temperate parts of the world; they are subterranean, found frequently in groups of 10 to 20 individuals a foot or more below the surface soil. Some of them are among the most highly valued of esculent fungi. The common truffle (*Tuber cibarium*) is black, and has a roughened surface. Its size varies from that of a large plum to a large potato. On account of its agreeable flavor, it is used in the preparation of many dishes. It is common in the central and southern parts of Europe, chiefly in loose soils, in woods and pastures, as in the pine, oak, and chestnut woods of France and Italy. Other species, as *Tuber æstivum*, *Tuber rubum*, and *Tuber melanosporum*, are found in some parts of France, Italy, and other countries of Europe, and are sought and used in the same manner as the common truffle. Dogs and pigs are trained to seek them, and readily discover by the scent the spot where they grow under ground. The stirring of the soil in the gathering of truffles seems to increase productiveness. White truffles (*Terfezia leonis*), a species of a nearly allied genus, which has also been found in many places, grows half above ground, is pinkish, and is generally as large as a walnut. It is less aromatic than the common truffle, but is used in the same way. As yet edible species are little known in the United States.



TRUFFLE.

TRUJILLO, trōō-hēl'yō (formerly TRUXILLO, from Lat. *Turris Julii*). A town of the Province of Cáceres, Spain, in Estremadura, 24 miles east of the city of Cáceres on the main highway from Madrid to Portugal (Map: Spain, C 3). The surrounding country is mountainous, but produces wheat, wines, oil, and fruits; live stock is raised. The principal manufactures are chocolate, leather goods, pottery, and delft-ware. There are valuable forests in the vicinity. The town contains many convents and churches, of which the most famous is that of Santa Maria de la Concepción, which holds the tomb of Francisco Pizarro (q.v.). The so-called 'Tower of Julius' and other Roman ruins are found in the vicinity. The population of the ayuntamiento in 1900 was 9304.

TRUJILLO, or **TRUXILLO**. A seaport of Honduras, on the Atlantic coast, Bay of Truxillo, 137 miles northeast of Tegucigalpa (Map: Central America, E 3). The town was formerly the most important port of Northern Honduras. In recent years much of its trade has been diverted. Population, about 4000. Trujillo was founded in 1523 and was formerly the capital of the Republic. Here the celebrated American filibuster Walker was captured and executed in 1858.

TRUJILLO, or **TRUXILLO**. A Peruvian city, capital of the Province of Libertad (formerly the Intendencia of Trujillo), situated near the mouth of the river Moche, 320 miles northwest of Callao, and connected by rail with its port, Salaverry (Map: Peru, B 5). The town is still surrounded by walls of the seventeenth century. It contains a cathedral, a university, and a theological seminary. It was formerly an important commercial centre, but, as its port is an open roadstead, its trade is now restricted largely to the province. Near it lie the ruins of the Inca city Gran Chimu, Trujillo was founded by Pizarro in 1535, and named in honor of his birthplace. It was destroyed by an earthquake in 1619. Its population in 1900 was about 8000.

TRUL'LIBER, PARSON. A fat and brutal curate, the antithesis of Parson Adams, in Fielding's *Joseph Andrews*.

TRUM'BULL, BENJAMIN (1735-1820). An American clergyman and historian, born at Hebron, Conn. He graduated at Yale in 1759, and was pastor of the Congregational Church at North Haven, Conn., from 1760 until his death. He served in the Revolutionary Army as chaplain and as volunteer soldier. He published: *Twelve Discourses on the Divine Origin of the Holy Scriptures* (Hartford, 1790); *General History of the United States of America* (Boston, 1765-1810); and a painstaking and excellent *History of Connecticut from 1630 till 1713* (Hartford, 1797).

TRUMBULL, HENRY CLAY (1830-1903). An American clergyman and author, born at Stonington, Conn., and educated at Williston Seminary, at Yale, and at the University of New York. He was ordained a Congregational minister, served as chaplain of the Tenth Connecticut Regiment in 1862-65, and was in several Confederate prisons. In 1875 he became editor of the *Sunday School Times*. His publications include: *The Knightly Soldier* (1865); *Kadish-Barnea* (1883); *Teaching and Teachers* (1884); *Principles and Practice* (6 vols. 1889); *Studies in Oriental Social Life* (1894); *War Memories of an Army Chaplain* (1898); and *Old-Time Student Volunteers* (1902).

TRUMBULL, JAMES HAMMOND (1821-1897). An eminent American philologist, born in Stonington, Conn., and educated at Yale. Feeble health prevented the completion of his college work as well as his entering upon active professional life. After 1847 he was a resident of Hartford. From 1847 to 1852 and again from 1858 to 1861 he was Assistant Secretary of State, and from 1861 to 1865 was Secretary of State, for Connecticut. He was among the foremost of American philologists, and was a well-known writer on historical subjects of local interest. He also made a thorough study of the Indian tongues, and prepared a glossary of Eliot's Indian Bible. He was the State librarian in 1854-56, and from 1863 until his death was librarian of the Watkinson Library of Hartford;

from 1849 to 1863 was secretary of the Connecticut Historical Society, and was its president from 1863 until his death. He was one of the editors of the *Colonial Records of Connecticut* (15 vols., 1850-90); he also edited the *Memorial History of Hartford County* (1886); and he prepared an edition of T. Lechford's *Plain Dealing* (1867), and of Roger Williams's *Key into the Indian Language* (1866). His own publications include: *The Composition of Indian Geographical Names* (1870); *The Best Method of Studying the Indian Languages* (1871); *Historical Notes on the Constitution of Connecticut* (1872); *The True Blue Laws of Connecticut, and the False Blue Laws Invented by Rev. Samuel Peters* (1876); and *Indian Names of Places in and on the Borders of Connecticut, with Interpretations* (1881). He also wrote numerous articles in his particular fields of study, and also secured further recognition as a bibliographer by preparing the catalogue of George Brinley's library (1878-97).

TRUMBULL, John (1750-1831). An American judge and poet, born in Watertown, Conn. Precocious in childhood, he passed his examinations for Yale at the age of seven, but spent six further years in preparatory study, and was not graduated until 1767. Two years later he wrote essays in imitation of Addison for local journals. In 1771 he became tutor at Yale, studied law, and was admitted to the bar in 1773, having already signalized his satiric powers in *The Progress of Dullness* (1772). To this he added a second and third part in 1773, and in that year entered the law office of John Adams in Boston. At New Haven in 1774 he composed the first portion of his most famous satire, *McFingal*, a mock epic after the fashion of *Hudibras*. During the Revolutionary War he lived in Westbury and Hartford, where he completed *McFingal* (1782). This work became very popular, no less than thirty pirated editions being known to collectors. From it is taken the familiar quotation "A thief ne'er felt the halter draw With good opinion of the law." His political writing after the Revolution was Federalist in spirit and a protest against anarchical tendencies. His poetical works were collected in 1820. He coöperated with the famous Hartford Wits in the *Anarchiad*, and was State Attorney (1789), legislator (1792, 1800), and Superior Court judge from 1801 to 1819, when he moved to Detroit, where he died. *McFingal*, which may be best read in the edition of B. J. Lossing (1860), is a vigorous production, and, though lacking in sprightliness, is one of the few Revolutionary poems worth a glance to-day.

TRUMBULL, John (1756-1843). An American historical and portrait painter. The son of Jonathan Trumbull, War Governor of Connecticut, he was born at Lebanon, Conn., June 6, 1756, graduated at Harvard in 1773, and two years later entered the Continental Army. Having made for Washington a plan of the British works before Boston Neck, he was appointed an aide-de-camp, and the following year a deputy adjutant-general under Gates. He retired from the army in 1777, but in 1788 he took part as a volunteer in General Sullivan's expedition to Rhode Island; and in 1780 he became a pupil of Benjamin West, in London. The news of André's execution fastened upon him the suspicion of being a spy, and he was imprisoned for eight months. In 1782 he returned to America and remained until the Peace of Paris had been signed, when he went back to London to continue his studies. In 1784 he went to Paris, where, in consultation with Thomas Jefferson, he painted his first historical picture, "The Signing of the Declaration of Independence." This picture and those of the "Surrender of Burgoyne," "Surrender of Cornwallis," "Resignation of Washington at Annapolis," hang in the Capitol at Washington. Most of his pictures are at the Art Gallery of Yale College, to which he presented them in return for an annuity of $1000. Among the principal are the "Battle of Bunker Hill" (1786); "Death of Montgomery" (1781); "Battle of Princeton," "Battle of Trenton," and portraits of Washington, Hamilton, the Duke of Wellington, and others. Other well-known portraits by him are those of Washington, George Clinton, John Jay, and Alexander Hamilton, in the New York City Hall; of General and Mrs. Washington in the National Museum, Washington; of John Adams, of his father, Jonathan Trumbull, and of Rufus King. Although not of the highest rank, his work is good in composition and color, and is pervaded by a healthy realism. In 1794 he served under Jay as secretary of legation in England; and from 1816 to 1825 was president of the Academy of Fine Arts, New York, in which city he died, November 10, 1843. Consult his *Autobiography* (New York, 1841); Durand, in *American Art Review* (1881).

TRUMBULL, Jonathan (1710-85). An American patriot and political leader, born at Lebanon, Conn. He graduated at Harvard in 1727, studied for the ministry, and for a time held a pastorate at Colchester, Conn., but in 1731 joined his father in mercantile pursuits. Meanwhile he began the study of law, and in 1733 was sent to the General Assembly, of which he became Speaker in 1739. In 1740 he was appointed Governor's assistant, in which position he was retained for many years; and from 1766 to 1769 he was Deputy Governor, and as such the *ex-officio* Chief Justice of the Superior Court of Connecticut. From 1769 to 1783 he was Governor, and at the outbreak of the Revolutionary War was the only one of the colonial Governors who gave his unqualified support of the Patriot Party. At the close of the war he was prominent as an advocate of a strong federal government. According to a long accepted tradition he was called by Washington 'Brother Jonathan,' a phrase which later came into general use to personify the United States. See National Nicknames.

TRUMBULL, Jonathan (1740-1809). An American political leader, the son of Jonathan Trumbull (1710-85), born at Lebanon, Conn. He graduated at Harvard, 1759, was for several years in the State Legislature; was paymaster-general of the Northern Department from July, 1775, to July, 1778; and was military secretary to General Washington, with the rank of lieutenant-colonel, in 1781-83. He was a Federalist member of Congress from 1789 to 1795, being Speaker of the House in 1791-95; was a member of the United States Senate in 1795-96; was

Lieutenant-Governor of Connecticut in 1796-98; and was Governor from 1798 to 1809.

TRUMBULL, Joseph (1782-1861). An American lawyer, grandson of Jonathan Trumbull (1710-85). He was born at Lebanon, Conn. After graduating at Yale in 1801, he studied law and from 1804 to 1828 practiced at Hartford. In the latter year he became president of the Hartford bank. He was a member of the Legislature from 1832 to 1848, and in 1851. In 1834-35, on appointment, he served in Congress as a Whig, and again in 1839-43 was a member of that body. In 1849-50 he was Governor of Connecticut. He was actively interested in public internal improvements and in educational matters.

TRUMBULL, Lyman (1813-96). An American jurist and politician, born at Colchester, Conn. He received an academic education, taught school in Georgia, and was admitted to the bar in 1837. He removed to Belleville, Ill., and in 1840 was elected to the Legislature as a Democrat. In 1841-42 he was Secretary of State, and from 1848-53 was a justice of the Supreme Court. From 1855 to 1873 he was a member of the United States Senate. When the slavery question became acute he joined the Republican Party, was chairman of the Judiciary Committee after 1861, supported the Emancipation Proclamation, and the suspension of *habeas corpus*, and drafted the Thirteenth Amendment to the United States Constitution. After the war he was one of the five Republican Senators who refused to vote for the impeachment of President Johnson, and thereafter acted with the Democrats. In 1873 he returned to the practice of law in Chicago. In 1880 he was the unsuccessful Democratic candidate for Governor of Illinois. He joined the Populists in 1894, and defended the leaders of the great railway strike in Chicago in that year.

TRUMPET (OF., Fr. *trompette*, It. *trombetta*, trumpet, diminutive of Fr., OF. *trompe*, It. *tromba*, trumpet, probably from OHG. *trumba, trumpa*, Ger. *Tromme*, drum, perhaps corrupted from Lat. *triumphus*, triumph; ultimately connected with Eng. *drum*). A musical instrument of great antiquity, which, in its present form, consists of a tube 8 feet long, less in diameter than the horn, doubled up in the form of a parabola, and sounded by a mouthpiece. By means of crooks the instrument can be adjusted to any degree of the chromatic scale. With the exception of the one in C, all trumpets are transposing instruments. The music is always written in the treble clef. The sound is bright and penetrating. The older composers, including Beethoven, had to be very careful in the selection of the trumpets for a particular composition, and even then it was not always possible to have the trumpet play all the notes desired. To remedy this serious defect the instruments were provided with valves, enabling them to produce all chromatic intervals from g to g^2.

TRUMPET CALLS. See Bugle and Trumpet Calls.

TRUMPETER (so called from its note), or Agami. One of the birds of the family Psophiidæ, allied to the cranes, and natives of South America. They have the plumage of the head and neck short and velvety, while that of the rump is long and loose, and possesses the remarkable character of having a series of sub-orbital bones as in reptiles. The best known species is *Psophia crepitans*, which occurs in large flocks north of the Amazon, especially in the forests of British Guiana. These birds, of which several species exist, have little power of flight. The flesh is palatable, and they are domesticated by the Indians. Another species (*Psophia leucoptera*) is termed 'corcosoda.' See Plate of Cranes, etc.

TRUMPETER BEE. The member of a colony of bumblebees whose office it seems to be to arouse the denizens of a nest to work in the early morning.

TRUMPETER-FISH. The most important of the commercial food-fishes of New Zealand, *Latris necatia*, often reaching a weight of 50 pounds. It is a member of the 'long-fin' family Cirrhitidæ, related to the sea-breams (Sparidæ), which furnishes many valuable food-fishes throughout the Indo-Pacific region. One species (*Chilodactylus macropterus*) is highly prized both at the Cape of Good Hope and in Australia, and reaches a weight of 25 pounds. These fishes are called 'long-fins' on account of a prolongation of one of the rays of the pectoral fins.

TRUMPETER HORNBILL. See Hornbill.

TRUMPET-FISH. See Snipefish.

TRUMPET FLOWER (so called from the shape of the flower). The popular name of the genus Tecoma (natural order Bignoniaceæ), comprising about twenty-four species of Asiatic, Australian, African, and North American mostly climbing and twining shrubs without tendrils, producing large flowers with a long tubular corolla which suggested the common name. The trumpet creeper, or trumpet vine (*Tecoma radicans*), is a beautiful North American hardy species which climbs by means of aërial rootlets and has large attractive funnel-shaped, orange-yellow, and scarlet flowers. Tecoma australis is an ornamental Australian climber. Tecoma jasminoides, another Australian species, is grown in greenhouses. Tecoma capensis is a South

TRUMPET CREEPER (*Tecoma radicans*).

African climbing shrub with clustered racemes of orange scarlet flowers. Tecoma grandiflora, a rather tender Chinese and Japanese species, is in common cultivation. Tecoma stans, a yellow-flowered Texan species, is an erect shrub. The plants are propagated by seeds, layers, cuttings of well-developed shoots, and most commonly by root cuttings. Species of the closely related genus Bignonia are sometimes also called trumpet flower.

TRUNK-BACK TURTLE. The leatherback (q.v.).

TRUNKFISH (so called from its incasement, which resembles a trunk), or BOXFISH. A fish of the order Ostracodermi, and family Ostraciidæ, with a short, cuboid body, covered by a carapace formed of firmly united polygonal bony scutes, the jaws, bases of the fins, and caudal peduncle free and covered by smooth skin. They swim by means of a curious sculling motion of the small dorsal fins and anal fins, the tail acting as a rudder, while the pectoral fins fan water into the gills. There are about twenty species, all of tropical seas, and dwelling near the bottom, feeding on minute animals. The common trunkfishes, such as the West Indian *Lactophrys trigonus*, have the carapace or 'box' three-angled. A somewhat different one (*Lactophrys tricornis*) is the 'cowfish' or 'toro' of Florida and Cuba, and distinguished by the stout spines that form three 'horns' on the head. It ranges to the Cape of Good Hope, reaches 18 inches in length, and makes good food when baked in its shell. See Plate of PLECTOGNATH FISHES.

TRUN'NION, COMMODORE. In Smollett's *Peregrine Pickle,* a retired sailor, the eccentric uncle of the title character. His household is arranged on naval lines and subjected to the discipline of a ship.

TRU'RO. A seaport in Cornwall, England, eight miles north of Falmouth, at the junction of the Allen and the Kenwyn with an inlet of the sea called the Truro River (Map: England, A 6). Truro is the centre of a mining district, and exports tin and copper ore. Its cathedral, an Early English structure in granite, consecrated in 1887, ingeniously incorporates portions of Saint Mary's Church, a Perpendicular edifice of the reign of Henry VII. The grammar school dates from 1546. Anciently called Truera and Truruburgh, Truro was the sea of the Stannery Parliaments of Cornwall, and was a privileged tin coinage town. Population, in 1901, 11,562.

TRURO, THOMAS WILDE, Baron (1782-1855). An English jurist and Lord Chancellor. He was born in London, was educated at Saint Paul's School, and was trained as a lawyer. In 1805 he was admitted as attorney and for some years practiced as such, but in 1817 was called to the bar as barrister, and in 1820 made himself celebrated by his defense of Queen Caroline. In 1831 he entered Parliament and gradually won for himself as great distinction there as he had won in the courts. In 1839 he became Solicitor-General, and in 1841 became Attorney-General, but held the office only a few months. In 1843 he introduced Rowland Hill's plan for postal reforms in the House of Commons, in 1846 was again made Attorney-General on the resumption of office by Lord John Russell, and a few days later was appointed Chief Justice of the Court of Common Pleas. In 1850 he was made Lord Chancellor and created Baron Truro of Bowes, but was relieved by the fall of the Government in 1852.

TRUSS (OF., Fr. *trousse,* from *trousser,* to pack, bind, tie, It. *torciare,* to twist, wrap, tie, from Lat. *tortus,* p. p. of *torquere,* to twist). An instrument employed in the palliative treatment of hernia, with the view of preventing its descent, and in some cases of effecting a permanent cure. It consists essentially of a pad or cushion attached to a metallic spring, with straps so arranged that its position may be retained during the varied positions of the body. The necessity of having recourse to a suitable truss the moment that the slightest protrusion shows itself in any of the parts liable to hernia cannot be too strongly urged. Many varieties of trusses have been devised. The choice of the instrument required in any particular case should be left to the surgeon. See HERNIA.

TRUST (ME. *trust, trost, trist, tryst,* Goth. *trausti,* covenant, treaty, OHG. *trōst,* Ger. *Trost,* trust, protection; connected with Eng. *true,* OPruss. *druwis,* faith, *druwit,* to believe). In its broadest sense, a legal relation existing between two or more persons such that a court of equity will compel one to hold property or an interest in property of which he has the legal title for the benefit of the other or others. The person so holding the legal interest in property is called the *trustee,* and the person entitled to the benefit, or, as is sometimes said, the 'equitable interest' in the property, is known as the *beneficiary* of the trust, or the *cestui que trust.* The *fidei commissum* (q.v.) of the Roman law, which was a form of trust created by will, has been supposed to have been the model of uses, the early form of trust introduced into England by the clergy as a means of avoiding the operation of the mortmain statutes (q.v.). Another analogy has been found in the Roman idea of *usufructus,* or the right of temporary enjoyment of a thing as distinct from the legal ownership of it. The analogy, however, between uses or trusts on the one hand, and the *fidei commissum* and the *usufructus* on the other, fails in many important particulars, and it seems most probable that the use is an independent product of English jurisprudence, although its development was greatly aided by the doctrines of the Roman law with which the clergy were familiar.

The practice of conveying land to uses, that is, the granting of land to one to be held by him for the benefit of another, seems to have existed as early as the reign of Edward III. Such grants were made by debtors to avoid levy of execution by creditors, and by disseisors to avoid the claims of rightful owners of the land. By thus conveying land to another to the use of the grantor, the grantor retained all the benefits of a purely legal ownership, while he divested himself of all its burdens. First, the obligation of the grantee to uses to hold the land to the use of his grantor seems to have had only a moral or religious sanction, and, resting as it did upon conscience and good faith, was a proper subject for the then rapidly growing jurisdiction of the Court of Chancery. (See CHANCERY.) There is some evidence that the Chancellor took jurisdiction to enforce such obligations upon equitable grounds in the reign of Richard II., and the jurisdiction became well established during the reigns of Henry VI. and Edward IV. By virtue of the Chancellor's power to command things to be done, he could compel the feoffee to uses to carry out fully the equitable obligation imposed upon him by the grantor, and in the reign of Edward IV. we find the Chancellor imposing the same obligations upon those who acquired the legal title from the feoffee by inheritance or by purchase, if the purchaser had notice of the claim of the *cestui que use*. Equity also came to recognize the right or interest of the *cestui* as analogous to a legal interest in the land which might be freely conveyed or assigned and which might be inherited. Thus, in addition to the power of the legal owner of land to divest himself of the burdens of legal ownership by the conveyance to uses, he was also enabled to grant the use in ways not permitted at common law, as, for example, the grant of the use of property by the husband to his wife.

At this period (Edward IV.) there were three recognized methods of creating a use or trust in lands: (1) *By feoffment* or *transmutation of possession* as already mentioned. Analogous to this was the practice of enfeoffing another to the uses to be declared in the feoffor's will. Equity in such cases compelled the feoffor or trustee to hold the property for the benefit of those named in the feoffor's will. (2) *By bargain and sale.* When the legal owner entered into a legal contract for the sale of land in which the buyer paid, or agreed to pay, the vendee for the land, a court of equity treated the vendor as a trustee and compelled him to hold the land for the use or benefit of the buyer. (3) *By covenant to stand seized.* This was a covenant by which the legal owner of land covenanted to stand seized or possessed of the land to the use or for the benefit of a blood relative. Courts of equity treated such an instrument as a valid declaration of trust, enforceable against the covenantor for the benefit of the relative named in the covenant.

The use of the trust as a means of evading the obligation of legal ownership led to the enactment of the Statute of Uses, 27 Henry VIII., cap. 10. Its purpose was to abolish the practice of creating uses or trusts of land, and its effect was to declare that, by operation of law, the legal title should be deemed vested in the beneficiary or *cestui que use*. Upon its face the statute was effectual to serve this purpose, and its immediate effect was to permit the creation and transfer of legal estates in the same manner as uses or equitable estates had been created and transferred before the statute, and incidentally to permit the conveyance of a legal interest in land by mere deed of bargain and sale without feoffment as at common law. (See CONVEYANCE; USES, STATUTE OF.) Influenced, however, by the same powerful motives which were responsible for the development of the system of uses, the early lawyers, by a method of reasoning now difficult to understand, ultimately gave to the statute a meaning and effect the exact opposite of that intended. It was held that when land was granted to A for the use of B, the efficiency of the statute to vest the grantee to uses with the legal title was exhausted, so that if the grant was made to A for the use of B for the use of C, then B, who acquired the legal title by operation of the statute, would hold it for the benefit of C. It was also held that when an active duty was imposed upon the grantee to uses or trustee, as by a grant of real estate to A to collect and pay over the rents to B, the use was not executed by the statute by making B the legal owner, but was enforceable by Chancery as before the statute. The result, therefore, was that the system of trusts was preserved and its development stimulated rather than hindered by the statute. In both England and the United States there is a complete system of trusts of both real and personal property, either as developed by courts of equity or modified by statutes.

In order to create a trust all that is now necessary is that one should convey or grant, either by will or by grant *inter vivos*, specific property to one in trust for another, or that one having the legal title to such property should declare that he holds it in trust for another. No consideration is necessary to create a trust, and no writing or other formal document is required except that trusts of real estate are required by the Statutes of Frauds to be evidenced by writing. No particular words are necessary, but the intention of the person creating the trust must be clear. Any legal person or a corporation if within its corporate powers may become a trustee. Formerly the legal title held by the trustee, according as it was real or personal property, passed upon his death to his heirs or next of kin, whom equity would compel to hold the property for the benefit of the beneficiaries under the trust, but generally by modern statutes provision is made in case of the death or misconduct of a trustee for the appointment by the court of a new trustee, who acquires the title of the first trustee. Any legal person may be a *cestui que trust*, but it has been held upon somewhat unsatisfactory reasoning that trusts for the benefit of unascertained beneficiaries or for the benefit of inanimate objects were invalid, even though the trustee was able and willing to carry out the trust. In general, also, all the rules governing and determining the illegality of agreements are applied by courts of equity in determining the validity of trusts.

Trusts have been classified with reference to the manner of their creation as Express, Implied, Resulting, and Constructive. (1) The express trust is one created by the intent of the person creating or declaring the trust, expressed in written or spoken language, such as the trust created by express clauses in a will or by a formal declaration of trust. (2) The term 'implied trusts,' which has been sometimes applied to constructive trusts, denotes trusts created by the intent of the person creating or declaring it, when his conduct or language, either written or spoken, is such that the court infers or implies the intention to create the trust. (3) Resulting trusts are trusts which are not created as a consequence of actual intention, but which courts of equity in certain instances treat as trusts intended to be created. As it is said, under certain circumstances, the intention to create a trust is presumed. Thus, if the purchaser of real estate pays the purchase price, but takes the title in the name of a third person, the courts of equity hold that a resulting trust is created in favor of the purchaser, or when one conveys property to a trustee upon a trust which fails or is illegal, a resulting trust is deemed to be created in favor of the grantor, and in many cases when voluntary conveyances or conveyances without consideration are made a resulting trust is implied in favor of the grantor. (4) Constructive trusts include all those cases not included in the preceding classes in which courts of equity upon some equitable ground will compel the person having the legal title or interest in property to hold it for the benefit of another. Like resulting trusts, they differ from express and implied trusts in that they are not created as a consequence of intention of the interested parties. Thus, whenever the legal title of property has been wrongfully acquired by fraud, the person guilty of the fraud, or any person claiming under him who is not a bona-fide purchaser of the property for value, will be treated as a trustee and compelled to turn the property over to the person defrauded who is a constructive *cestui que trust.* Equity acts in a similar manner in enforcing equitable liens (q.v.) by compelling the lienee to hold the property subject to the claim of the lienor.

The so-called doctrine of tracing trust funds is a special application of the doctrine of constructive trusts. Not only will equity follow property acquired by fraud or breach of trust into the hands of any person who is not a purchaser in good faith for value, but it may compel any such constructive trustee who has disposed of the property to account for its proceeds in his hands, even though the proceeds have in time been converted into other property. As neither resulting nor constructive trusts are created by intention of the interested parties, neither is within the Statute of Frauds requiring the trust to be evidenced by writing. The trustee is, strictly speaking, the legal owner of the property, with all the rights and obligations of legal ownership, subject only to the right of the *cestui que trust* to compel with the aid of a court of equity performance of the trust. The trustee may sue and be sued with reference to the trust property without joining the *cestui que trust.* He may convey it, giving a complete legal title, although he may act in violation of the trust. With reference to the *cestui que trust,* however, he must perform completely the terms of the trust, and he cannot delegate his authority. He must act in good faith and with due care in administering his trust, and for failure to do this he must account to his *cestui.* When he has funds in hand he must keep them properly invested. In many States the investments which a trustee may make are regulated by statute or by settled practice. Aside from his fees allowed by law or specifically granted by the terms of the trust, he cannot make any gain or profit from his position as trustee. In several of the United States, notably in New York, statutes have been passed defining and generally regulating trusts and attempting to some extent to limit the doctrine of trusts as developed by the English Court of Chancery. It may be said, however, that neither by legislation nor otherwise has there been any material modification of the notion of a legal interest vested in one person and held by him for the benefit of another, the obligation to so hold the property being enforced by courts having equity powers. More changes have been made in the direction of substituting one trustee for another with facility in case of death or misconduct of a trustee, and in providing for the accounting of trustees and regulating their acts. Breach of trust or misappropriation of trust funds was not a crime at common law. It is now generally made a crime, being punishable as one of the statutory forms of embezzlement. In New York misappropriation of trust funds falls within the statutory definition of larceny and is punishable as such.

Consult the statutes of the various States; also the works on the law of trusts and trustees by Lewin (10th ed., London, 1899); Romer (London, 1898); Robbins and Maw (3d ed., London, 1901); and also the authorities referred to under EQUITY. See CHANCERY; EQUITY; FRAUD; FIDUCIARY.

TRUST, CHARITABLE. See CHARITABLE TRUSTS.

TRUST COMPANIES. Institutions chartered by the several States of the United States for the purpose of performing, as corporations, the general acts and assuming the general responsibilities imposed upon individuals under the law of trusts. The trust company in the United States exists in various forms, and combines with its trustee business numerous other lines of banking; as, for instance, the private savings bank business in certain States, chiefly in the West; mortgage investment in nearly all States; title guarantee and other insurance; and of recent years a general banking business similar in all respects to that of the ordinary deposit bank.

The growth and extension of trust companies in the United States has been one of the most noteworthy incidents in the country's recent financial history. The Comptroller of the Currency, in his annual report summarizing the various banking institutions in the United States, had returns in 1898 from 246 institutions of this class, which number had at the close of 1902 risen to 417. In 1902, according to the same report, the assets of the 417 companies aggregated $1,983,214,707. On January 1, 1899, there had been incorporated in New York State 49 trust companies, having aggregate resources of $579,205,442. At the opening of 1903 there were 77 institutions in existence, with total assets of $1,039,956,625. On January 1, 1898, the deposits of the New York trust companies aggregated $383,328,724. At the opening of 1903 their total was $734,342,837. The loan account, which amounted at the opening of 1898 to $261,765,000, had risen at the opening of 1903 to $597,194,389. At the opening of 1898 investments by trust companies in stocks aggregated in New York State $113,525,797; at the opening of 1903 they had very nearly doubled, rising to $219,378,946.

The trust companies have occupied public interest and discussion chiefly because of the exceptional increase of deposits since 1896-97, which is a result partly of the general practice maintained by these companies of offering interest on deposit accounts—a practice very generally abandoned nowadays by banks in the larger cities. The trust companies in New York City offer interest on all deposits at a rate varying from 2 to 4 per cent., according to the agreement made as to the permanency of the deposit. In addition to the large amount of deposits thus attracted, the immense credit fund in the hands of the trust companies for loaning purposes has made possible the increase of their deposits, through the making of such loans, at a far more rapid rate than heretofore.

Public discussion has converged on these operations, not only because of their magnitude, but because banking deposits maintained by the trust companies have not been guarded in the same way as have those of the banks. In general, there is no restriction in the State laws as to the amount of cash reserve which a trust company must keep against its deposits, the presumption of the law being that trustee business pure and simple was being carried on. The question whether this position was altogether safe from a banking standpoint has been debated with considerable energy, and various reforms or remedies have been suggested. In the making of such reforms, whether through private arrangement or through legislative act, two difficulties arise, due to differences either in the character or practices between the trust companies and the banks. First, the trust companies, though keeping on hand a cash reserve amounting at times to barely 2 per cent. of their deposit funds, nevertheless maintain on deposit at demand in other institutions an amount bearing a much larger proportion to their own deposit liabilities. On such deposits with other institutions trust companies usually draw 2 per cent. interest. The magnitude of these deposits may be shown from the New York trust company returns of January 1, 1903. As against their own deposit liabilities of $734,342,837, they then had on hand in cash only $10,493,236, but reported also as on deposit with other banks to their credit $128,166,652. The second difficulty in the way of arbitrary regulation of the trust company reserve fund lies in the fact that not all trust companies do a general banking business, some of them restricting their activities to trustee business of the old-fashioned order. In general, it has been recognized that deposit accounts held in a trustee business as originally contemplated need no more than a nominal cash reserve.

The trust companies of New York State may be taken as typical in a study of the problem. The important point to notice in these companies is that the law which created them is acknowledged not to have contemplated the doing of business on precisely the lines now followed by many of the institutions. Seventeen trust companies in New York State were chartered by special act of the Legislature between 1822 and 1887. In the latter year the general trust company law was passed, which, as subsequently amended, is now the basis of authorization for the business of the 60 subsequently incorporated companies. The purpose of the law, as clearly shown in these various enactments, was to create a class of institutions which in their powers, duties, and responsibilities should be able to act as substitute for the individual trustee. The general trust company law of New York State as it now stands authorizes the companies to perform the following functions: (1) To act as the fiscal or transfer agent of any State, municipality, body politic, or corporation, etc. (2) To receive deposits of trust moneys, securities, and other personal property from any person or corporation, and to loan money on real or personal securities. (3) To lease, hold, purchase, and convey any and all real property necessary in the transaction of its business, or which the purposes of the corporation may require, or which it shall acquire in satisfaction or partial satisfaction of debts. (4) To act as trustee under any mortgage bond issued by any municipality, body politic, or corporation. (5) To accept trusts from and execute trusts for married women, in respect to their separate property, and to be their agent in the management of such property. (6) To act under the order or appointment of any court of record as guardian, receiver, or trustee of the estate of minors. (7) To take, accept, and execute any and all such legal trusts, duties, and powers in regard to the holding, management, and disposition of any estate, real or personal, and the rents and profits thereof, or the sale thereof, as may be granted or confided to it by any court of record, or by any person, corporation, municipality, or other authority. (8) To take, accept, and execute any and all such trusts and powers of whatever nature or description as may be conferred upon or intrusted or committed to it by any person or persons, or any body politic, corporation, or other authority. (9) To purchase, invest in, and sell stocks, bills of exchange, bonds and mortgages, and other securities. (10) To be appointed and to accept the appointment of executor or of trustee under the last will and testament, or administrator with or without the will annexed, of the estate of any deceased person, and to be appointed and to act as the committee of the estates of lunatics, idiots, persons of unsound mind, and habitual drunkards.

These functions make plain both the nature of the trust company's business as contemplated by the legislators, and its difference from the banking business as conducted by an ordinary deposit bank. It will be observed that the act above quoted does not specifically in any place authorize the trust company to transact a general deposit banking business. But the statute does not deny such powers, and in section 8 it provides that a company incorporated under the act may accept "any and all such trusts and powers, of whatever nature or description, as may be conferred upon or intrusted or committed to it by any person or persons." This is a sufficiently sweeping proviso to cover the doing of banking business in any deposits intrusted to the company by individuals, and on that basis a great part of the trust company business as nowadays understood has been built up.

It is because of this growth of a business not contemplated in the original authorizing act that the most interesting recent controversy over the trust company business has grown up. In New York State, trust companies which report semi-annually to the State Banking Department showed in 1898 'deposits in trust' of $185,099,694; at the opening of 1903 their 'deposits in trust,' which still should have referred to deposits under the strict purpose of the original act, were given as $205,341,290. On the other hand, what are classed in the reports as 'general deposits,' referring presumably to the funds of depositors subject to all the rules which govern deposits of individuals in banks, amounted on January 1, 1898, to $198,229,029, but at the opening of 1903 had risen to $529,001,547. It is probable that the classification of deposits as above is somewhat loose; nevertheless, the statement is sufficient to show the enormous growth of the purely banking side of the trust company business. The banking laws of the United States and of the various States provide without exception for the maintenance of a specified percentage of deposit funds in cash reserves. This percentage, in national banks, varies from 7 per cent. to 25 per cent. of the total deposit liabilities. As the above citation from the trust company act will show, no such restriction has been applied in the case of the trust companies.

The question whether the cash deposited with the banks was a legitimate reserve for all purposes has been the bone of contention in controversy on the subject of trust companies. The banks have contended that it is not and that the trust companies should be required to maintain in cash an adequate reserve. The trust companies have in general answered that the funds deposited by them with the banks, if they are properly secured by the banks' own reserve, should be a sufficient guarantee against any sudden demands by the trust companies' depositors. In the early part of 1902 this controversy became acute. At that time 27 trust companies in Greater New York used by arrangement the facilities of the New York Clearing-house, for the purpose of exchanging and redeeming checks paid into them. Such checks were delivered by the trust company to a bank specified as its clearing-house agent, and by that agent were properly exchanged in the daily clearings. On April 29, 1902, the New York Clearing-house adopted the following resolution: "Every institution which hereafter may be granted permission to clear through a member of this association shall be required to keep in its vaults such cash reserve to its deposits as the clearing-house committee may determine. The percentage of such reserve, however, is not to exceed that required of banks members of the Clearing-house Association." The rule did not apply to any of the numerous trust companies at that time actually using the clearing-house facilities. A year later, on February 8, 1903, the following more drastic resolution was adopted by the clearing-house: "Every non-member institution (not a bank required by law to maintain a specified reserve) now or hereafter sending its exchanges through a member of the association shall on and after June 1, 1903, keep in its vaults a cash reserve equal to 5 per cent. of its deposits; and on and after February 1, 1904, such cash reserve shall be at least 7½ per cent. of its deposits, and on and after June 1, 1904, such cash reserve shall be such percentage as shall from time to time be fixed by the clearing-house committee, but not less than 10 nor more than 15 per cent. of its deposits. The reserve hereby required shall be an average reserve as against the average deposits as shown upon its weekly statements."

A vigorous controversy arose as to whether the trust companies should submit to this regulation. It was pointed out that for many of them the clearing-house facilities were not indispensable, and that they could arrange individually for the redemption of checks paid in to them. On the basis of this reasoning 10 trust companies, including several of the largest institutions of the kind in New York City, formally withdrew from the clearing-house. Those which remained, numbering 17, acceded to the clearing-house rule and began to build up a cash reserve in accordance with its requirements.

TRUSTEE. See TRUST.

TRUSTEE PROCESS. A legal process used in Massachusetts and several other New England States, corresponding to the garnishee process in use in most jurisdictions. See ATTACHMENT and GARNISHMENT, and consult the authorities there referred to.

TRUST FUND DOCTRINE. A theory adopted by the United States courts, to the effect that the capital stock of a corporation is a *trust fund* for the payment of its debts. This theory probably originated in the rule that subscribers for stock are liable up to the par value of the stock subscribed for by them. The incidents of an equitable trust are not applied in case of an insolvent corporation. Any diligent creditor may satisfy his whole claim, even to exhausting the entire assets of the corporation, if he levies execution before the other creditors, and in absence of a statute to the contrary an insolvent corporation may make a preference of creditors in paying debts. If the assets and capital stock were a true trust fund for the benefit of creditors, a court of equity would compel an equal distribution of the assets among all the creditors. The term *trust fund*, therefore, seems an unfortunate misnomer of a just and equitable rule, but no hardship is created thereby. See EQUITY, and the authorities there referred to. See also TRUSTS.

TRUSTS. The word Trusts in this article is used of large corporations or associations of corporations or of individuals mostly engaged in manufacturing, which possess sufficient power to fix the prices of their products, in part at least, on the principle of monopoly. It does not include railways or combinations of railways, or Trusts in the technically legal sense.

INDUSTRIAL CONDITIONS LEADING TO FORMATION OF TRUSTS. The Trusts are a late development, since, until late in the nineteenth century, industrial conditions were not favorable for their formation. In earlier times organizations possessing monopolistic power were either created by law or secured their power through the possession of some natural advantage, such as the exclusive possession of certain natural resources, as mines, etc., or through the advantage which comes from the exclusive occupancy of positions of advantage in doing their work—railroads, telegraphs, etc. In the modern Trust we often find combined with the advantages of great capital and perfected business organization also some of these natural advantages, but they are not the essence of the Trust advantage. The chief causes, from the industrial point of view, which have led to the organization of Trusts, are: (1) The existence of competition which was practically ruinous in its nature, brought about in part by the ease of intercourse between persons in different localities, and by the difficulty of withdrawing readily capital once invested in fixed plants. Such competition almost of necessity at times will become so fierce that all parties concerned will fail of making any profit. (2) The possibility of saving industrially many of the wastes which come from the competitive system, provided the interests of the various competitors are harmonized. Without discussing in detail these wastes of competition, there may properly be mentioned the salaries of traveling salesmen, the expense of keeping up expensive show windows, the cost of competitive advertising, the loss from undue extension of credits, the loss of custom which comes from carrying only a partial instead of a complete stock, the loss from the payment of cross freights, the loss from running manufacturing plants to only part of their capacity or part of the time. There may be mentioned also as a gain from combination the saving from standardizing the machinery and from prevention of the waste of time due to stopping and changing machinery, the saving from the most efficient organization of laborers and from managing all plants in an enterprise by the most skillful men instead of having part of them directed by men of meager ability, the certainty of a regular supply of raw material, and the most efficient use of by-products.

OTHER INFLUENCES AS CAUSES. Aside from the industrial conditions that have led to the organization of Trusts, certain other influences are to be noted. (1) The promoters of the large enterprises have in many cases succeeded in making very large profits from the organization. Likewise the financiers who have underwritten the stock have been able to exact very large payment for the risks which they have taken. The immediate personal interest of the promoter and financier has thus been a very powerful factor—sometimes even the most powerful factor in bringing about the combinations. (2) Governmental favors of various kinds have sometimes tended in the same direction. Although the protective tariff can scarcely be mentioned as a direct cause of the organization of industrial combinations, it is doubtless true that when an industry which otherwise would not have prospered has been first made very profitable by a protective tariff, so that numerous rival establishments have invested large sums of money in it, the consequent rivalry has led to the formation of combinations. It is also probable that in certain instances the protective tariff, by lessening foreign competition, has promised to the promoters of a combination the opportunity for greater profits than could have been anticipated without the existence of the tariff. In this indirect way, therefore, we may well consider the legislative favor of the protective tariff under certain circumstances as an indirect cause of the Trust. Similarly, the monopoly granted by the patent laws, by copyrights, by trade-marks, and other legislative benefits, have led to the organization of some of the great combinations.

EXTENT OF COMBINATION MOVEMENT. As yet, there are no satisfactory statistics regarding the extent of the combination movement in this country. The only material of this nature that is trustworthy is that secured by the United States Census of 1900, published in volume vii., part i., of the *Report on Manufactures.* This report included only those 'Trusts' which consist of a number of formerly independent mills which had been brought together into one company under a charter obtained for that purpose. Accordingly many establishments which might properly have been included under the word 'Trusts' were excluded. Moreover, many of the largest corporations organized during the last few years, including the United States Steel Corporation, were organized later and hence were not included. The figures given, however, include 185 combinations with 2040 plants. The total capitalization was $1,436,625,910. The total cost of materials used was $1,089,666,334, and the value of the products $1,667,350,949. The total gross value of all manufactured products enumerated in the census was $13,004,400,143. For the purpose of comparison there should be subtracted from this total the value of the products of the hand trades or the mechanical and neighborhood industries, since these are not adaptable to the form of management known as the industrial combination. There remains a total gross product of industries susceptible of combination into Trusts of $11,820,784,665. Comparing this with the product of the industrial combinations, it seems that in 1900 the Trusts produced nearly 14.1 per cent. of the total gross product of the manufacturing industries of the country, as enumerated by the census.

Doubtless at the present time this ratio would need to be somewhat increased. Yet it would probably be fair to say that even at the present time the Trusts do not manufacture more than 25 to 30 per cent. at the outside of all the industries in the country readily susceptible of industrial combination. It is impossible at the present writing to say more than that the Trusts have developed very rapidly of late years, and that they apparently, though not certainly, are absorbing steadily a continually growing percentage of the entire industries of the country. It seems, however, to be equally clear that there are many lines of industry which are not susceptible of management under the Trust organization, and a point will probably be reached within the not far distant future when industries which, from their nature, can be advantageously organized into Trusts will all substantially be so organized, and those not capable of advantageous organization in this form will be recognized as industries normally managed by independent producers.

THE MONOPOLY CHARACTER OF THE TRUSTS. Many of the Trusts are closely connected with natural monopolies which give them a decided advantage over their competitors. It is well known that the Standard Oil combination, in its earlier days at any rate, derived great advantage from the special rebates which it received from the railroads. There is also reason to believe that many other of the later combinations have received somewhat similar favors. The United States Steel Corporation, as well as some of its constituent companies, has made it evident that one of the great advantages possessed by these organizations is the ownership of mines from which they derive a large part of their raw material. Through this ownership of a large percentage of all the available raw material in the country they are able to put their rivals at a decided disadvantage. Certain Trusts also may in certain localities control so large a percentage of the raw material that they may readily crush their rivals in those localities, as, for example, the Standard Oil Company in its local control of oil wells, the salt combination in its control of salt wells and mines, etc. The extent to which a Trust, therefore, may in itself be a monopoly depends often to a great degree upon the extent to which it has a monopoly of the raw material of the industry which it seeks to control. The effects of the Trusts upon prices and their legal and social status in the community may in many cases depend upon this one factor.

Promoting and Financing. If, as is often the case, the promoter organizes a new company to take over the various plants which he is intending to combine under one management, or to develop some new patent, it has been the common practice for him to issue stock far beyond the actual cash value of the plants under consideration; then to pay for these plants with as much of the stock of the new company as was necessary to secure them, retaining the balance for his own services. In other cases, when the company is organized, the distribution of the stock among the different parties in interest is agreed upon jointly, and the promoter receives a certain percentage of the entire amount as his reward. Inasmuch as he in many cases takes considerable risk, and as the success of the enterprise is practically due largely, if not entirely, to his initiative, it has at times been possible for him to secure for his reward as high as 20 per cent. of the capital of the organization, paid to him in common stock. With such large rewards as are often hoped for and sometimes obtained, it is evident that the interest of the promoter may become a very direct cause for the formation of the Trusts.

Scarcely less prominent than the promoter in this regard is the financier. When either a new enterprise is to be started or a combination of existing establishments is to be made, it is usually necessary to raise a considerable amount in cash, in order that the new institution may start with capital in hand. Frequently also many of the plants purchased need to be paid for in cash. The stock of the new company is ordinarily the source from which it is desired that such cash should come. Inasmuch, however, as the general public is not likely to take the stock immediately and pay for it in cash, it is desirable that some one be found who will underwrite it, that is to say, who will take the stock and agree to furnish in exchange therefor an agreed-upon sum in cash at a certain fixed date in the future. For this service, so speculative in its nature, the financier ordinarily demands and frequently receives very high compensation. In certain instances, which were cited before the United States Industrial Commission, for each $100,000 in cash furnished, the promoter received $150,000 in common stock, while the underwriter, the capitalist, received $150,000 of common stock, and in addition thereto $100,000 in preferred.

Capitalization and Overcapitalization. Of late years there has been a strong tendency toward overcapitalization. The promoters have ordinarily adopted secret methods in the organization of their companies, and many of the larger Trusts have not been ready to give much information, even to the stockholders themselves. In consequence, large blocks of stock have at times been unloaded upon the public in prosperous times which have proved to have comparatively little value. It is usually stated by business men that overcapitalization has practically no influence upon wages or upon prices of products—that in a comparatively short time the stocks are estimated at substantially their true value, and that in consequence an overissue of stock does little harm. On the other hand, it is asserted by many, and there is certainly reason in their contention, that the overissue of stock by somewhat secret methods gives a decided advantage to those who are managing the organization, and that in many cases without laying themselves open to legal attack the promoters may easily secure from the public much more capital than the actual business would justify. Moreover, even when the organization is running, if secret methods are adopted, the directors who know the exact conditions of the business are often tempted to manage the business for their own benefit as dealers in stocks, rather than for the legitimate profit that would come only from manufacturing.

When a company has once been overcapitalized, also, there is naturally and properly a desire on the part of the directors to pay reasonable dividends to the stockholders. This temptation is at times so great or the pressure from the stockholders themselves is so insistent that often, especially when competition is not severe, prices will be held at rates higher than would be beneficial to the business in the long run. So, also, efforts to reduce wages may often be attempted temporarily, in order to secure dividends before the next election of directors. While this policy must in the long run prove unwise, and while in the long run stocks will doubtless exchange for something like their actual value, for considerable periods of time, if secret methods are practiced, overcapitalization may do harm not only to investors, but also to laborers and to the general consumers.

Forms of Organization and Management. While the form of organization of the Trust may often not have any material effect upon its economic influence, it is still very frequently true that the form is determined to a considerable extent by the legal institutions of the country; and sometimes the form of organization is of significance not merely from the legal point of view, but also from the economic. When some years ago the pressure of competition arising from the large amount of capital for investment in this country had tended to lessen the profits of manufactures, the first effort to lessen this competition naturally resulted in agreements upon prices or in agreements among different manufacturers to divide the selling territory among themselves, or in some other similar form of agreement which left to each establishment complete autonomy as regards its own management, but which brought about some form of an alliance to lessen the competition. Such agreements were usually and more or less accurately called Pools. (See Pooling.) This form of agreement (Kartell) is still common in Germany, and is, in fact, the usual form of agreement there where the courts uphold such contracts. In the United States, on the other hand, the courts have very generally held that such agreements were in unreasonable restraint of trade, and in consequence void, as contrary to public policy. The parties to the pools, therefore, knowing that they could not be legally bound, frequently violated the terms of the agreements by increasing their output beyond the amount agreed upon, cutting prices, and by other similar means. To overcome these difficulties, the form of the Trust was at length invented and put in practice—in the first place by the Standard Oil Company, in 1882. Under this form of organization, the stockholders of each of the separate companies assigned their stock to a few trustees, giving thus an irrevocable power of attorney. In lieu of the stock assigned, the trustees issued trust certificates to the stockholders of the separate companies, and upon these trust certificates profits were divided. All of the earnings from the different members of the company were pooled, and each manufacturer received his due share as evidenced by the certificates regardless of the question whether his establishment were running or closed. The trustees, having in their hands the voting power of all the stockholders, elected whatever persons seemed to them best as officers of the separate companies. In this way the management was absolutely unified and the interests of all parties concerned became one. The courts finally holding that this Trust agreement was illegal, the plan was later adopted of organizing a new company which should buy up all of the separate plants of the different companies entering the combination, so that in this way a unified management was secured within the law.

In order that a more convenient form of handling the properties of the different companies might be secured. and that under certain circumstances somewhat greater flexibility of management could be attained, a third form of organization was later adopted which was in many respects quite like that of the earlier Trusts. In this form a new company is organized as a stock-holding company. This company then buys up all or a large proportion of the stocks of each of the companies coming into the organization, and holds these stocks. The officers of the central organization are thus in a position, by voting the stocks of the different companies, to elect the directors and officers of those companies and thus control their policy.

Prices. Competitive prices, it is frequently assumed, will in the long run be fixed mainly by the cost of production of that part of the stock which is produced at the greatest disadvantage. Monopoly price, on the other hand, is fixed at that point which will secure to the monopolist the greatest net return. If greater return will be secured by lowering the price and increasing the sales, the price will be lowered. If the net returns will be greater by increasing the price, even though the number of sales be lessened. that policy will be adopted. In technical discussions regarding prices, the assumption is usually made of either a régime of free competition. or of what is substantially monopoly. In a practical discussion of the effects of Trusts upon prices, we must recognize that there may be certain monopolistic powers which may enable prices to be raised somewhat above the competitive rate, but which are still not sufficient to enable the Trust to fix prices entirely regardless of a potential competition. So, also, this monopolistic power may vary in degree in different industries or in the same industry at different times.

If the economies of industrial combination spoken of before are great, it is evident that without lessening profits prices of the finished product might be placed somewhat lower than those under the competitive régime, or prices of the raw materials used might be raised above those prevailing under the competitive régime without lessening profits. We see, therefore, that it is within the power of the managers of the Trusts, provided the Trust has been carefully organized in an industry adapted for combination to put prices below the competitive rates in order to drive out competitors, and then if they have secured monopolistic power thereby, to put prices, within certain limits at any rate, above competitive rates.

Whatever may be the theoretic possibilities, however, under the Trust system, it is essential to note what has in fact been the result, inasmuch as, in addition to the technical economic powers that have been suggested, the psychological factors of public opinion, of demands of laborers, of the boldness of the managers, etc., may all enter into the problem as factors in price determination. Although the Trusts have been in existence for a considerable length of time, it is still as yet altogether too early to determine what the ultimate effect of the Trust upon prices is to be. At the present time, however, there are many instances to show that in individual cases, for short periods of time at any rate, the Trusts have actually lowered prices below the former competitive rates. Likewise numerous instances can be found of prices raised by the Trusts above former competitive rates. The surest way to test the effect of the combination upon prices is to determine the margin of difference between the cost of leading raw materials used and of the finished products. If an industry is simple in its nature, so that the raw material forms a large part of the value of the finished product, this test can be made with comparative ease, as, for example, in the case of sugar refining, oil refining, the manufacture of alcohol, etc. Several industries were subjected to this test by the Industrial Commission. with the general result that up to date the influence of the Trust had apparently been to raise the margin between the price of the raw material and that of the finished product somewhat above that obtained under the competitive system. This is a result which seems to establish beyond all doubt the fact that unless the cost of manufacture had been increased—a supposition clearly contrary to the fact as claimed by the Trust people themselves—their profits must have been materially increased; and that the Trust had in reality raised prices to consumers, even though the actual price of the finished product may over a series of years have fallen. On the other hand, in certain instances, it was shown that although this had been the early experience and the first result, showing clearly a decided monopolistic power on the part of the combination, this margin had later been lessened, apparently under the pressure of potential, if not of actual competition. It is a fair assumption to make that for the time being at any rate, if the Trust secures considerable monopolistic power, it will place prices somewhat above the competitive rates, although in certain instances it may possibly be true that the saving in the cost of production will enable the combination to keep prices as low as would be possible under the competitive system, while still increasing its profits. On the other hand, it is also safe to conclude that where the chief source of monopolistic power is merely that which is derived from great capital or from a minor association with some natural monopoly, either actual competition will eventually set in or a potential competition will appear so threatening that prices in the long run will be maintained at only a little above—possibly not even at all above—competitive rates.

Wages. As indicated in the discussion on prices, so far as the Trusts really make savings through their new method of organization, they have a surplus fund which could be used in some way. Testimony before the Industrial Commission, and also the events of the last few years as reported in the public press and in public meetings, seem to show that in certain instances the laborers have gained slightly from being able to take advantage of this increased ability of the Trusts to pay. The statistical investigation made by the United States Department of Labor at the request of the Industrial Commission in 1900, while the material was not complete enough to reach positive conclusions, indicated that, so far as the evidence went, the industrial combinations had, on the whole, not brought about any lowering of the wages of labor, and had probably produced a slight increase.

The attitude of the Trusts toward the laboring classes and toward the labor unions has apparently not differed materially from that of individuals and corporations under the competitive system. Some oppose trade unions; some favor them. Some are kindly disposed toward the laborers; some are disposed to grant them no favors. So far as a tendency can be detected, it seems to be toward the consolidation on the one hand of the laborers into larger and larger unions in order that they may be able to hold their own against the combinations, and on the other, for the larger combinations to recognize that as they are themselves organized, they must themselves deal with an organized body of laborers. If this tendency can be seen, however, it must be recognized that there are many exceptions.

It is somewhat encouraging to note that in many instances the unions and the Trusts are uniting upon trade agreements for a period of a year or several years, and that through this system of trade agreements the danger of expensive strikes is being lessened, although as yet this custom has become by no means universal. There appears also to be a tendency for the trade unions and the employers to unite for the benefit of both and to exercise their power at the expense of the consumers by maintaining prices higher than would obtain under the competitive system. It is to be expected that this union of employers and laborers against consumers is likely to become more frequent if the Trusts and the unions increase in number and strength.

Social Effects. It has often been charged that the great corporations and Trusts exert a corrupting influence upon legislatures and the courts. It is probable that in individual cases this charge is true. On the other hand, legislatures have not been free from such charges under the competitive system, and it probably would be difficult to prove absolutely that conditions are worse now than they were before the great industrial corporations were formed. The remedy for such an evil would seem to be chiefly in improving the character of our legislatures.

A more significant consideration is whether the Trust, by bringing so many individuals under one centralized management, destroys to any material extent the powers of self-reliance and of self-direction on the part of individuals which are naturally developed by the struggles of the competitive system. Opinions differ to a considerable extent on this subject, but there can be no doubt that, although the opportunities for a man to start an independent business in certain lines of industry are lessened, on the other hand the competition for promotion and for positions of responsibility within the combination itself is severer in the case of the great corporation than in the case of the private business or partnership. When a group of two or three partners are managing a business, they may readily give preference to their sons or friends even when the business ability of such persons is not of the highest type. When the interests of thousands of stockholders must be considered, and there are large boards of directors, each feeling that his position depends to a considerable extent upon the success of the business, favoritism cannot be shown to any very great extent.

Legal Position. When a Trust or combination is organized, its rights and powers are determined by the ordinary rules of common and statute law applicable to the particular form of organization adopted. That is, if the combination is a Trust, its rights and powers are determined by the ordinary rules of law governing Trusts; or if the combination is effected by one of the methods of corporate combination, its rights and powers are determined by the general law of corporations. Aside from these questions of the methods of organizing combinations, the Trusts raise no peculiar legal issues except that as to their legality when organized.

In ascertaining whether a combination is unlawful at common law, it should be remembered that the mere combination or coöperation of several individuals is not in itself unlawful, and in the case of partnerships and corporations combination of individuals is encouraged by the law. Combination by corporations, however, as has already been indicated, when not authorized by statute, may be such an abandonment or misuse of their corporate franchises as to be illegal under the general law of corporations. In general it may be said that combinations are unlawful *per se* only when the purpose of the combination is unlawful or against public policy, or when the means adopted by the combination for effecting its purposes are unlawful or against public policy.

The grounds upon which combinations have been held to be unlawful at common law may be somewhat roughly classified as follows: (1) That the contract (when the combination has been effected by contract) is illegal and void at common law because in restraint of trade. (2) That the combination is an unlawful conspiracy either civil or criminal. (See CONSPIRACY.) Technically the second class includes the first, since there can be no combination without two or more parties to it who are technically guilty of conspiracy where the purpose is to enter into an illegal contract. Since, however, each is recognized as a distinct ground for declaring combinations illegal, the classification may be adopted as both convenient and practical. For a full discussion of the legal doctrines relating to restraint of trade and conspiracy, reference should be made to those topics. (See also MONOPOLY, ENGROSSING, FORESTALLING, REGRATING.) With reference to conspiracy, it may be said that combinations are conspiracies, and therefore unlawful, when the purpose of the agreement or combination is either to do something unlawful or to do something lawful in an unlawful manner. In general, combinations are held to be illegal because of their purposes and methods when they restrain fair competition or create oppressive monopolies. Owing to the difficulty of applying this test to any particular case, it may be extremely difficult to draw a clear line of distinction between those combinations which are lawful and those which are unlawful.

At common law the remedies of individuals against acts of illegal combination are limited to the recovery of any damage suffered because of the unlawful conspiracy involved in the combination or to the securing of an injunction restraining those joined in the combination from doing some threatened injury to the plaintiff. In either case it is necessary for the plaintiff to show actual damage suffered by him or that the defendant threatened to do some act causing such damage. When the combination is in the corporate form and is acting outside its corporate powers, or its constituent corporations have ceased to act as separate corporations so as to amount to an abandonment of their charters, the State may proceed against the corporate combination or any of the constituent corporations to compel a forfeiture of its charter by *quo warranto*. There is, however, no other method at common law by which either the State or a private individual could proceed against a combination on the ground that it is illegal and is working a public injury. As a result of agitation upon the subject of Trusts, almost all of the United States have adopted statutes or clauses in their State constitutions restraining or prohibiting all contracts, agreements, undertakings, or combinations in restraint of trade or tending to create monopolies, whether such restraint would have been unlawful at common law or not. In general the courts have held that these statutes are constitutional under both State and Federal constitutions, and not in violation of the constitutional provisions against abridging the freedom of contract, depriving citizens of liberty or property without due process of law, or denying them equal protection of the laws. In the interpretation of these statutes, however, the courts have justly regarded them as an innovation upon the common law to be interpreted with strictness and caution. Moreover, the difficulty of giving such legislation its proper effect without making it subversive of established rights of property has to some extent prevented all these restraining acts from having the effect intended. It may be said that the principal test to be applied in determining whether statutes of this class are violated is whether the act or agreement complained of was done with intent to control prices or whether such would be a natural result of the act or agreement. They usually provide that contracts made in connection with such an act or agreement shall be void, and attach criminal or quasi-criminal penalties for their violation. In some States parties injured by such violations of anti-monopoly statutes are given rights of action to recover damages for the injury suffered.

A far more effective agency for restricting the growth of monopoly is the exercise of the power of the several States to control all corporate enterprises within their respective territories. A State may grant to a corporation its charter and power to do business upon such terms as the Legislature may choose, and it is also within the constitutional power of a State to impose any terms, however exacting, as a condition to which corporations created under the laws of other States must conform if doing business within its limits, provided such conditions do not interfere with interstate commerce, the power of regulation and control of which is by the United States Constitution lodged with the Federal Government.

A State may thus limit the amount of capital of a corporation organized under its laws; and it may by its charter or general laws existing at the time of its creation limit or regulate its business. In the same manner a State may impose similar or even additional conditions upon all foreign corporations wishing to do business that is not interstate commerce within the State. In this connection, however, it should be remembered that the charter or other legislative authority to a corporation to do business once granted is deemed to be a contract, and that the State is forbidden by the United States Constitution to impair the obligation of contract. See CORPORATION; CHARTER; DARTMOUTH COLLEGE CASE.

It will be seen that the powers of restriction just referred to are limited to corporations and have no application to natural persons or partnerships. The important above-mentioned limitations upon the power of the States to control corporations, coupled with the fact that it has been the policy of many of the States to grant to corporations organized under their laws practically unlimited power, have in effect seriously interfered with any effective statutory restriction of monopolies by the several States.

The Federal Government may to some extent restrain monopoly under cover of its constitutional power to regulate interstate and international commerce. Its power in this respect has been deemed to be practically absolute. It cannot, however, be said at this time (1903) that the power of Congress to control or restrain the business of individuals or corporations by enactments that are not intended primarily for the purpose of controlling or regulating interstate commerce, but for the purpose of restricting, or making unlawful, or assuming control over, a business which is lawful and unrestricted in the several States, is without limitation, since that question has not been definitely and finally determined by the Supreme Court of the United States. Acting under its power to regulate commerce, Congress in 1887 enacted the Interstate Commerce Act, having for its purpose the control and regulation of business carried on by common carriers engaged in interstate commerce. Its particular object was the prevention of unlawful discrimination in rates by common carriers engaged in interstate commerce, which had contributed in a large degree to the growth of monopolistic enterprises. This was followed in 1890 by a statute for the protection of interstate and international trade, commonly known as the Sherman Act (26 United States Statutes at Large, 209).

This statute provides that all contracts, combinations in form of Trusts or otherwise, or conspiracies in restraint of interstate or international commerce are illegal, and that all persons participating in such agreement, combination, or conspiracy are guilty of a misdemeanor and subject to a penalty for violation of the act. The statute also provides that all goods in transportation in violation of the act may be seized, and their forfeiture compelled by a proceeding brought in behalf of the Government, and that a proceeding may be brought by the Attorney-General enjoining all acts in violation of the statute and for the dissolution of contracts entered into in violation of it.

It has been held by the courts that this act does not apply to monopolies created and authorized by a State, but that it is intended to apply to all direct restraints of trade by individuals or corporations, whether such restraints would have been deemed reasonable or unreasonable at common law. The restraint or monopoly need not be complete. The statute is violated if the contract or combination tends to such monopoly. Notwithstanding the scope and severity of the statute, it has been found not to be particularly effective in restraining the growth of monopolies or Trusts, so called, and it is not unlikely that further legislation of a similar character will be enacted.

In the Congressional session of 1902-03 the law creating the Department of Commerce and Labor made provision for a Bureau of Corporations, whose duty it should be to collect full data regarding Trusts, with the purpose of thus acquiring information which might be used, if deemed advisable, for further legislation. The President was given power to make public such of this information as he thinks wise, in order that through the remedy of publicity some of the evils might possibly be checked. Likewise, the Interstate Commerce Act was amended by the so-called Elkins law, which, it is thought, will prevent, better than the previous provisions of the law could do, discriminations in railroad rates.

The decisions of the Supreme Court of the United States and of the United States Circuit Court, both in earlier cases, and especially in the case of the Northern Securities Company, indicate that the Federal Government has the power to prevent combinations among railroads or manufacturing corporations engaged in interstate commerce which are created for the purpose of securing monopoly, or which in actual practice do tend toward restraint of trade, and that whether this restraint is reasonable or unreasonable.

The English Government has gone no further in the way of anti-monopoly legislation than the old provisions of the common law against monopoly and the somewhat rigid provisions of their corporation act regarding publicity in the promotion and management of companies.

In France the status of the law seems not to be definitely fixed, for although there are statutes existing against combinations to influence prices, and although there have been certain successful prosecutions under this law, notably in the case of the Copper Syndicate, still industrial combinations in the form of joint selling bureaus do exist without apparent legal opposition.

In Germany, contracts for fixing prices, controlling output, or in other ways tending toward the prevention of destructive competition have been upheld by the courts as reasonable, and the restriction of such combinations is apparently limited to those that can be shown to be contrary to public policy. In Austria the Government has made efforts to put the combinations under somewhat more rigid supervision, especially for financial reasons, but although there has been considerable feeling against the Trusts, as yet comparatively little has been done by either the legislature or the courts, and some very strong combinations have been in existence there for several years. Both in Austria and in Germany, however, Government commissions have been studying the subject with reference to further legislation, and so far as their recommendations go, the inclination is to recognize the combinations as proper, provided they place themselves sufficiently under Government supervision and conduct their business so that it will not be considered by the Government officials as contrary to public policy.

Bibliography. Steinmann-Bucher, *Wesen und Bedeutung der gewerblichen Kartelle* (Leipzig, 1891); Halle, *Trusts or Industrial Combinations* (New York, 1895); Liefman, *Die Unternehmerverbände* (Leipzig, 1897); Pohle, *Die Kartelle der gewerblichen Unternehmer* (ib., 1898); Rousiers, *Les industries monopolisées* (Paris, 1898); Baker, *Monopolies and the People* (New York, 1899); *Corporations and Public Welfare*, report 4th annual meeting, American Academy of Political and Social Science (ib., 1900); *Report of Chicago Conference on Trusts* (Chicago, 1900); Collier, *Trusts* (New York, 1900); Ely, *Monopolies and Trusts* (ib., 1900); Jenks, *Industrial Combinations*, Bulletin of Department of Labor (Washington, 1900), id., *The Trust Problem* (4th ed., New York, 1903); *Reports of the United States Industrial Commission*, vols. i., ii., xiii., xviii. and xix. (Washington, 1900-1902); *Trusts and Trade Combinations in Europe*, State Department, Consular Reports, vol. xxi. (ib., 1900); Le Rossignol, *Monopolies Past and Present* (New York, 1901); Raffalovich, *Les trusts* (Paris, 1903). Also consult the authorities referred to under such titles

as Restraint of Trade; Conspiracy; Constitutional Law, etc.

TRUTCH, Sir Joseph William (1826—). A Canadian statesman, born at Ashcot, England. He was educated at Exeter, studied civil engineering under Sir John Rennie, and in 1849 removed to the Pacific Coast. From 1859 to 1864 he was employed in the construction of public works for British Columbia, and from 1864 to 1871 was chief commissioner of lands and works, and surveyor-general. for the same colony. He was also an *ex-officio* member of the executive and legislative councils from 1864 until in 1871 British Columbia joined the Dominion federation. From 1871 to 1876 he was Lieutenant-Governor of British Columbia, and in 1876-89 was resident Dominion agent for British Columbia.

TRUXILLO, trōō-hēl'yō. See Trujillo.

TRUX'TUN, Thomas (1755-1822). An American naval officer, born at Jamaica, L. I. Going to sea at the age of twelve, he was first an apprentice on an English packet, was subsequently impressed for service on an English frigate, and finally entered the merchant marine. Coming to Philadelphia late in 1775, he was made captain of the *Congress*, the first American privateer sent out during the Revolution. In command successively of this vessel, the *Independence*, the *Andrew Caldwell*, the *Mars*, the *Saint James*, and the *Commerce*, he captured numerous prizes, and overcame many vessels more powerful than his own. After engaging for a time in the East Indian service, he was appointed captain in the newly organized United States Navy, 1795, and was put in command of the *Constellation*. On February 9, 1799, during the short naval war with France, he captured, with the loss of only two killed and three wounded, the French frigate *Insurgente*, which lost 29 killed and 41 wounded. In the following year (February 1st), he likewise defeated the *Vengeance*, which, however, after surrendering, managed to escape. The French loss in killed and wounded was 160, the American 39. Subsequently he was put in command of the West India Squadron with the rank of commodore. Retiring from the navy in 1802, he lived for a time in New Jersey, and then removed to Philadelphia, where he was sheriff, 1819-1821. He published *Remarks, Instructions, and Examples Relating to Latitude and Longitude, also the Variation of the Compass* (1794).

TRY'ON, Dwight William (1849—). An American landscape painter, born in Hartford, Conn. He studied under C. Daubigny Chevreuse of the Hartford School of Art, and professor of and Guillemet in Paris; in 1886 became director of art at Smith College, Northampton, Mass., and afterwards he settled in New York City. His earlier works show a trace of the influence of Daubigny, but his own personality was strong enough to prevail. His subjects are confined to New England, and are of the simplest description. His skill in analysis and in technique has given him a high place among American landscape painters. His general treatment is broad, and he is fond of the hazy effects of spring and autumn. Notable paintings, but in a higher key than is usual with Tryon, are "October Afternoon" (1903) and "Autumn—New England" (1903). Other important works include: "Morning Twilight" (1903); "New England Hills—August" (1901); "Dawn" (1901); "Winter Afternoon" (1894); "Morning" (1893). Some of his water-color work is also well known.

TRYON, Sir George (1832-93). An English admiral, born at Bulwick Park, Northamptonshire. He was educated at Eton, and entered the navy in 1848. In 1860 he was promoted to commander, and in 1866 to captain. In the following year he showed considerable talent for organization and foresight as director of transports for the Abyssinian expedition. In 1874-77 he was in command of a ship in the flying squadron, and from that time till 1887 served with the Mediterranean fleet. In 1884 he became rear-admiral, and in 1889 vice-admiral. His appointment in 1891 to the command of the Mediterranean station was a popular one, but there on June 22, 1893, off Tripoli, he was responsible for one of the most terrible naval accidents of modern times. During some manœuvres he ordered the battleships *Camperdown* and *Victoria*, which were proceeding in parallel lines, to turn inward, thus causing the former to ram and sink the latter with great loss of life. He went down with the *Victoria*. Consult C. C. Penrose-Fitzgerald, *Life* (London, 1897).

TRYON, Thomas (1634-1703). An English zealot, known as the 'Pythagorean.' He was born near Cirencester, in Gloucestershire, England. He was taken from school before he had learned to read and put to spinning and carding (1643-46); and thereafter till his eighteenth year he tended his father's sheep. He then drifted to London. He joined the Anabaptists, but afterwards renounced their doctrines, through the influence of the mystical writings of Jakob Böhme (q.v.). At the age of forty-eight he began a long series of pamphlets, in which he recommended for drink only water, and for food only bread and fruit, with some liberty in the use of butter and cheese. His book on this theme is known as *The Way to Health* (1698), published originally in 1682 as *Health's Grand Preservative*.

TRYON, William (c.1725-88). A British colonial Governor, born in Ireland. He secured a commission as captain in the British Army in 1751, and became lieutenant-colonel in 1758. Through his marriage to Miss Wake, a relative of the Earl of Hillsborough, First Commissioner of Trade and Plantations, he was appointed Lieutenant-Governor of North Carolina June 27, 1764, and succeeded to the Governorship July 20, 1765, after the death of Arthur Dobbs. He succeeded through the tact of his wife in securing £15,000 to build a Governor's house at New Bern, pronounced the handsomest building in the Americas. The heavy taxation required for this and the Cherokee expedition was one of the causes of the insurrection of the Regulators (q.v.), which he suppressed with severity. In July, 1771, he was transferred to New York, where he greatly strengthened the militia. In 1773 the Government house, at Fort George, near New York City, was burned, and Tryon and his wife barely escaped with their lives. He made a large grant of land to King's College (Columbia), and he himself speculated in Western lands. He visited England in 1774, and on his return in June, 1775, found the colony in rebellion. In October he took refuge on shipboard and remained in the harbor until Howe's entry in September, 1776. In 1777 he took active command of some loyalist troops, and in June, 1778, gave up civil for military duties entirely, and was promoted 'major-general in America.' In 1779 he made an expedition into Connecticut, where he burned Danbury. During the winter of 1779-80 he was in command of the New York district, but returned to England in 1780, and was promoted to the rank of lieutenant-general in November, 1782.

TRY'SA (Lat., from Gk. Τρύσα, now called *Geul-Bashi*). An ancient town, situated on a plateau (2475 feet high) in Southern Lycia, a short distance west of Myra. The site is of interest only from the Heroön erected near the end of the fifth century B.C. by a native prince. This is a quadrangular inclosure about 60 × 75 feet, with a door in the south wall. In the northeast corner stood the large sarcophagus, and in the southeast the small booths for the guard and the funeral feasts. The importance of the monument is in its sculptured decorations. Around the inner wall near the top are two rows of sculptured frieze, and a similar decoration adorns the outside of the south wall. Only the sculptures around the door show any trace of Oriental influence; the rest are evidently derived from good Greek models. On the outside are represented the expedition of the Seven against Thebes, a battle between Greeks and Trojans on the right of the door, and on the left battles of the Greeks with Amazons and centaurs. Inside on the south wall on the right are Odysseus slaying the suitors and the Calydonian Hunt, on the left a banquet and dance of youths and maidens. On the east wall, which is much mutilated, can be traced the deeds of Theseus, a battle with centaurs, and a banquet. The north wall contains the Dioscuri carrying away the daughters of Leucippus, a hunting scene, and the conflict of the Lapithæ and centaurs. The west wall contains the battle of Greeks and Trojans between the city and the ships, apparently the storming of the city of Troy, and the battle of Achilles with the Amazon. Apparently the artist was influenced by the great painters of the fifth century, and for this reason the frieze possesses a unique importance. Its total length is nearly 350 feet, and the height varies between three and four feet. First mentioned in 1841 by Schönborn, the ruins were excavated between 1881 and 1883 by an Austrian expedition, and the sculptures brought to Vienna. Consult Benndorf and Niemann, *Das Heroön von Gjölbaschi-Trysa*, with Atlas (Vienna, 1889).

TS'AIDAM or **CH'AIDAM**, chī′däm. See Tibet.

TSANA, Lake. See Tzana.

TSAR. See Czar.

TSARITSYN, tsȧ-rē′tsĭn. One of the most important ports on the Volga, situated in the Government of Saratov, Russia, where the Volga approaches within 40 miles of the Don (Map: Russia, F 5). Connected by rail and water with the interior of Russia, Tsaritsyn is the natural outlet for the region of the lower Volga, and to some extent of the region of the Don. The chief articles of commerce are fish, salt, petroleum, grain, lumber, wool, and mustard. The local manufactures are spirits, beer, and machinery. The town is poorly built. There is a fine Lutheran church. Population, in 1897, 55,967.

TSARSKOYE SELO, tsär′skô-ye sye-lô′. A district town and the summer residence of the Russian Emperor, situated in the Government of Saint Petersburg, about 15 miles south of the capital (Map: Russia, C 3). It is a pretty town with extensive parks belonging to the royal residences and villas of the Court aristocracy. The Old Palace is characterized by great splendor and contains a fine picture gallery and the celebrated amber room. The Palace of Alexander, built by Catharine II., is less pretentious. A considerable part of the town's permanent population is made up of the military and Court employees. Tsarskoye Selo was formerly the seat of the Alexander lycée, where many of the most prominent literary men (including Pushkin) and statesmen of Russia were educated. Population, in 1897, 22,353. The railway line from Tsarskoye Selo to Saint Petersburg, constructed in 1838, was the first railway in Russia.

TSCHAIKOWSKY, chī-kôv′skê, Peter Ilyitch (1840-93). The greatest composer Russia has thus far produced, born at a small place called Votkinsk, in the Ural mining region, on May 7, 1840. He studied jurisprudence in Saint Petersburg, and in 1859 obtained a position in the Ministry of Justice. In company with a young poet named Apukhtin, who greatly influenced his future, he listened to Italian opera whenever an opportunity presented itself. This love of Italian music left its traces in Tschaikowsky's scores. He entered the Conservatory where Anton Rubinstein, its director, was attracted by the young man's ability. Tschaikowsky resigned his Government position, studied music with all the vigor of his nature, and on his leaving the Conservatory three years later, he continued to study orchestration with Rubinstein and took up the flute, piano, and organ. In 1866 he accepted the position of teacher of harmony at the Moscow Conservatory. It was at this time that he met the poet Ostrovsky, who gave him the libretto for his first opera, *Voyevoda* ["The Chieftan"].

Tschaikowsky's first musical idols were Glinka, the father of modern Russian music, and Mozart. He venerated Beethoven and admired Schumann, but, singularly enough, he never cared much for Chopin. Schumann, with his short-breathed phrases, was the Russian's model in writing for the pianoforte. Tschaikowsky went on composing, undeterred by the lack of appreciation on the part of both the Rubinsteins. Even the brilliant and effective first piano concerto was picked to pieces by Nicholas, and so hurt was the young composer that he erased the dedication to Nicholas and substituted the name of Hans von Bülow, who rewarded the courtesy by producing the concerto in Boston on the occasion of his first visit to America (1875-76). Tschaikowsky made the acquaintance of Balakireff, who urged him to compose the *Romeo et Juliette* fantaisie overture. Now flowed forth a stream of songs, symphonic poems, concertos, symphonies, operas, chamber music, overtures, dances, many experimental in form, much that was mediocre and also some genuine masterpieces. An unhappy marriage, briefly endured, sent him into a retirement at Klin, which was occasionally interrupted by trips to Germany, France, Italy, Switzerland, and England. He met Brahms and liked the man, but never concealed an antipathy for his music. He admired Wagner, with many reservations, though he willingly visited Bayreuth. But he took no great interest in the music drama, preferring old-fashioned operatic forms. All his opinions, musical and otherwise, may be found in his *Diary*, and in his musical criticisms, which were edited by G. A. Laroche. His fame grew apace, and in the spring of 1891 he visited America, in response to the invitation of Walter Damrosch, and was present at the dedication of Carnegie Hall, New York. On November 6, 1893, Tschaikowsky died in Saint Petersburg, after a short illness, of cholera. His death evoked universal sympathy, and Russia learned from the western world that she had lost her greatest composer.

For many years the opposition to Tschaikowsky was based upon the allegation that he was not really one of the Neo-Russian nationalists, who with Tolstoy 'went to the people' for their themes. Tschaikowsky, like Turgenieff, was a traveled man of culture, and a cosmopolitan on certain sides of his art; but there was no truer patriot than this fiery-souled poet, who demonstrated his slavophilism in a hundred of his compositions. His happiest work is in the pure fantasy, or what he was pleased to term, 'overture fantaisie.' Thus his *Manfred, Romeo et Juliette, The Tempest*, and *Francesca da Rimini*, gives us Tschaikowsky at the very top of his powers. The unfailing invention which marked his poetic works seemed to desert him when he attempted purely abstract music. A poet first, musician afterwards, Tschaikowsky was inspired by poetic themes. He was a born master of orchestration. The *timbres* of his instruments meant for him so many voices, and so his works are often tone-dramas, operas without words. Tschaikowsky's music reveals the mighty pessimism of his nation. His symphonies are often built upon typical phrases, taken from the folk-song; he is Russian in his operas, with their national texts and treatment. Some of his songs —he wrote over a hundred—are masterpieces: "Nur wer die Sehnsucht kennt," "Don Juan Serenade," "Disappointment," "Warum sind die Rosen so blass?" His Florentine string sextet is warm in color, and in his three string quartets he often strays across the borders into the pleasing country of the operatic. The world has come to recognize the last movement of the *Pathetic* symphony as an unapralleled embodiment of woe. But as a whole the work hangs loosely together. The fifth symphony is more homogeneous, the fourth, in F minor, more Russian. There are three piano concertos, a violin concerto, and many piano pieces. The symphonic poems, with their wealth of musical imagery, their dramatic power and thrilling effects constitute Tschaikowsky's claim to immortality. He had a predilection for ballet-music and left charming specimens of dance music in the *Nut-Cracker* suite and other compositions in a light vein. His operas are seldom heard outside of Russia. *Eugene Onegin* (1879) is said to be a work of unequal genius. Besides it, *The Voyevoda* (1869): *The Maid of Orleans* (1881); *Mazeppa* (1882), and *Iolanthe* (1893) met with success. Other noteworthy works include the lyric drama *Snowdrop*; three ballets; *Le lac des cygnes; Le belle au bois dormant* (1890); and *Le cassenoisette;* symphonies, symphonic poems, and a great mass of miscellaneous compositions. He published a *Treatise on Harmony* (1872); a translation of Gevaert's *Traité d'Instrumentation;* and also wrote *Musikalische Erinnerungen und Feuilletons* (1899).

Consult the biographies by Rosa Newmarch (London, 1900), Knorr (Berlin, 1900), Modest, *Tschaikowsky* (Germ. trans., Leipzig, 1901), and Hruby (ib., 1902); also Huneker, *Mezzotints in Modern Music* (New York, 1899); Runciman, *Old Scores and New Readings* (London, 1899); and *Imbert, Profils de musiciens* (Paris, 1888).

TSCHERMAK, chĕr′mȧk, GUSTAV (1836—). An Austrian mineralogist. He was born at Littau, Moravia; was educated at the University of Vienna, and in 1868 was appointed a professor in the university and director of the Royal Mineralogical Cabinet. In 1877 he resigned the directorship. His contributions to the proceedings of the Vienna Academy are very numerous, and treat for the most part subjects of crystallography and petrography. He is also a prominent authority on meteorites. In 1871 he established at Vienna the *Mineralogische Mitteilungen*, published since 1878 as the *Mineralogische und petrographische Mitteilungen.* His publications include: *Die Porphyrgesteine Oesterreichs* (1869); *Die mikroskopische Beschaffenheit der Meteoriten* (1883); and a *Lehrbuch der Mineralogie* (1884; 5th ed. 1897).

TSCHIRNHAUSEN, chêrn′hou-zen, EHRENFRIED WALTER, Count (1651-1708). A German scientist and mathematician. He was born and educated at Leyden. He traveled considerably in France, Italy, and Switzerland, and served in the army of Holland (1672-73). Tschirnhausen erected large glass works in Saxony, where he constructed burning glasses of unusual perfection and carried on his experiments (1687-88). To him are due some valuable discoveries in the manufacture of porcelain. His *Medicina Mentis* (1687) testifies to the philosophic tendency of his thought. In mathematics Tschirnhausen is known as the founder of the theory of catacaustics, or caustics by reflection. The original articles appeared in the *Acta Eruditorum* from 1682 to 1698. These publications contain also his work on equations and quadratics. In connection with the latter he invented the quadratrix (see QUADRATURE) known by his name. Consult Weissenborn, *Lebensbeschreibung des Tschirnhausen* (Eisenach, 1866).

TSCHISTOPOL, chĭs′tō-pōl. A district in the Government of Kazan, Eastern Russia (Map: Russia, H 3). Area, 3592 square miles. Population, in 1897, 307,224. The principal industries are the raising of cereals, flax, and hemp, and the curing and manufacture of leather. The district town Tschistopol, on the left bank of the Kama, 90 miles southeast of the city Kazan, has three churches, a mosque, a gymnasium for girls, a bank, and various industrial establishments. There is considerable trade in cereals and wood products. Population, in 1897, 20,161.

TSCHUDI, cho͞o′dē, ÆGIDIUS or GILG (1505-72). A Swiss chronicler, known as the father of Swiss history. He was born at Glarus, studied at the universities of Basel, Vienna, and Paris, and after holding several administrative offices entered the French army in 1536, serving till 1544. Once more he held office in various cantons and became, in 1558, chief magistrate of Glarus. He was a bitter opponent of the Reformation and sought to check the spread of the new doctrines by force of arms. This brought him great unpopularity and necessitated his temporary absence from the canton. During his last years he took little share in political affairs, and devoted his time to a study of the vast amount of historical materials which during many years he had gathered from public archives and the libraries of monasteries. His *Die uralt wahrhaftig alpisch Rhetia* was published at Basel in 1538, but his two great works, the *Schweizerchronik, or Chronicon Helveticum,* and the *Gallia Comata,* did not appear till more than one hundred and sixty years after the author's death. The *Schweizerchronik* covers the period 1100-1470, and is valuable for the large number of original documents incorporated in the text. Though uncritical, the *Schweizerchronik* has remained the great source for Swiss history. The *Gallia Comata* is in nature antiquarian, and was intended as an introduction to the *Chronicon Helveticum.*

TSCHUDI, CLARA (1857—). A Norwegian author, born at Tönsberg of Swiss parents. Intending to become a dramatic singer, she studied at Dresden and Berlin, but presently turned her attention to literature, and after publishing some works bearing on women's rights, such as *Kvindebevægelser* (1885) and *Tre nutiskvinder* (1887), became known through the historical portraits *Eugenie Keiserinde af Frankrig* (1889, 2d ed. 1897), *Keiserinde Augusta, Skildringer fra Hoflifet i Berlin* (1892), and especially through her *Marie Antoinettes Ungdom* (1894) and *Marie Antoinette och Revolutionen* (1895-96), which were followed by *Napoleon's Moder, Silhouetter,* and *Reiseminder og Skizzer* (all 1898).

TSCHUDI, FRIEDRICH VON (1820-86). A Swiss scholar, brother of Johann Jakob von Tschudi. He studied theology first at Schaffhausen, then at Basel, Bonn, and Berlin; and was made pastor of Lichtensteig in 1843, but resigned in 1847. He settled in Saint Gall, where he wrote, under the pseudonym of C. Weber, *Der Sonderbund und seine Auflösung* (1848), and under his own name several agricultural studies and the often reëdited and frequently translated *Das Tierleben der Alpenwelt* (1853). He held several official posts, and was distinguished for his services to education.

TSCHUDI, JOHANN JAKOB (1818-89). A Swiss naturalist, born at Glarus. He studied at Swiss, French, and German universities, and then traveled extensively in South America, visiting Peru (1838-43), and Brazil, the Plata States, Chile, and Bolivia (1857-59). From 1860 to 1862 he was Swiss Ambassador to Brazil, and in 1866 became diplomatic representative at the Court of Vienna, retiring in 1883. He published *System der Batrachièr* (1838); *Untersuchungen über die Fauna Peruana* (1844-47); *Peru, Reiseskizzen* (1846); *Die Kechuasprache* (1853); *Antiguëdades peruanas* (1851), with Don Mariano de Rivero; *Reisen durch Südamerika* (1866-69); *Ollanta,* an ancient Peruvian drama out of the Quichua language (1875).

His son HUGO (1851—), born at Jakobshof, Austria, studied in Vienna jurisprudence and art-history, and after extensive travels through Europe became connected with the royal museums in Berlin, in 1884, and was appointed director of the National Gallery in 1896. Besides numerous important essays in various art-periodicals, he published, in collaboration with Pulszky, the text to *Die Landes-Gemäldegallerie in Budapest* (1883), and with Bode, *Beschreibung der Bildwerke der christlichen Epoche in den königlichen museen zu Berlin* (1883). Since 1894 he has edited the *Repertorium für Kunstwissenschaft* (Stuttgart, 1875 et seq.), conjointly with Thode.

TSÊNG KI-TSEH, tsŭng′ kē′ tsĕh′ (1837-90). A Chinese statesman and diplomat, better known as the Marquis Tseng, born in Hu-nan. He served under his father as secretary, and in 1877 succeeded to the paternal title. In the following year he was appointed Minister to Great Britain and France. In 1880 he was further intrusted with an embassy at Saint Petersburg, and there negotiated the treaty by which Kulja was restored to China. In 1881 he was created vice-director of the Imperial Clan Court, and vice-president of the Board of War, and in 1885 arranged a convention with Great Britain in regard to the opium traffic, and was appointed assistant director of the newly established Admiralty Board. In 1886 he returned to Peking, became a member of the Tsung-li Yamen (q.v.), and in 1887 vice-president of the Board of Revenue. Two years later he was appointed director of the Tung Wen Kwan, or Peking School of Languages, and held this position until his death.

TSETSE-FLY (South African name). A biting fly (*Glossina morsitans*) of the family Muscidæ, related to the common stable-fly (q.v.), which occurs in portions of Africa. The tsetse-fly bites all warm-blooded animals, but seems particularly attracted to cattle and horses. Its bite was formerly considered poisonous, and apparently produced death in beasts of burden coming from regions where the fly does not occur. The disease produced by the bite is called 'nagana.' Animals which have once recovered appear to be immune, or 'salted.' It has been determined that the bite of the tsetse-fly is not specifically poisonous, but that the insect acts as the carrier of a hæmatozoan parasite, taking it with the blood of diseased animals and carrying it to non-immunes. The tsetse-fly does not lay eggs, but multiplies by producing, one at a time, full-grown larvæ which immediately change to pupæ, just as do the so-called pupiparous Diptera. It was at one time supposed that the tsetse-fly would form a serious obstacle to the settlement of Africa by civilized races, but this is not the case. Only certain animals are affected by the disease, and the fly acts simply as a carrier; moreover, cattle became immune after residence in infected regions.

TSHI, tshē, or **CHWI.** A negro people on the African Gold Coast. See SUDAN.

TSI-NAN FU, or **TSE-NAN FOO,** chē′nän′-fo͞o′. A city of China, capital of the Province of Shan-tung. It lies in a large fertile plain 3½ miles south of the Yellow River, 245 southeast of Peking, and 400 west of Chi-fu, the principal treaty-port of the province (Map: China, E 4). The walls of the city proper have a circuit of 12 miles and are well built, but there is a large extramural population protected by a great encircling mud rampart. The principal streets are comparatively clean, and are lined with good shops. The city is noted especially for its silk brocades, its trade in precious stones, and the varied glass and other products of Po-shan-hien, the chief city of the 'black country' of Shan-tung. It has a drum-tower, a great examination hall capable of accommodating over 10,000 candidates, many fine temples, a Roman Catholic cathedral, besides the Yamens, or offices of the Governor and the high officers of the province. In the western part of the city are several geyser-like springs said to be connected with similar springs in Taishan (q.v.), some 60 miles distant. A few miles east of the city are several important iron mines. Population, 250,000, including 2000 Mohammedan families, and the inhabitants of the suburbs. Tsi-nan is on the railway line projected by the Germans, and now under construction.

TS'ING-TU, or **JŌDŌ.** The Chinese and the Japanese names respectively of "The Land of Bliss," sometimes called the "Paradise of the West," presided over by Amitabha (or Amida) Buddha, re-birth in which is promised to all who put their faith in Amida. Life is there so long that it is practically eternal, and as it is a place of surpassing delight, free from all troubles, all pain and all misery, and can be reached without the performance of works of any kind, its attainment has become the aim of the adherents of the Ts'ing-tu sect of Buddhists in China, and the Jōdō and Shinshiu sects of Japan. Nirvana is too difficult. See *Sukhāvatī* and *Shinshiu;* and Edkins, *Chinese Buddhism* (London, 1880).

TSI-TSI-HAR, chē'chē'här'. The largest, the most northerly, and the most thinly populated of the three provinces of Manchuria (q.v.), known to the Chinese as Hei-lung-kiang. It is generally mountainous, covered with forests, and abounds in both large and small game—tigers, bears, leopards, deer of various kinds, antelopes, wild boars, wolves, foxes, badgers, wild cats, sables, and other fur-bearing animals, and hunting and trapping are extensively carried on. In the southwest are great prairies occupied by the Mongols, who maintain large herds of cattle, horses, etc., upon them. The climate is severe, the mercury falling in winter to 40° F. below zero, and lower. In summer it sometimes rises to 90° and 95°. Agriculture is chiefly confined to the river valleys, where are produced pulse, maize, millet, tobacco, wheat, sesamum, and the poppy. The drainage is to the north through the Sungari. Gold is found in the northwest, north, and east, and is mined at Moho. Much soda is produced and exported to China. The province is crossed by the Trans-Manchurian branch of the Russian Trans-Baikal Railway, which connects at Harbin with the Russian Railway that runs south-southwest to Port Arthur and Dalny. The population, estimated at 2,000,000, consists of Manchus, Korchin Mongols, Solons, Yakuts from Siberia, 6600 families of whom settled on the banks of the Nonni in 1687, and Chinese, chiefly from the northern provinces. The government is military, but there are two civil officials in as many localities where the population is largely Chinese. Besides the Bannermen a force of 7000 foreign-drilled Chinese troops is maintained. Tsi-tsi-har has long been a penal colony; and there is much brigandage. The capital, Tsi-tsi-har, on the Nonni, was built in 1692 in order to overawe the neighboring tribes. It is a few miles north of the Trans-Manchurian Railway, and is a dirty poorly built city with a population of between 30,000 and 40,000.

TSONG KHA-PA, tsông' k'hä'pä', **TSONG-K'A-PA**, or **TSOṄ-K'A-PA** (the man from Tsong-k'a); generally spoken of as Jé-rim-po-ch'é (c.1355-1419). A noted Tibetan reformer of Lamaism (q.v.). He was born at Tsong-k'a, in the Province of Amdo, near the Chinese frontier, and while still a child he was devoted by his parents to a religious life. At sixteen he began theological studies and a year later proceeded to Central Tibet. In Southern Tibet he spent eight years as a hermit and became convinced of the need of reform. Identifying himself with the *Kah-dam-pa*, 'The Sect bound by the Orders' (of the *Vinaya*, or 'Books of Discipline'), which had been purified and reformed by the Indian monk Atísha in the eleventh century, he reorganized it, and gave it the name of *Ge-lug-pa*, 'the Followers of the Virtuous Order.' In 1409 he built the great monastery of Gah-ldan ('Paradise'), 25 miles from Lhasa (q.v.), where he preached regularly, and by the time of his death his followers numbered over 30,000 in Lhasa alone. His reforms consisted in a stricter observance of the 235 rules of the *Vinaya*, or 'discipline,' a life of ethical purity, strict celibacy, simplicity in dress, the abandonment of the red robes which had become common, and the readoption of the yellow hat and the patched yellow robes worn and prescribed by the Buddha. He also reinstated the fortnightly 'disburdenment,' or rehearsal of the *Pratimōkṣa Sūtra* in regular assemblies of the Order at Lhasa, and restored the custom of retiring yearly for meditation. Tsong-kha-pa was buried in the Gah-ldan, where his embalmed remains form the chief object of veneration.

TSO TSUNG-T'ANG, tsō' tsŭng't'-äng' (1812-85). A Chinese general and administrator. He was born at Hiang-yin, in Hu-nan, secured his second or 'master's' degree in 1832, and during the earlier years of the Taiping Rebellion served in Hu-nan and Hu-peh. In 1861 he had the command of the army operating in Che-kiang, and in the following year was also made Governor of that province. In 1863 he was also appointed Governor-General of the combined provinces of Che-kiang and Fu-kien, and by October, 1864, he had entirely recovered Che-kiang and was rewarded with an earldom. When the rebellion ended in 1865, he was also in command of Kiang-si and Kwang-tung. Appointed in 1866 Governor-General of Shen-si and Kan-su, then in the hands of the Mohammedan rebels, he first turned his attention to the Nien-fei insurgents, drove them from the neighborhood of Han-kow, entered Shen-si and defeated them there in 1867, and utterly routed them near Tien-tsin in August, 1868. He returned to Shen-si, pacified that province in 1869, drove the rebels beyond the Great Wall, and captured Su-chow in Kan-su in 1873. In 1875 he was appointed Imperial commissioner for Turkestan, and in April, 1876, he advanced with the main body of his army beyond the Great Wall, crossed the desert of Hami, and by October 10, 1877, had captured in succession Urumtsi, Tihua, Manas, Pidjan, Turfan, and Ku-che, north of the Tian-Shan; and by January 2, 1878, Harashar, Aksu, Kashgar, Yarkand, Yengi-shar, and Khotan—all in Eastern Turkestan, south of the Tian Shan—had been reconquered, and the campaign brought to a close. Tso was made a marquis and received many other honors. On his return to Peking in 1881 he became a member of the Tsungli Yamen, and immediately succeeded in having all the Chinese students in the United States recalled. In the same year he was transferred to Nanking as Governor-General of Hu-nan and Hu-peh, whence in 1884, on the outbreak of French hostilities in connection with the Tongking affair, he was ordered to Fu-chow to direct the military operations, and died there in the following year.

TSOW-HIEN, tsou′hyĕn′. A small district or prefectural city of Shan-tung, China, noted as the birthplace of Mencius (q.v.) and the home of his lineal descendant and representative. It is about 15 miles east of Kiuh-fow (q.v.), the birthplace of Confucius, and in the midst of a region of great historic interest, hallowed in the eyes of the followers of these two early sages. There is a temple in honor of Mencius, and south of the city is his tomb, approached from the south by a fine avenue of cypress and yew.

TSU, tso͞o. The capital of the Prefecture of Miye, Central Hondo, Japan, situated on the eastern coast, 47 miles south-southwest of Nagoya (Map: Japan, E 6). It has a number of fine temples, of which that of Ko-no Amida attracts many pilgrims. Population, in 1898, 33,287.

TSUNG-LI YAMEN (or YAMŬN), tso͞ong′ lē′ yä′mŭn′ (Chin., general managing office). The office or bureau through which the foreign Ministers in China until recently communicated with the throne and the Six Departments of Government. It was established in 1861, and was organized by Prince Kung (who became its first president) in conference with Sir Frederick Bruce, the first British Minister, and comprised between eight and twelve members. In 1901 it was superseded by the Wai Wu Pu, or 'Department of Foreign Affairs.'

TSURUGA, tso͞o-ro͞og′å. A seaport of the Province of Echizen, Japan, about 50 miles north of Kioto, with which it is connected by rail (Map: Japan, E 6). It stands at the head of a deep bay, and is well situated for trade with Korea and Manchuria. Its harbor is protected by a breakwater and a lighthouse, and is the best on the northwest coast of the main island. Junk-building is the chief industry. It contains one of the oldest Shinto temples of the country. Population, about 12,000.

TSURUOKA, tso͞o′ro͞o-ō′kå, or **TSURUGAOKA.** A town in the Prefecture of Yamagata, Northern Hondo, Japan, 75 miles north-northeast of Niigata (Map: Japan, F 4). It was formerly a castle town. Population, in 1898, 20,461.

TSUSHIMA, tso͞o′shē-mä. An island of Japan, commanding the southern entrance to the Sea of Japan, less than 50 miles south of Korea, and separated from the island of Kiushiu by Krusenstern Channel (Map: Japan, A 6). It is penetrated by a deep inlet on the west, which at its narrowest is only 16 yards wide. At high water the narrow connecting spit is overflowed, forming two unequal islands. They are both mountainous, with peaks ranging from 1128 to 2130 feet above the level of the sea. Area, 262 square miles. The northern or larger island is indented with many fine bays, and the chief coast town is Waniura. Fishing is the chief industry and dried cuttlefish the chief export. The chief city, Idzunohara or Fuchiu, on the south island, has a population of about 10,000. Total population of the island, 38,636. Tsushima was held for centuries by the So family, who served as intermediaries in all relations between Japan and Korea, and Korean blood is very noticeable among the inhabitants.

TUA, to͞o′å, TERESINA (1867—). An Italian violinist, born in Turin. Her principal teacher was Massart of the Paris Conservatory, under whom she made such rapid progress that in 1880 she won the first prize. She was uniformly successful from the beginning of her artistic career. In 1891 she retired from the concert platform owing to her marriage with Count Franchi-Verney della Valetta, but in the autumn of 1895 she again took up her concert work and made a very successful European tour.

TUAMOTU (to͞o′å-mō′to͞o) **ISLANDS.** See LOW ARCHIPELAGO.

TUAREGS, to͞o-ä′rĕgz. Berber nomads in the Middle Sahara, numbering some 300,000, and perhaps descendants of the ancient Gætulians. (See GÆTULIA.) In various places they have mixed with negroes. They are tall, with slender figures and regular features, dark in complexion, with an occasional blond, and, owing to their frugal diet are long lived. The costume varies with location, but a common article of dress is the *litham*, a cloth wrapped about the face to protect the eyes and breathing organs from the dust of the desert. The Amoshagh or Noble Tuaregs wear a black litham and the Imghad or servile a white one, which gives rise to the epithets Black Tuaregs and White Tuaregs. Their weapons are a long, straight sword, a dagger, a spear six feet long, and occasionally a gun. They were monogamists until the Mohammedan conquest, when they began to vary somewhat in this respect. The women have great freedom among them, go unveiled, and have a part in public affairs. Consult: Duveyrier, *Les Touaregs du nord* (Paris, 1864); Bissuel, *Les Touaregs de l'ouest* (Algiers, 1888); Bernard, *Deux missions chez les Touareg* (ib., 1896); King, *Search for the Masked Touareks* (London, 1903); Masquerai, *Dictionnaire français-touareg* (Paris, 1893).

TUAT, to͞o-ät′. A group of oases in Algerian Sahara, North Africa, comprising the oases of Gurara and Tidikelt. It is a comparatively well-settled region and abounds in date palms. It is watered principally by the Wadi Saura or Mzaud and also by some subterranean watercourses. The largest lake is the Sebkha Gurara. The population of the region is estimated at 100,000, composed of Tuaregs, negroes, and Arabs. Tuat was formerly regarded as a dependency of Morocco, but with its occupation by French troops in 1900 has practically become a part of the French sphere of influence, and attempts are being made to extend the Algerian railway system into Tuat.

TUATARA, tōō'à-tä'rà (Maori, spiny). A reptile of New Zealand (*Sphenodon* or *Hatteria punctatum*), which looks like a large stout lizard, but whose structure shows it to be the sole surviving representative of a primitive group, the Rhynchocephali, otherwise extinct in the Triassic age. Large males reach a length of 2½ feet, are dark olive green, and have a row of short yellowish, horn-sheathed spines along the vertebral line. The skin is rather granular, except on the belly, where it is scaly. All its anatomy distinguishes this animal from lizards and allies it with the ancient Prosauria—the carpus, for example, has the primitive number of 10 bones, all separate; and there is an entire absence of external copulatory organs.

The tuataras were once numerous through New Zealand, but have been killed off by civilization and bush-fires, until now they inhabit only some small parts of the North Island. They dwell in burrows of their own digging, which they share with sundry petrels. They are fond of water, and are able to remain submerged for hours without breathing. During the day they sleep, but at night hunt for food, which consists of insects and worms in the interior and on the coast of small fishes, crustaceans, etc.; all food is taken alive. They move very slowly and lazily, but are fierce fighters when called upon to defend themselves. They lay in summer about ten eggs, elongated and hard-shelled, which are buried in warm sand and left to hatch, but this does not happen until about thirteen months later, although the embryos grow to nearly their full size in half that time or less, and then seem to æstivate. Consult: Gadow, *Amphibia and Reptiles* (London, 1901); Newman, *Transactions Zoölogical Society*, vol. xv. (ib., 1897); Howes, *Transactions New Zealand Institute*, vol. x. (Wellington, 1878); Van Haast, id., vol. xiv. (1881).

TUATHA-DE-DANAAN, tōō-ä'thȧ dȧ dȧ-nän' (Ir., Race or Tribe of Danaan). A prehistoric people of tall stature and blond type, who, according to the ancient annals of Ireland, invaded the island from the north several centuries before the Christian Era and by defeating the Firbolgs (q.v.) in the battle of Moytura became masters of the country until in turn overcome by the Milesians (q.v.). They were probably of Scandinavian origin.

TUBA (Lat., trumpet). A name given to the bass instruments of the saxhorn family, also called bombardons. Tubas are made in many keys, and, as they are played from the notes as written, they require no special transposition. They are the lowest of the brass instruments and their range is from $_1\mathrm{B}\flat$-f^1. Their tone is full and majestic; the most usual sizes are the bass tuba in B♭ and the contrabass tuba in $_1\mathrm{B}\flat$. Their introduction into the orchestra is due to Wagner, who obtained fine effects through them. The tuba has since then become a fixture in the orchestra, being used as the bass of the trombone choir. As such it has entirely superseded the ophicleide (q.v.). The instrument is built in two forms, obolng, like the euphonium, and round. See HELICON.

TUBA. A tribe of Western Siberia. See YENESEIANS.

TUBE-NOSE. A tube-nosed or harpy bat, a small East Indian fruit-bat of the genus Harpyia, remarkable for the fact that the nostrils are in the form of two extended and somewhat divergent tubes projecting above the upper lip. See Plate of BATS.

TUBER (Lat., swelling, tumor, knob on plants). A thickened and shortened branch from a subterranean stem. The leaves are usually reduced to minute scales with buds in the axils, forming in the potato the so-called 'eyes.' Its function is to act as a food reservoir, and to give rise directly to new plants. See STEM.

TUBERCLE. See TUBERCULOSIS; BACTERIA; DISEASE, GERM THEORY OF; SERUM THERAPY.

TUBERCULIN, KOCH'S LYMPH, or PARATOLOID. A glycerin extract of pure cultures of the Bacillus tuberculosis, first prepared in 1891 by Robert Koch (q.v.). It is a brownish, albuminoid liquid, neutral in reaction and soluble in water, and consists mainly of ptomaines of the bacillus, with coloring matters, extractives, and salts. When injected into the tissues of a healthy (non-tuberculous) person no reaction follows; but in the presence of tuberculosis, wherever situated, both a local and general febrile reaction is observed. The general symptoms are fever and chills; locally it affects the skin, which becomes red and swollen. A better serum was introduced by Koch in 1897, and efforts in the same direction were made by Klebs in Germany and Hunter in England, the earlier product having been found to contain substances very toxic to man. Of the curative value of tuberculin there appears to be some doubt. With the first serum treatment was tedious and prolonged, and the result uncertain. But it was hailed as a specific, and widely used by unskilled observers and on unsuitable cases. The results were disappointing and the remedy fell into disrepute. With the production of purer serums treatment has been more successful. Tuberculin is chiefly valuable as a diagnostic agent. It is largely used as a test for tuberculous cattle, to guard against the consumption of infected milk and meat. See TUBERCULOSIS.

TUBERCULOSIS (Neo-Lat., from Lat. *tuberculum*, little swelling, pimple, tubercle, diminutive of *tuber*, swelling, tumor, knob on plants), or CONSUMPTION. An infectious disease, caused by the Bacillus tuberculosis, characterized by the formation, in the tissues, of nodular bodies, called tubercles, and manifested symptomatically by fever, cough, dyspnœa, and progressive loss of strength. The disease is widespread and causes about one-seventh of the deaths throughout the world. Its clinical features were recognized many centuries ago, and Hippocrates and Galen described them very accurately; but it was not until the growth of anatomical study in the seventeenth and eighteenth centuries that the characteristic lesions (tubercles) were recognized and associated with the disease. Important additions to the pathological knowledge of tuberculosis were made by Bayle (1810) and to its physical diagnosis by Laennec (about 1834). Virchow's work in cellular pathology and finally Koch's brilliant discovery of the causative bacillus in 1882 settled all doubts as to the genesis and pathology of the disease, and since then nothing essential has been added to our knowledge concerning it.

Consumption prevails in all latitudes. Toward the poles and in very high altitudes the mortality is somewhat lower. No race is exempt, but negroes and Indians, and other races to whom the disease is comparatively new, are especially susceptible. In rare instances the disease is congenital, derived from the mother; there has been found no proof of paternal transmission either in man or animals. The great frequency in young infants of tuberculosis, whether of the lungs, meninges, or bones, is taken by many observers to prove that the virus can be transmitted. Heredity plays an important rôle in determining the disease in individuals. Children of tubercular parents are more liable than others to contract consumption, and hereditary predisposition can often be traced in a family for several generations. Two classes of individuals naturally predisposed toward consumption have long been recognized: the one tall, with straight limbs, regular and even beautiful features, dark hair, long eyelashes, thin and delicate skin; the other stunted, with coarse features, thick lips, light hair, sluggish action, and a tendency to enlargement of the lymph glands. A predisposition to tuberculosis is acquired under conditions that seriously lower vital resistance. Among those are overcrowding, deficient ventilation, poor food, prolonged and exhausting disease, pregnancy and lactation, and unhealthful occupations, such as glass-blowing, coal-mining, street-sweeping, exposure to cold and damp, and the excessive use of alcohol. The disease is most frequently acquired in early adult life (from twenty to thirty-five). The pulmonary complications following measles and whooping-cough in children are often forerunners of a tuberculous deposit in the lungs. The direct medium of contagion is the sputum of the tuberculous patient. The number of bacilli thrown off in this manner is enormous. By a patient moderately advanced in the disease Nuttall estimated there were expectorated in the twenty-four hours between two and four billions of bacilli. The sputum becomes dry and desiccated, the bacilli are distributed by the dust and obtain entrance to the body again through the respiratory tract. The flesh or milk of tuberculous cattle is capable of transmitting the disease both to man and to other animals. Many cases of intestinal and mesenteric tuberculosis in children are attributable to this source. Finally, infection can be brought about by direct inoculation. Demonstrators of morbid anatomy, butchers, and handlers of hides are subject to a local tuberculosis of the skin. Infection has taken place from circumcision, washing the clothes of phthisical patients, and through a cut from a broken sputum cup.

When the tubercle bacilli have once definitely invaded the lungs the disease runs its course with different degrees of rapidity. It may be fatal in three or four months, or ten to fifteen years may elapse between infection and death. During this time it may be quiescent for months or a year or more. Two types are usually recognized. The rapid form (galloping consumption) begins after a cold or exposure, with rapidly rising temperature, pain in the side, difficult breathing, rust-colored sputum, and consolidation of one or more lobes of a lung: in other words, like an attack of pneumonia. Instead, however, of improving at the end of the tenth day, the symptoms become graver, the fever continues high, the lung is rapidly softened and destroyed, and the patient dies in from three weeks to as many months. This form is always fatal. The second type, sometimes called chronic ulcerative phthisis, comes on more slowly and runs a longer course and includes the majority of cases of pulmonary tuberculosis. The disease begins with a slight but annoying and unproductive cough, chilly sensations, indigestion, loss of appetite, and gradually increasing weakness. As the trouble progresses, the cough becomes severe and constant, with yellow or whitish expectoration, containing usually multitudes of bacilli, and sometimes tinged with blood. Fever is higher in the afternoon and evening and the temperature rarely drops to normal. Night sweats, pains in the chest, steadily progressing weakness, dyspnœa, and wasting are now present. Occasionally quantities of blood are brought up (hemoptysis) during a paroxysm of coughing. It is bright red, frothy, and due to the ulceration of an artery of some size. The course is not always fatal; the disease may be arrested at any stage, and partial or complete healing take place, leaving scars or cavities in the lung. Improvement may be only temporary and the process start up again under favorable conditions. In fatal cases the last stage is marked by an exhausting diarrhœa, and swelling of the lower extremities. Death may take place suddenly from hemorrhage or gradually from exhaustion. Examination of the chest shows a deficient expansion of the ribs, rapid heart action, exaggerated voice sounds, irregular and high-pitched respiration, and different varieties of râles, depending on the stage of the morbid process. The prevention of tuberculosis is one of the most difficult problems with which the sanitarian has to grapple, the disease being so widely disseminated, and so insidious in its approaches. Efforts in this direction are mainly directed to destroying tuberculous cattle, segregation of phthisical individuals, and destruction of their sputum. Municipal ordinances against spitting in public places have been passed in many cities. In sanatoria patients use special receptacles for their sputum, which is thoroughly disinfected and burned. Boards of health in the larger cities are taking note of cases in private life and urging them to dispose of expectorated matters in a sanitary way.

Individuals predisposed to consumption should lead an exceptionally careful life in an equable climate and out of doors. Particular attention should be given to keeping the upper respiratory passages in a healthy condition and guarding against colds. Tuberculosis is a curable disease in its earlier stages. Spontaneous cure is an every-day phenomenon and a large proportion of individuals dying of other diseases are found on autopsy to possess healed tubercular lesions in the lungs.

There is no successful specific treatment. Koch's tuberculin and its various modifications and the different antitoxins and antitubercle serums are being used, but are still in the experimental stage, and have to be administered with great circumspection. The treatment of consumption is in most cases best carried out in well-regulated sanatoria, where the patient's life and habits are under expert surveillance. The main objects in view are to place the sufferer in an environment favorable for the attainment of the best possible nutrition, to relieve the cough, sweats, and other wearing symptoms, and to give medicines that tend to check the progress of the disease. Fresh air is an essential consideration, whether treatment is carried on in sanatoria or at home. In general, a dry, germ-free bracing atmosphere, with an equable temperature and plenty of sunlight, where the patient can live practically out of doors, should be selected. There is no advantage in sending inevitably fatal cases away from home. Moderately advanced cases are as a rule more comfortable in warm climates like that of Florida and South California. The sleeping room of the consumptive should be well ventilated. Nutrition should be kept up to a high point by a plentiful supply of good, easily digested food, given at frequent intervals and carefully adapted to the patient's digestive powers. Milk, eggs, koumiss, or broths may be taken between meals, and when the stomach is not equal to solid food, a small amount of wine or whisky may be given at meal time to stimulate appetite and digestion. Life should be out of doors, but exercise should stop short of fatigue. The mental condition of the patient is of the utmost importance and cheerful surroundings and occupation should be chosen where possible.

Of the drugs that seem to have a definite curative value, the creosote group, cod-liver oil, and the hypophosphites are most valuable. Creosote, creosote carbonate, guaiacol and guaiacol carbonate, given in gradually increasing doses, are of use in all stages, but particularly in the active inflammatory stages. They diminish cough very markedly. Iodoform is sometimes given instead of creosote. Cod-liver oil improves the nutrition and is especially useful in what is illy termed the pretubercular stage. It acts better in children than in adults, and better in glandular and bone tuberculosis than in pulmonary. The emulsified fats or cream are good substitutes when cod-liver oil cannot be taken. Iron, arsenic, strychnine, and similar tonics are given according to indications. Besides general measures, special symptoms have to be watched and treated. Fever is combated by rest, fresh air, and small doses of quinine; severe cough by opiates; night sweats by belladonna, strychnine, and the mineral acids. Hemorrhage from the lungs calls for complete rest, large doses of opium or morphine, and suprarenal extract, with ice over the point of bleeding when it can be located. Vomiting, headache, indigestion, diarrhœa, etc., are all present and have to be managed as in other diseases.

Attempts to treat the disease locally by means of inhalation of antiseptic vapors, and ozonized air, and later by the X-ray and concentrated sunlight, have had a very small measure of success.

Tuberculosis attacks, primarily or secondarily, the lymph glands, bones, joints, intestines, peritoneum, brain, kidneys, bladder, spleen, liver, pleuræ, pericardium, heart, generative organs, and skin. Its manifestations in these situations are described in the articles on SCROFULA; ADENITIS; PLEURISY; PERITONITIS; MENINGITIS; KIDNEYS, DISEASES OF; BLADDER; PERICARDITIS; etc.

PATHOLOGY AND BACTERIOLOGY. Tuberculosis is invariably due to the presence in the body and to the action upon the body tissues of a specific micro-organism known as the tubercle bacillus.

The tubercle bacillus is a thin bacillus from three to four micromillimeters long, i.e. about one-half the diameter of a red blood cell. It is often slightly curved and there is a marked tendency of the bacilli to hang together, two often lying in the shape of a letter V. The bacillus grows on ordinary culture media at body temperature, but the growth is extremely slow. Thus, cultures on blood serum or on nutrient agar rarely show any signs of growth earlier than two weeks, when thin grayish dry scales begin to appear on the surface of the medium. Cultures grow best in the dark; in fact, the bacillus is killed by exposure for a few hours to the direct rays of the sun. From a pure culture successive cultures may be made indefinitely. Such cultures show a gradual loss of virulence, but no changes in growth characteristic. Inoculation of susceptible animals, such as the guinea-pig, with these cultures reproduces the disease. See Plate of DISEASE GERMS.

The bacillus stains with difficulty with the aniline dyes, but when once stained retains the dye with great tenacity. It is upon this staining characteristic that our most important method for morphologically differentiating the tubercle bacillus depends. This consists in staining a suspected specimen with a strong solution of a red dye known as fuchsin, to which carbolic acid has been added to increase its penetrating powers. After staining, the specimen is washed in dilute acid, which extracts the stain from all other bacteria. The tubercle bacilli retain the red stain in spite of the action of the acid and may thus be differentiated. But three other bacilli resemble the tubercle bacillus in this staining reaction. They are the bacillus of leprosy, the smegma bacillus, and the so-called 'hay bacillus.' The first and last of these can usually be excluded on the ground of the impossibility of their being present. The smegma bacillus as a rule enters into consideration only in examining urine for the tubercle bacillus.

The changes which the tubercle bacillus causes in the body tissues are various. Thus it may stimulate the passage of serum and white blood cells from the blood vessels into the tissues, causing an exudative inflammation; or it may stimulate the production of new connective tissue, causing what is known as a productive inflammation; or its effects may be more severe and lead to death of tissue or necrotic inflammation. Any one of these effects may be produced separately, or, as is commonly the case, they are combined. The most distinctive feature of the action of the tubercle bacillus in the body is the production of what are known as tubercles or tubercle tissue. This tubercle tissue may occur either as the nodular tubercle or as diffuse tubercle tissue. In either case, according to Osler, "The 'tubercle' presents in its early formation nothing distinctive or peculiar either in its components or in their arrangement. Identical structures are produced by other parasites, such as the actionomycosis and the strongylus in the lungs of sheep." In the production of the 'tubercle' the bacilli, according to the extensive researches of Baumgarten, first cause a proliferation of the connective tissue elements with the production of epitheliod and giant cells. Following this is an inflammatory reaction with the exudation of serum and white blood cells. The 'tubercle,' which is now fully developed, may next undergo degenerative changes consisting of either caseation or sclerosis. Caseation begins in the centre of the growth and consists in a degeneration of the cells and their reduction to a homogeneous, structureless mass. Coincident with the caseation or following it is a sclerosis by which the tubercle is converted into a firm, hard substance composed of connective tissue rich in fibres. Osler describes very graphically these two processes as follows: "In all tubercles two processes go on: one—caseation—destructive and dangerous; and the other —sclerosis—conservative and healing. The ultimate result in a given case depends upon the capabilities of the body to restrict and limit the growth of the bacilli. There are tissue soils in which the bacilli are, in all probability, killed at once—the seed has fallen by the wayside. There are others in which a lodgment is gained and more or less damage done, but finally the day is with the conservative protecting forces—the seed has fallen upon stony ground. Thirdly, there are tissue-soils in which the bacilli grow luxuriantly, caseation and softening, not limitation and sclerosis, prevail and the day is with the invaders—the seed has fallen upon good ground."

Small tubercular nodules are called miliary tubercles. Seen with the naked eye the nodular tubercle is a small white, gray, or yellowish body, the smallest not visible without a miscroscope. Microscopically these tubercles show around their edges proliferated connective tissue and endothelial cells, with often some giant cells, while the centre is composed of tissue undergoing caseation or coagulation necrosis. Tubercle bacilli may be few or numerous.

Diffuse tubercle tissue usually results from a rather extensive local infection resulting in many small foci near together. From these tubercles start to grow, and these coalescing form considerable areas of tubercle tissue. In addition to the formation of tubercles the bacilli or the presence of the tubercle tissue may set up secondary inflammatory processes.

Suppuration in connection with tubercular inflammation frequently occurs. In the so-called 'cold abscess,' however, the fluid is not, properly speaking, pus, but the products of breaking down of the tubercles. The question as to whether the tubercle bacillus alone is capable of causing suppuration is still debated. It seems probable, however, that most cases of suppuration in tubercular conditions are due to what is known as 'mixed infection,' that is, the presence of pyogenic cocci with the tubercle bacilli.

Acute general miliary tuberculosis is characterized by a rapid development of tubercles, usually of small size, in many parts of the body at about the same time. The number of tubercles is frequently very large. One of the explanations offered for such sudden general diffusion of tubercles is that the infection is secondary to tubercles located in the walls of some of the small blood vessels or lymphatics.

Pulmonary tuberculosis, tuberculosis of the lungs, lung consumption, or, most commonly called simply 'consumption,' is a form of tubercular infection in which the only or the most prominent lesions are in the lungs. The bacilli usually gain entrance by being taken into the lungs with the inspired air. Less commonly infection of the lung may occur through bacteria being brought to them by means of the blood or lymph channels from tubercular foci in other parts of the body. Several factors must be considered as determining the character of the inflammation which the tubercle bacillus may induce in the lungs. Among these may be mentioned the number of bacilli introduced, their virulence, the manner in which they enter the lungs, whether in respiration or by means of the blood or lymph, the susceptibility of the individual, etc. As a result of variation in these factors we find a variation in the character of the inflammation set up. Thus there may result an exudative inflammation in which the air spaces of the lung and the smaller bronchi are filled with serum, leucocytes, fibrin, and cast-off epithelium. Such reaction is quite similar to that induced by the pneumococcus in pneumonia. On the other hand, instead of an exudative inflammation, the tubercle bacillus may bring about the production of new tissue, that is a productive inflammation. This new tissue is composed of small round cells and epithelioid cells, such as have been described above as tubercle tissue. In some cases there is death or necrosis of lung tissue with the formation of abscesses.

While it is common for these different lung-tissue reactions to tubercular infection to be associated, the predominance of one or another allows us to differentiate several quite distinct types of tuberculosis of the lungs.

Acute Miliary Tuberculosis of the Lungs. This occurs usually as a part of a general miliary tuberculosis, although it may be difficult to find lesions in other organs. The tubercles vary in size and are found in both lungs, lying in the lung tissue proper, in the walls of the vessels and bronchi, or in the connective-tissue septa. They may be quite evenly scattered or distributed in groups. The structure of the tubercles has been already described. The tubercles undergo coagulation necrosis, and there is apt to be some inflammatory reaction in the adjacent air spaces, as evidenced by more or less exudation. Some of these tubercles may be of considerable size, but many of them are often too small to be visible to the naked eye. These tubercles may go on to suppuration. They may coalesce to form larger tubercles. On the other hand, instead of breaking down, the tissue is sometimes converted into masses with or without calcified centres. These are known as 'healed tubercles,' and may or may not contain tubercle bacilli.

Tuberculous Broncho Pneumonia. In this form of tuberculous infection of the lungs, the tuberculous areas occur in the walls of the smaller bronchi and in the contiguous lung tissue. In its early stages the inflammation is mostly catarrhal, there being a more or less extensive exudate into the affected bronchi. As more and more bronchi are affected, there is frequently a coalescence of adjacent areas, with the formation of quite large masses of consolidation. These breaking down form cavities. The progress of the affection may be slow or rapid, and is one of the forms of pulmonary tuberculosis popularly called 'phthisis.'

The term 'phthisis' is also applied to diffuse exudative tuberculosis inflammation of the lungs, which may be either acute or chronic. In the acute form extensive areas of lung tissues may be involved, become consolidated, and, undergoing necrosis, result in the formation of large cavities. In the chronic form there is a slower involvement of the lung tissues, and there is apt to be more fibrous tissue, especially in the walls of cavities. These cavities may be small or large; are usually at first devoid of any wall, but soon acquire a wall of fibrous tissue, often lined with new tubercle tissue or with granulation tissue. This lining tissue often contains enormous numbers of tubercle bacilli, which are cast off in the sputum. It also furnishes a lodging place for pyogenic cocci, which cause suppuration of the membrane, and it is not at all improbable that these pyogenic cocci are very largely concerned in the formation of the cavities themselves. This secondary or concurrent infection, as it is called, is also largely responsible for the bronchitis and yellow or greenish expectoration which so usually accompanies phthisis. Blood vessels stretch across these cavities or lie exposed in their walls, to be broken either by an extension of the disease itself or from a strain too sudden for their weakened walls. In this way may be caused the hemorrhages so frequently associated with phthisis.

The most frequent site of tubercles in the adult lung is the apex, although the initial lesion may occur in any part of the organ. In children the bronchial lymph nodes are usually first affected. 'Healed tubercles' of the apex are found in a large proportion of autopsies.

Associated with the lesions in the lungs may be lesions in other parts of the body. These may be secondary to the pulmonary infection or the lung lesion may be secondary to other lesions. Acute or chronic inflammation of the pleura commonly accompanies the disease of the lung tissue proper. This inflammation may be simply exudative or may be tuberculous. Infection with the pyogenic cocci sometimes results in an empyæma (purulent pleurisy); or the opening up of bronchi or air spaces into the pleura may result in a pneumo-thorax.

Tuberculosis of Serous Membranes. That of the pleura has been mentioned. Tubercular pleurisy may, however, occur independently of any lesion in the lung proper. Tubercular peritonitis may be primary, but is more frequently associated with tuberculous disease of some adjacent organs. Thus in women nearly half the cases are due to extension from the Fallopian tubes. In man the initial lesion may be in the seminal vesicles or prostate. It may be part of a general miliary tuberculosis. In the tubercular peritonitis of pulmonary phthisis the infection seems to reach the peritoneum through the intestines. In some cases minute tubercles are scattered over a part or all of the peritoneum and are usually accompanied by a serous or sero-fibrinous exudate. There may be larger areas of tubercular tissue which undergo necrosis. Secondary infection by the pyogenic cocci may occur, resulting in a purulent exudate. In what is known as chronic fibroid tuberculosis of the peritoneum there is little exudation, the tubercles are firm and pigmented, and the peritoneal surfaces matted together by fibrous adhesions. It is not uncommon to have tumor-like formations. These may be due to sacculated exudations, to matting together of omentum or intestinal coils, or to enlargement of mesenteric glands. Tubercular pericarditis may be primary or secondary, acute or chronic. In the acute miliary form the membrane is studded with tubercles and there is usually some sero-fibrinous exudate. In rare cases the exudate is large, Musser in one case reporting 34 ounces of fluid in the pericardial sac. In chronic cases the membrane is thickened, adherent, and usually shows several cheesy tubercular masses. The bronchial and mediastinal lymph nodes are regularly involved.

Tuberculosis occurs in bones, periosteum, and joints. In tuberculous osteitis the tubercles may be small and scattered, or less in number and of considerable size. Abscesses are sometimes formed. The adjacent joints are frequently involved. The spongy parts of the bone are more susceptible than the hard parts. The vertebræ, carpal and tarsal bones are most commonly affected. The chronic, purulent periostitis of poorly nourished children is frequently tubercular. For description of the lesion in tubercular arthritis, see Synovitis.

Genito-Urinary System. Tuberculosis of the kidney may be primary, a part of a general miliary tuberculosis, or, as is most commonly the case, secondary to lesions in other organs. There may be small nodules in the kidney proper, or in the pelvis; or there may be quite large areas of tubercular tissue with necrosis. These may occur in only one kidney or in both kidneys. With much destruction of kidney tissue, cavities or cysts are formed, in some cases the kidney being almost wholly replaced by cysts of various size. There is apt to be thickening of the pelvis and tubercle tissue in its walls. Tuberculosis of the ureter and bladder is almost always secondary, especially to disease of the kidney pelvis. Small tubercles or patches of tubercle tissue are present in the ureter or bladder walls. Tuberculosis of the testes occurs as a primary lesion or, more frequently, as secondary to lesions elsewhere. In tuberculosis of the Fallopian tubes, the tubes are enlarged, their walls thickened, and the lumen usually filled with cheesy matter. Both tubes are frequently involved. Adhesions and the formation of abscesses are common results.

Liver. Miliary tubercles of the liver are quite common as a part of a general miliary tuberculosis. Many of these tubercles are microscopic in size. Sometimes the tubercles are in among the liver cells, in other cases they develop in the walls of the smaller bile vessels, forming abscesses. Large tubercular patches having a diameter of an inch or more are sometimes found. In connection with the tubercular process there may be a marked increase in the connective tissue of the liver, constituting what is known as a tuberculous cirrhosis.

Lips, Mouth, etc. In tuberculosis of the lips, which is a rare disease, there develops on the lip an extremely sensitive ulcer. This ulcer has much the appearance of an epithelioma or a chancre. Tubercular laryngitis is most frequently secondary to tuberculosis of the lungs. Miliary tubercles form in the submucosa and are accompanied by a catarrhal inflammation of the mucous membrane. With necrosis of the tubercles, ulcers are formed. These ulcers often run together, involve adjacent parts, and determine extensive destruction of tissue. Tuberculosis of the tongue is marked by the appearance of small nodules on the upper surface or edge of the organ. These open on the surface and become ulcers. It is a rare condition except when associated with tuberculosis of other parts. Tuberculosis also occurs in the palate, tonsils, pharynx, œsophagus, and stomach. The lesions are similar to those described in other mucous membranes, that is, the formation of nodules, a catarrhal inflammation, and necrosis with the formation of ulcers.

INTESTINES. In tuberculosis of the intestines there is involvement of Peyer's patches and of the solitary lymph nodules as well as ulcers of the mucous membrane between the patches. As a primary lesion it is extremely rare in adults, much less rare in children, where there is apt to be involvement of the mesenteric glands or a tubercular peritonitis. In the secondary form of the disease in adults the lungs are the usual seat of the primary lesion. The ulcers occur chiefly in the colon, cæcum, and ileum. They may be very extensive, affecting the greater portion of the mucous membrane of both large and small intestines. The ulcers are irregular in shape, rough in outline, their long axes transverse to the lumen of the gut. They usually involve not only the mucous membrane, but also the submucosa and muscular coats. They rarely perforate. With healing of the ulcers, extensive scar tissues may form, so contracting the bowel as to cause stenosis. Not uncommonly tubercles are present on the peritoneum adjacent to the intestinal ulcers. Tuberculosis of the rectum is quite frequently associated with fistula, the fistula being of the nature of a tuberculous ulcer.

In tuberculosis of the breast, nodules form in the gland. These may become necrotic, communicate by fistulous openings with the surface, and form ulcers. In the majority of cases the axillary glands are involved.

Tubercular lesions may occur in the brain as part of a general miliary tuberculosis. In such cases it affects the meninges, causing a tuberculous meningitis, usually associated with an increase in the fluid within the ventricles (acute hydrocephalus). In chronic tuberculosis of the brain the lesion is a meningo-encephalitis, the tubercles affecting both meninges and brain tissue proper. The lesion is usually localized and there are in most cases several nodules. These nodules vary in size from a quarter of an inch to nearly an inch in diameter, sometimes being even larger. The nodules on section present a grayish yellow appearance, a necrotic sometimes almost fluid centre, and are surrounded by an area of clear soft tissue. The nodules are usually attached to the pia mater and extend from the surface into the brain. The nodules may interfere with cerebral circulation, causing softening, or sinus thrombosis, or may incite an acute meningitis. The pia is apt to be thickened and adherent to the brain surface. Instead of several nodules there may be one large solitary tubercle. Lesions quite similar to those described for the brain may occur in the cord either with or without brain lesions. See BACTERIA; DISEASE, GERM THEORY OF.

Consult: Latham, *Pulmonary Consumption* (London, 1903); Osler, *Practice of Medicine* (New York, 1901); Ziegler, *Pathological Anatomy* (Eng. trans., ib., 1887); Klebs, *Tuberculose* (Hamburg, 1894); and monographs by Virchow (1863-65) and Koch (1882-90).

TUBERCULOSIS (in animals). Viewing the evidence at hand, investigators have attributed the various forms of tuberculosis in animals to Bacillus tuberculosis. Birds are commonly supposed to be affected by a different form, but the differences observed are also considered to be due to differences in the anatomy and resisting power of different animals. Horses, sheep, goats, dogs, and cats are rarely affected; poultry and parrots frequently; cattle and hogs most commonly. European and American statistics from tuberculin tests and from meat inspection indicate that from 10 to 50 per cent. of the cattle examined are affected. Tubercles may be found locally or generally distributed in the respiratory, alimentary, and lymphatic structures and in the bones of the animal examined. The popular notion that tuberculosis in man is caused by the consumption of tuberculous meat and milk is without sure proof, and obviously experiments cannot be made to determine this point. Since, however, such food products are feared, and since they suggest uncleanness and negligence on the part of both producer and consumer, they should be avoided. Governmental inspection of dairies and meat has wrought great improvements in the sanitary conditions of stock and dairy farms, and methods of handling milk and meat, and has educated the public to demand pure animal products. The danger is far less than is generally supposed, since experiments indicate that milk from cows suspected to be tuberculous may be fed to calves without danger, and when pasteurized it may be used as human food with no untoward results.

For the detection of incipient cases of tuberculosis in cattle tuberculin is usually employed. This substance contains what is called the toxin produced during the growth of the bacillus, but does not contain the living organism. When injected into healthy cattle tuberculin produces no reaction, but in affected cattle an elevation of from 1½° to 3° or more of the body temperature and a slight swelling at the point of injection are looked for. Animals which show these symptoms are considered tuberculous and are separated from the rest of the herd. If they are valuable they may be used for breeding purposes, since the progeny rarely exhibit tuberculous symptoms. The calves are usually separated from their mothers very soon after birth. No reliable medical treatment has been discovered, though repeated injections of tuberculin have in some instances appeared to be slightly curative. Some cases recover spontaneously. Preventive measures are cleanliness, airy quarters, pure water and food, and free range upon good, well-managed pastures.

TUBEROSE (from Lat. *tuberosa*, fem. sg. of *tuberosus*, tuberous, from *tuber*, swelling, tumor, knob on plants; associated by popular etymology with Eng. *tube rose*), *Polianthes tuberosa*. The only species of its genus, which belongs to the natural order Amaryllidaceæ. The plant, which is a native of Mexico, has a tall stem with long leaves at the base and shorter ones toward the top of the several-flowered spike of very fragrant white blossoms. The plant grows well in mild climates, but it bears the open air in northern countries only during the summer. Near Grasse, in Southern France, the tuberose is largely grown as a source of perfume. The popularity of a double-flowered form has suffered from its too extensive use in funeral designs, etc. In outdoor culture in mild climates the plants are not disturbed during the winter, but in northern climates the tuberous rootstocks are taken up and stored in a dry, frost-proof place. In the colder regions where the bulbs fail to mature completely they are imported usually toward the end of the year, planted in pots, and given bottom heat. When danger of frost has passed they are set in light, moist, and rich soil and kept well supplied with water.

TUBEROSE (*Polianthes tuberosa*).

TUBES. See PIPES.

TUBES OF FORCE. See ELECTRICITY.

TUBES OF INDUCTION, TUBES OF MAGNETIC FORCE. See MAGNETISM.

TUBE-WEAVER. Any one of the tube-building spiders of the families Drassidæ and Clubionidæ. They are, as a rule, dark-colored spiders, which spin no web, but wander about at night in search of prey and hide during the daytime. They make silken tubes in which they hide in the winter and while molting or laying eggs. See SPIDER.

TUBIGÓN, tōō'bē-gōn'. A town of Bohol, Philippines, situated about 28 miles from Tagbilaran (Map: Philippine Islands, H 10). Population, in 1887, 11,616; now 15,850.

TÜBINGEN, ty'bing-en. A town of Württemberg, Germany, crowning a hill on the Upper Neckar, 18 miles south-southwest of Stuttgart, on the edge of the Black Forest (Map: Germany, C 4). It owes its celebrity chiefly to the ancient university. (See TÜBINGEN, UNIVERSITY OF.) The antique houses and narrow streets of the old part of the town give it a quaint appearance. Saint George's Church (*Stiftskirche*) contains a beautiful choir, and the new Catholic church is a superb edifice. The town hall is an interesting timber-built structure, recently restored. The poet Uhland, who was born in Tübingen, is commemorated by a fine statue. On a hill above the city stands the interesting Renaissance castle, Hohentübingen, completed in 1540. It affords a magnificent view. The university library and observatory are here. North of Tübingen is the Cistercian monastery of Bebenhausen (1185), an exceptionally fine example of Gothic architecture. It has beautiful cloisters and an art collection. The Protestant seminary, dating from 1536, became noted under Baur, who founded the Tübingen school of theology. (See TÜBINGEN SCHOOL.) There is also a Catholic seminary. Both of these institutions possess good libraries. The town has a surgical clinic, a woman's hospital, and a hospital for the insane. The manufacture of surgical and scientific instruments, book printing, and the cultivation of hops and the vine are the leading industries. Population, in 1900, 15,338, nearly all Protestants.

Consult: Eifert, *Geschichte der Stadt Tübingen* (Tübingen, 1849); Fink, *Tübingen* (Zurich, 1891).

TÜBINGEN, UNIVERSITY OF. A German university, founded in 1477 by Count Eberhard im Bart of Württemberg. It was organized with the usual four faculties. Reuchlin, Melanchthon, and Heinrich Bebel taught there at various times. Under Dukes Ulrich and Christopher, the university took an active part in the Reformation. What made the university famous in its early days and since is the Protestant seminary established in 1536 for the education of evangelical ministers, which is directly under the Minister of Public Worship and Education. It thus became the leading theological university in Germany. The institution maintained a steady growth until the establishment of the Karlsschule by Duke Charles Eugene, when it suffered a temporary decline. King Frederick took away from the university in 1811 most of its rights and privileges. In 1817 the Catholic university founded at Ellwangen in 1812 was united with Tübingen, and a Catholic theological faculty was added; at the same time the faculty of political science was created, and in 1863 was added the natural science faculty. In the nineteenth century the institution experienced a vigorous growth, due chiefly to the great theologians, such as Baur, the head of the Tübingen school of criticism, Strauss, and many others. Since 1832 the whole university has practically been rebuilt. In 1902 the university consisted of the following faculties: (1) Evangelical-theological; (2) Catholic-theological; (3) law; (4) medicine; (5) natural science; (6) philosophy; (7) political science. It includes numerous seminaries, laboratories, and clinics. The library now contains over 390,000 volumes and nearly 3800 manuscripts. The attendance in 1902 was 1524. Consult Klüptel, *Die Universität Tübingen in ihrer Vergangenheit und Gegenwart* (Leipzig, 1877).

TÜBINGEN SCHOOL. A term applied to a modern theological movement which had its origin in the teachings of Ferdinand Christian

Baur (q.v.), of the University of Tübingen. Though he was unwilling to admit that he was a disciple of Hegel, Baur's distinctive and guiding principles were those of the Hegelian philosophy. It was his aim to reconstruct the history of early Christianity so that it would be seen to be in harmony with the laws which everywhere govern historical evolution. He began with the Apostolic age, a method which has since won universal approval. In 1831 he published his essay *Die Christuspartei in der korinthischen Gemeinde, der Gegensatz des paulinischen und petrinischen Christentums in der ältesten Kirche, der Apostel Petrus in Rom.* In this were foreshadowed all his later critical results. His position was that the early Apostolic Church was split into two hostile factions, Pauline (Gentile) and Petrine (Jewish), between whom there was a bitter conflict. Although an element of Jewish Christianity remained unreconciled to the last (the Ebionites), the Pauline party (mainly after Paul's death) made concessions, and thus brought about a reconciliation which resulted in the establishment of the Old Catholic Church. These views were elaborated and fully stated in the works: *Ueber die sogenannten Pastoralbriefe* (1835, the same year in which Strauss's *Leben Jesu* appeared); *Paulus der Apostel Jesu Christi, sein Leben und Wirken, seine Briefe und seine Lehre* (1845, 2d ed. 1866); *Die kanonischen Evangelien* (1847); and *Das Christentum und die christliche Kirche der drei ersten Jahrhunderte* (1853). Baur's position led him to attempt a thorough reconstruction of the history of the origin of the New Testament literature. His theory demanded that the New Testament books in which the evidences of the conflict were most patent, or in which either of the two conflicting views was positively stated, should be considered earliest in date. Therefore, Paul's four genuine letters (Rom., I. and II. Cor., and Gal.) of the Pauline wing, and the Apocalypse by John with the early Hebrew form of the Gospel of Matthew, of the Petrine or Jewish party, were named as the earliest productions of the Apostolic Church. The other books were dated according to the exigencies of the general theory—Mark, as altogether neutral, being set down as the latest of the Synoptics, and with our Greek Matthew, Luke, Acts, John, and the Pastoral Epistles placed very late, altogether outside of the Apostolic age. In Acts, in particular, the desire to reconcile the two parties, even at the expense of genuine Paulinism, was said to be quite manifest. This criticism, based on the supposed tendency (*Tendenz*) of the New Testament documents and now known as 'tendency criticism, (*Tendenzkritik*), was thoroughly under the control of the Hegelian conception ("thesis, antithesis and synthesis") of history. Baur's theory, practically unaltered, was advocated with great brilliancy by E. Zeller in the organ of the school, the *Theologische Jahrbücher* (from 1842 on), and in *Die Apostelgeschichte nach ihrem Inhalt und Ursprung* (1856), by A. Schwegler in *Das nachapostolische Zeitalter* (1846), and by Karl Planck and Karl Köstlin in various publications. Others of the school differed from the master in important details, but fully accepted the main principle. Of these Volkmar in Switzerland, Hilgenfeld and Holsten in Germany, Scholten in Holland, S. Davidson in England, may be cited as representatives. David Strauss is also often spoken of as a representative of the Tübingen school. This, however, is not strictly correct. Strauss was indeed influenced by Baur in his early years, but that was before Baur himself had fully formulated his views.

The most important defection in the ranks of Baur's disciples was that of Albrecht Ritschl (q.v.), who in the second edition of his *Die Entstehung der altkatholischen Kirche* (1857) asserted that it was a mistake to explain the origin of Old Catholic Christianity as a union of early Jewish or Petrine Christianity and modified Paulinism. His trenchant criticism and that of others gradually showed the baselessness of many of Baur's positions. At his death in 1858 it was already evident that the dates he assigned to New Testament books could not longer be defended. The whole theory, in fact, as originally formulated by Baur, has no advocates at the present time, although many prominent scholars of to-day, as Hilgenfeld, Hausrath, O. Pfleiderer, H. J. Holtzmann, Schmiedel, while independent of any formal adhesion to Baur's theory, are at one with the great Tübingen professor on important points.

Literature. Besides the writings noted above, see the estimates by Reuss, *Geschichte der heiligen Schriften des Neuen Testaments* (2d ed., Brunswick, 1890); Dorner, *Geschichte der protestantischen Theologie* (Munich, 1867); R. M. Mackay, *The Tübingen School and Its Adherents* (London, 1863); Pfleiderer, *Development of Theology in Germany Since Kant* (ib., 1890).

TUBULAR BRIDGE. See Bridge.

TUBULIFLORÆ. A suborder of composite plants. It consists of eleven tubes, the members of which are characterized by having all their perfect flowers tubular, the ray flowers when such are present are either neutral or pistillate. Among the genera are Eupatorium, Aster, Inula, Helianthus, Veronica, Helenium, Anthemis, and Calendula.

TUBURÁN, tōō′bōō-rän′. A town of Cebú, Philippines, situated on the coast, 51 miles southwest of Cebú (Map: Philippine Islands, H 9). Population, 10,760.

TUBUS. A Nigritian people. See Tibbus.

TUCANO, tōō-kä′nō. A tribe residing upon the Uaupés River, on the Brazil-Colombia border, and supposed to be remotely of Arawakan stock (q.v.). They take their name from the toucan bird. They tattoo three lines upon each cheek, build circular houses of poles covered with palm leaves, are good canoemen, and are noted for their skill with the blowgun.

TUCK, Friar. The jolly chaplain and boon companion of Robin Hood and his men. He figures in the Robin Hood legends and appears in Scott's *Ivanhoe* as the Holy Clerk of Copmanhurst.

TUCK'ER, Abraham (1705-74). An English moralist, born in London. He studied at Merton College, Oxford, and was entered at the Inner Temple, but was never called to the bar. Inheriting a large fortune from his father, he purchased in 1727 Betchworth Castle and estate, near Dorking, in Surrey. During his last years he was blind. Tucker's great work is entitled *The Light of*

Nature Pursued (1768-78). It was begun in 1756, and formed the chief literary occupation of the rest of his life. It extended to seven volumes, only four of which were published in the author's lifetime, under the pseudonym of Edward Search. It is not a systematic treatise, but consists of a series of disquisitions on metaphysics, theology, and morals, all of which exhibit remarkable originality, simplicity of humor, and ingenuity of illustration. Consult his *Works*, edited with a *Life* by H. Mildmay (London, 1805; several times reprinted).

TUCKER, George (1775-1861). An American historian and miscellaneous writer, born in Bermuda. He was graduated at William and Mary College in 1797, studied law, practiced at Lynchburg, was a member of the Virginia Legislature, and of Congress (1819-25), gained distinction as a debater and constitutional lawyer, and was (1825-45) professor of moral philosophy and political economy in the University of Virginia. He was a frequent contributor to political periodicals, and published, among many other works, *Letters on the Conspiracy of Slaves in Virginia* (1800); *The Valley of the Shenandoah* (1824), a novel; *A Voyage to the Moon*, a satirical romance (1827); *Principles of Rent, Wages, and Profits* (1837); *Life of Thomas Jefferson* (1837); *The Theory of Money and Banks Investigated* (1839); *Progress of the United States in Population and Wealth in Fifty Years* (1843); *History of the United States* (to 1841, 1856-58); *Banks or No Banks* (1857); and *Essays, Moral and Philosophical* (1860). His *History of the United States* is still a work of some importance.

TUCKER, John Randolph (1812-83). An American naval officer, born at Alexandria, Va. He entered the United States Navy as a midshipman in 1826, and in 1855 reached the rank of commodore. After Virginia passed her secession ordinance in 1861, Tucker resigned his commission and entered the Confederate service. In command of the *Patrick Henry*, he took part in the Hampton Roads engagements, receiving command of the wooden fleet after the *Monitor-Merrimac* battle, and assisted in the repulse of the Union squadron at Drury's Bluff. He was promoted captain in May, 1863, commanded at Charleston and then at Drury's Bluff, and after the evacuation of Richmond was attached to Lee's retreating army. In 1866 Tucker became commander of the Peruvian Navy, with the rank of rear-admiral, and he commanded the naval forces of Peru and Chile in their war with Spain. Subsequently he explored parts of the Upper Amazon region. He died at Petersburg, Va.

TUCKER, Josiah (1712-99). An English economist and divine, the son of a Welsh farmer. He was educated at Saint John's College, where he graduated in 1736. He became rector of Saint Stephen's, Bristol (1749), and dean of Gloucester (1758). In 1755 he received from Oxford the degree of D.D. Tucker was a thorough student, and careful writer on political economy and subjects pertaining to religion. He also published several pamphlets in the beginning of the contest between the English Government and its American colonies in favor of separation. As an economist he has some claims as a forerunner of Adam Smith (q.v.), but Tucker elaborated no system.

TUCKER, Nathaniel Beverly (1784-1851). An American lawyer. He was born at Williamsburg, Va.; was educated at William and Mary College; studied law and practiced in Virginia until 1815, when he removed to Missouri. He was a judge in the Circuit Court until 1830; professor of law in William and Mary College 1834-51. He published works on *Pleading* and *Constitutional Law* and several practical essays. His best literary effort was his novel, *The Partisan Leader, a Tale of the Future* (1836). He also wrote *Balcombe* (1836).

TUCKER, St. George (1752-1828). An American lawyer, born in Bermuda. He came early to Virginia and was educated at William and Mary College, after which he was called to the bar. During the Revolutionary War he commanded a regiment at Yorktown, where he was badly wounded. In 1778 he married the mother of the afterwards celebrated John Randolph of Roanoke. He served in the Legislature, but won his chief distinction as professor of law in William and Mary, and as presiding judge of the Virginia Court of Appeals, and of the United States District Court. He is still remembered for a scholarly edition of Blackstone's *Commentaries* (1803) and for a single lyric beginning "Days of my youth." He also published a *Dissertation on Slavery* and other politico-legal works, and composed poems and dramas.

TUCKER, Samuel (1747-1833). An American naval officer, born at Marblehead, Mass. The son of a ship-master, he ran off to sea when only eleven years old, became commander of a merchantman in 1768, and in January, 1776, was commissioned captain in the American navy. In command of the *Franklin* and later of the *Hancock*, he captured more than thirty British vessels, and in March, 1777, was transferred to the frigate *Boston*, which (in February, 1778) carried John Adams as commissioner to France. After taking many prizes, he was forced to surrender at Charleston (May, 1780), but was soon exchanged, and as captain of the *Thorn* secured many prizes. In July, 1781, he was again captured and released on parole. He removed to the site of the present Bremen, Me., in 1792, and in 1813 captured a British vessel which had been threatening the neighboring coast. Subsequently he served in the Massachusetts Legislature (1814-18), helped frame the Maine Constitution (1819), and sat in the Maine Legislature (1820-21). Consult Sheppard, *Life of Commodore Samuel Tucker* (Boston, 1868).

TUCK'ERMAN, Bayard (1855—). An American author, lecturer on English literature in Princeton University. He was born in New York. He graduated from Harvard in 1878, completed his studies in Paris, and became favorably known through the following publications: *History of English Prose Fiction* (1882); *Life of General La Fayette* (1889); *Diary of Philip Hone* (1889); *Peter Stuyvesant* (1893); *William Jay and the Abolition of Slavery* (1893); and *Philip Schuyler, Major-General in the American Revolution* (1903).

TUCKERMAN, Edward (1817-86). An American botanist, born in Boston. He studied at Union College and Harvard University, frequenting in the latter the law and divinity schools, was in Europe in 1841-42 given to the study of botany, and completed his courses at Harvard in 1847 and 1852. From 1854 to 1873 lecturer on history at Amherst, he was appointed professor of botany there in 1858, and held this chair to the end of his life. Although devoted to a variety of botanical studies, he made a specialty of lichenology, and besides numerous contributions to various journals on this subject, published *A Synopsis of the Lichens of New England*, etc. (1848); *Genera Lichenum: an Arrangement of the North American Lichens* (1872); *A Synopsis of the North American Lichens*, part i. (1882); part ii. was edited, with an appendix, by Henry Willey (1888). His *Lichenes Americæ Septentrionales Exsiccati* (1847-55) contains 150 species. From 1834 to 1841 he contributed to the New York *Churchman* many articles on historical, biographical, and theological topics under the titles *Notitia Literaria* and *Adversaria.* Consult the *Memoir* by Farlow (Washington, 1887).

TUCKERMAN, Henry Theodore (1813-71). An American critic and essayist, born in Boston and prominent in the literary life of New York City after 1845. The more important of his numerous publications were: *The Italian Sketchbook* (1835); *Isabel, or Sicily: a Pilgrimage* (1839)—each the outcome of a residence in Italy; two volumes of verse, *Poems* (1851) and *A Sheaf of Verse* (1864); *Artist Life, or Sketches of American Painters* (1847); *Characteristics of Literature* (1849, 2d series 1851); *America and Her Commentators* (1864); *Thoughts on the Poets* (1864); and *Book of the Artists* (1867), a study of the rise and progress of art in America. He wrote a *Life* of J. P. Kennedy (1871), and was a useful writer in his day.

TUCKERMAN, Joseph (1778-1840). An American clergyman and philanthropist. He was born in Boston; graduated at Harvard College, 1798; studied theology, and became a Unitarian pastor in Chelsea in 1801. In 1826 he was appointed by the American Unitarian Association minister at large, devoting himself to city mission work. He is best known as one of the founders of the first sailors' aid societies in the country, and as one of the pioneers in the scientific direction of philanthropy. He wrote much in behalf of his projects. Consult the collection of his writings under the caption *On the Elevation of the Poor* (Boston, 1874) and his *Life* by W. E. Channing (Boston, 1841), and by Miss May Carpenter (London, 1849).

TUCKERMAN, Samuel Parkman (1819-90). An American organist, church composer, and musical lecturer. He studied the organ in Boston under Zeuner and became organist and choirmaster of Saint Paul's Church of that city in 1840. Nine years later he went to England and studied cathedral and church music generally, and at the same time lectured on musical subjects. He returned to Boston and took up church work and lectured on early cathedral and church music. His compositions are principally services, hymns, and anthems for the Episcopal Church service. He also edited collections: *The Episcopal Harp; National Lyre; Cathedral Chants* (1858); *Trinity Collection of Church Music* (1864).

TUCO-TUCO. A small burrowing rat-like rodent, a 'spiny rat' of the genus Ctenomys, several species of which are so called in imitation of their loud, treble call.

TUC′SON. The largest city of Arizona, and the county seat of Pima County, 130 miles southeast of Phœnix; on the Santa Cruz River, and on the Southern Pacific Railroad (Map: Arizona, C 3). It is the seat of the University of Arizona, opened in 1891, and of Saint Joseph's Academy. The public library has about 3500 volumes. Cattle-raising and farming are the leading industries of the surrounding district, which also has considerable mineral wealth. The industrial establishments of the city are for the most part connected with the mining industry. The water-works are owned by the municipality. Population, in 1890, 5150; in 1900, 7531.

Tucson was first permanently settled as a presidio by the Spaniards about 1776, though there had been previously a small Indian village, or rancheria (abandoned in 1763), under the control of the Spanish authorities. It lies within the territory obtained for the United States by the 'Gadsden Purchase' of 1853. It was the capital of Arizona Territory from 1867 to 1877, and was incorporated in 1877 and reincorporated in 1883. There seems to be no foundation for the belief that Tucson was founded by the Spaniards in 1560, and thus antedates Saint Augustine. Consult Bancroft, *History of New Mexico and Arizona* (San Francisco, 1880).

TUCUMÁN, to͞o′ko͞o-män′. The smallest and most densely populated province of Argentina, bounded by the Province of Salta on the north, Santiago del Estero on the east, and Catamarca on the south and west (Map: Argentina, D 9). Area, 13,000 square miles. The eastern portion is rolling, but the western portion becomes quite mountainous. The mountains, offshoots of the Andes, afford extensive forests in the valleys and some mines of gold, silver, and copper, but these are not extensively worked. Sugar and rum are the chief products, but cereals, rice, tobacco, and fruits are raised. The soil generally is fertile, but in some portions use must be made of irrigation. The population, which is largely mestizo, in 1895 numbered 215,693. Tucumán (q.v.) is the capital. Tucumán was originally a portion of the dominions of the Incas. After the conquest the *Gobernación* of Tucumán included many of the surrounding provinces and was first subject to the Audiencia of Charcas, and after 1776 to the Viceroyalty of La Plata.

TUCUMÁN, or **SAN MÍGUEL DE TUCUMÁN.** A city of Argentina, capital of the Province of Tucumán, 690 miles northwest of Buenos Ayres, on a plateau to the right of the River Tala or Sali (Map: Argentina, D 9). It is a regularly built city, but with narrow streets. The cathedral is modern. The city was founded in 1565. Here, July 9, 1816, the representatives of the Plata Provinces signed the declaration of independence from Spain. The population in 1895 was 34,305; in 1901 (estimated), 50,000.

TUCUM PALM. See Astrocaryum.

TUCUNA, to͞o-ko͞o′nȧ. A wild tribe of the Upper Amazon. See Ticuna.

TUCUXI, tōō-kōō′nē (South American name). A South American dolphin (*Sotalia Guianensis*), very abundant in the Bay of Rio Janeiro, where the natives regard it as able to bring ashore drowned persons, and have other fanciful ideas in regard to it. The genus Sotalia is represented by other species in various parts of the world, some of which live wholly in fresh water. Consult Beddard, *Book of Whales* (London, 1900).

TUDELA, tōō-ᴅā′lȧ. A town of the Province of Navarre, Spain, on the left bank of the Ebro, here crossed by a bridge of nineteen arches. It is 47 miles by rail from Saragossa (Map: Spain, E 1). Most of its important public buildings are modern, but it is especially famous for the romanesque Colegiata (formerly the cathedral), which is regarded as one of the finest churches in Europe. The chief industries are the sawing of lumber, the manufacture of licorice, cloth, silk goods, earthenware, and the production of oil and wine. The best wine of Navarre, resembling Burgundy, is produced in this vicinity. The population in 1900 was 8996. Tudela fell into the hands of the Moors in the eighth century, but was retaken by Alfonso I. of Aragon in 1114. In 1808 the Spanish forces under Castaños and Palafox were here twice defeated by the French under Lannes.

TUDELA, Benjamin of. A mediæval traveler. See Benjamin of Tudela.

TU′DOR. The family name of the dynasty which occupied the throne of England from 1485 to 1603. Its founder was Owen Tudor, an obscure Welsh knight, who married Catharine, widow of Henry V., and thus laid the foundation for the future greatness of his house. His son Edmund was made Earl of Richmond by Henry VI., kinsman of Edmund's wife, Margaret. It is through Margaret that the family derived its defective title to the crown. She was the heiress of the Beauforts, children of John of Gaunt by Catharine Swynford, who had been legitimized for every purpose except succession to the throne. Her son, Henry, Earl of Richmond, became head of the Lancastrian house in 1471, and in 1485, at Bosworth Field, defeated Richard III., who fell in the battle. Henry was able to secure the support of the Yorkist faction of the nobility upon promising to marry Elizabeth, the heiress of the York family. Parliament confirmed Henry's claim to reign of his own right, though the lawful heir was either his wife, Elizabeth, or, if females could not inherit the crown, her cousin Edward, the Earl of Warwick. The Tudor monarchs were Henry VII. (1485-1509), Henry VIII. (1509-47), Edward VI. (1547-53), Mary (1553-58), and Elizabeth (1558-1603). The Stuart dynasty, which succeeded to the throne in 1603, derived its title through Margaret, daughter of Henry VII., who married James IV. of Scotland. During the Tudor period the Crown was nearly absolute. The dynasty as a whole was a strong, purposeful one, and while the rights and functions of Parliament were not formally denied, its deliberations were controlled either by royal influence over the elections or by vigorous and tactful management. The local institutions, however, retained their full vigor and the English people thereby retained their training in self-government. When the danger of feudal anarchy and foreign invasion had passed away, and public safety no longer required a strong executive, Tudor absolutism speedily disappeared under the weak and tactless Stuart dynasty. For details and bibliographies, see the names of the separate sovereigns. See also Roses, Wars of the; York, House of.

TUDOR, Mary (1496-1533). Queen of France. She was the daughter of Henry VII. of England. In 1514 she was married to Louis XII. of France and after his death, in 1515, to Charles Brandon, Duke of Suffolk. Her only child, a daughter, Frances, became the wife of Henry Grey, Marquis of Dorset, and was the mother of Lady Jane Grey.

TUDOR, William (1779-1830). An American merchant and author, born in Boston. He was founder (1815) and first editor of the *North American Review*. He graduated at Harvard (1796), engaged in business, visited Europe, and on his return took part in founding the Anthology Club and contributed frequently to its magazine, *The Monthly Anthology* (1803-11). Out of this club grew the Boston Athenæum (1807), of which Tudor was also a founder. He originated the movement for erecting Bunker Hill Monument. In commerce he gained distinction as a pioneer in the ice trade with tropical countries. He was a member of the Massachusetts Legislature for some years, appointed United States consul at Lima, Peru (1823), and chargé d'affaires in Brazil (1827). He published *Letters on the Eastern States* (1820), *Miscellanies* (1821), *Life of James Otis of Massachusetts* (1823), and an anonymous political allegory, *Gebel Teir* (1829), written in Rio de Janeiro, where he died.

TUDOR STYLE. In English architecture, a rather indefinite term applied to the late Perpendicular (q.v.) and the transition from that to Elizabethan (q.v.)

TUFA (It., calcareous rock). A name applied to any crypto-crystalline variety of calcium carbonate which has a cellular structure, especially those varieties deposited from springs or streams. A similar material emanating from volcanoes is known as *volcanic tufa*.

TUFF (Fr. *tuf*, *tuffe*, from It. *tufo*, *tufa*, from Lat. *tophus*, *tofus*, tufa, calcareous rock). Fragmental volcanic material when compacted together to form a rock. The material which by cementation of some kind has formed the tuff may be finely comminuted (volcanic ash or sand), or of larger fragments (lapilli and bombs). A large proportion of tuffs have been laid down under water, or have been carried by water in the form of volcanic mud. In rare cases they are composed largely of crystals. Unconsolidated volcanic fragments are called agglomerate, or agglomerate tuff. If large and angular fragments predominate in a tuff it is often called a volcanic breccia. Such breccias are produced when a stream of lava flows over and picks up an agglomerate, and also when certain viscous lavas flow down a slope. In the latter case the lava stream consolidates in a shell about a central molten mass, the shell constantly fracturing and as quickly healing its fractures by outflow and consolidation of molten material.

TUFTS, Cotton (1734-1815). An American physician, born in Medford, Mass. He graduated at Harvard in 1749, studied medicine, and settled at Weymouth, Mass., and in 1765 wrote the instructions regarding the Stamp Act to the representatives of Weymouth in the Provincial Legislature. He was one of the founders of the Massachusetts Medical Society and of the American Academy of Arts and Sciences, being president of the former in 1787-95, and was a member of the State convention which ratified the Federal Constitution.

TUFTS COLLEGE. A coëducational institution under Universalist control at Medford, Mass., founded in 1852, comprising the College of Letters, the Divinity School (1869), the Medical School (1893), the Dental School (1899), and a Summer School. It confers the degrees of Bachelor of Arts, Philosophy, Science and Divinity, Master of Arts, Doctor of Philosophy, Medicine, and Dental Medicine, and Civil, Electrical, and Mechanical Engineer. The course of study is almost entirely elective, only two subjects, English and mathematics, being required for one year. Provision is made in the Bromfield-Pearson School for students whose preparation for engineering studies is deficient. It has a biological laboratory at South Harpswell, Maine. The attendance in 1903 was 340 in the College of Letters, 48 in the Divinity School, 407 in the School of Medicine, and 197 in the School of Dentistry. The campus of 125 acres and the 20 college buildings were valued at $1,000,000. Among the buildings is the Barnum Museum of Natural History, given by the late P. T. Barnum, with a large zoölogical collection, especially rich in skeletons and mounted skins of mammals. In 1903 the college owned property to the amount of $2,000,000, and had an endowment of $1,700,000 and an income of $200,000. The library contained 50,000 volumes and is a depository for Government publications.

TU FU, tōō fōō (712-70). One of the most noted of the poets of China. He was born in 712 in Siang-yang (q.v.) in the present Province of Hu-peh, according to one authority, or in Tu-ling in Shen-si, according to another. An official career having been closed to him through lack of success in the literary examinations, he became a professional poet, and between the years 742 and 755 he produced three descriptive poems which gained for him the favor of the Emperor then reigning, and a position at Court, where he became very popular. Internal troubles, however, compelled the Emperor to flee, and Tu Fu fell into the hands of the rebels, from whom he managed to escape in 757. He was recalled by the new Emperor, and became a censor. Having in this capacity defended an official who had incurred the displeasure of the Emperor, he fell into disgrace, was banished from the Court, and given the petty position of a sub-prefect in a small town of Shen-si. This he promptly resigned and retired to Sze-chuen. He made the acquaintance in 761 of the military commandant of the province, who brought his case to the notice of the Emperor, and a post was provided for him in connection with the Board of Works. This he held for six years, until the death of his friend the commandant, when he resumed his wandering life. He produced a great many poems. The edition published in 1059 contained 1405 compositions. He is the most quoted poet in China. See specimens in Giles, *Chinese Literature* (New York, 1901).

TUGENDBUND, tōō′gĕnt-bōōnt. An association organized at Königsberg, Prussia, in February, 1808, for the purpose of furthering the physical and moral regeneration of the Prussian people in the period of national degradation following the disasters of the years 1806-07 and the dismemberment of the Prussian kingdom by Napoleon I. at Tilsit. Its secret purpose was the overthrow of the French domination. It was dissolved in December, 1809, after it had accomplished much good in its self-appointed task of bringing to life the spirit of Prussian patriotism.

TUGUEGARAO, tōō-gā′gȧ-rä′ō. The capital of the Province of Cagayán, Luzon, Philippines (Map: Philippine Islands, F 2). Cagayán is the most northern province of Luzon and is exceedingly mountainous. The climate is very severe in the winter, and not healthful in the summer, owing to the excessive humidity. The province is well watered and has a fertile soil; its area is 6587 square miles; the population numbers 112,360. The capital is situated on the river Cagayán, in the southern part of the province. It has a town hall, court-house, and a government building. Population, in 1887, 19,446; now 16,825.

TUILERIES, twēl′rē′ (Fr., tile-works). A former royal palace in Paris, situated on the right bank of the Seine, on ground occupied, before the fifteenth century, by a number of tile-works. The site was acquired by Louise of Savoy, mother of Francis I., in 1527, and the erection of the palace was begun about 1565 by Catharine de' Medici. The work was under the direction of Philibert Delorme (q.v.), who was succeeded in 1570 by Jean Bullant. The main structure of the original palace comprised a central pavilion, circular in form, and crowned by a cupola. Henry IV. caused the erection of the Pavillon de Flore on the south wing and began the construction of a long gallery connecting it with the Louvre (q.v.). Under Louis XIV. the central pavilion was altered from round to square and the Pavillon de Marsan on the north wing was erected. In spite of its imposing size, the palace possessed little artistic interest, owing to the great and rather unharmonious diversity of architectural form displayed in its long façade. Before the Revolution it was only intermittently a royal residence, though it was frequently the scene of splendid fêtes; in its theatre were given plays of Corneille, Molière, and Voltaire. On October 6, 1789, Louis XVI. and the royal family, brought by the Parisian mob from Versailles, took up their residence in the Tuileries. The palace was invaded by a mob on June 20, 1792, but little harm was done. On August 10th, however, the organized sections of Paris stormed the Tuileries and after a bloody battle cut down the Swiss Guard, who, after defending the great stairway of the palace with devoted courage, were ordered by the King to lay down their arms. The royal family were forced to take refuge in the hall of the Assembly and thence were removed to the Temple. In 1793 the Convention began to hold its sessions in the north wing of the palace, the Pavillon de Marsan being given up to committee-rooms, administrative offices, etc. After the establishment of the Consulate the Tuileries became the residence of Napoleon, and, with successive changes in internal construction, it remained the residence of the rulers of France to the fall of the Second Empire, with the exception of the years 1848-52. During the War of the Commune in 1871 the palace was set on fire (May 24th) at the orders, it is supposed, of the Communist leaders. In the night of May 24th-25th heavy explosions of gunpowder completed the ruin of the main structure. The right wing alone, containing the Pavillon de Flore, escaped destruction. The Pavillon de Marsan was restored in 1875-78. The ruins of the main buildings were removed in 1883. The Garden of the Tuileries, covering about 75 acres, lies between the Place de la Concorde, the site of the palace, the Rue de Rivoli, and the Quai des Tuileries. It was laid out by Le Nôtre in the time of Louis XIV., but has undergone extensive changes, especially under the Second Empire. It contains some notable examples of sculpture, and is a popular resort of the Parisians, being especially a favorite playground with children. See PARIS.

TUKE, DANIEL HACK (1827-95). A celebrated English alienist, born at York. He studied medicine at Saint Bartholomew's Hospital College, of London, and in 1852 became a member of the Royal College of Surgeons, of which he became a fellow in 1857. He was afterwards visiting physician to the York retreat for the insane, and subsequently medical practitioner at Falmouth. He wrote many essays on the treatment of insanity for scientific periodicals, and was coëditor of the *Journal of Mental Sciences*, 1878-92. He wrote a prize essay on the *Progressive Changes which have taken place since the time of Pinel, in the Moral Management of the Insane* (1854); *The Asylums of Holland, Their Past and Present Condition* (1854); *On the Canon of the New Testament* (1860); *Insanity in Ancient and Modern Life* (1878); and a *Dictionary of Psychological Medicine* (1892).

TUKE, HENRY (1755-1814). A Quaker writer, born at York, England. His father was William Tuke (q.v.), one of the founders of the first asylum for humane treatment of the insane. After his education in liberal studies he engaged in business with his father at York, and at the age of twenty-five he became a minister of the Society of Friends. His books were extensively read at home and some of them were translated into French, German, and Danish. The chief of them are: *The Faith of the People Called Quakers* (1801); *The Principles of Religion as Professed by the Society of Christians Usually called Quakers* (1805); and *The Life of George Fox* (1813).—His son, SAMUEL TUKE (1784-1857), studied medicine and became widely known for his strenuous defense of the asylum at York, and for varied philanthropic work. Among his publications are *Descriptions of the Retreat* (1813) and *Practical Hints on the Construction and Economy of Pauper Lunatic Asylums* (1815), which are highly important in the history of the treatment of the insane.

TUKE, WILLIAM (1732-1822). An English philanthropist. He was born in York, was a Quaker in religion, and engaged in mercantile pursuits the greater part of his life, but found time for many works of benevolence. His greatest achievement was the foundation of the York Retreat in 1796, the first institution in England where the insane were treated with kindness and humanity. In this undertaking he had the aid of his son, Henry, Lindley Murray, and other Quakers. Tuke's biography was written by his great-grandson (York, 1856).

TULA, tōō'lȧ. A government of Central Russia. Area, about 11,960 square miles (Map: Russia, E 4). It belongs to the Central Russian plateau and has an undulating surface cut by deep river valleys. It is watered chiefly by the Oka and its tributaries and the Don. Tula belongs to the black soil belt of Russia. In the southwest are deposits of coal, and iron ore is found in all parts. Agriculture is the main occupation, but the household industries are also remarkably developed. The chief manufactured products are small metal articles, 'samovars' (tea-kettles), wagons, musical instruments, arms, etc. The total output was valued at $10,000,000 in 1899. The trade in grain is extensive. Population, in 1897, 1,432,743.

TULA. The capital of the Government of Tula in Russia, situated on the Upa, 121 miles south of Moscow (Map: Russia, E 4). It is an interesting and important town, with an old Kremlin rising above the river, an extensive Government arms factory and a museum. Tula has also a number of private arms factories, and extensive metal works, where the 'samovars' (tea-kettles) for which Tula is famous are manufactured. Population, in 1897, 111,048.

TULA. A Mexican town of the State of Hidalgo, 45 miles by rail north of the City of Mexico, on the Tula River (Map: Mexico, J 7). The town, the ancient capital Tollan, is believed to have been founded by the Toltecs and contains the ruins known as 'Montezuma's Palace,' and others of interest attributed to those people. The fortress-like church and cloister of San José date from 1553. There are some cotton manufacturing establishments. Its present municipal population, based on the census of 1895, is about 5000.

TULA. A Mexican town of the State of Tamaulipas, 66 miles southwest of Ciudad Victoria. It is an important commercial centre in a rich agricultural district. The population of the municipality in 1895 was 19,421.

TULALIP, tōō-lä'lĭp (North American Indian, bay, inlet). A tribe of Salishan stock (q.v.) occupying a reservation of 36 square miles on Tulalip Bay, an eastern inlet of Puget Sound, Washington. They are the remnant of the Snohomish and subordinate tribes, who were assigned to the present reservation by the treaty of Medicine Creek in 1854, at which time they numbered 1000, but are now reduced by one-half. Through the efforts of Catholic missionaries they are now entirely civilized, half of them being church members, while the rest adhere to their ancient religion or to the new 'Shaker' Indian ceremonial. They are entirely self-supporting, depending partly upon the abundant natural fish supply and partly upon labor among the whites.

TULANE, tū-lān', PAUL (1801-87). An American philanthropist, born near Princeton, N. J. He received a common school education and in early life removed to New Orleans, where he engaged in business and acquired great wealth. He retired in 1867, and returned to Princeton. In 1882 he gave $2,000,000 worth of real estate in New Orleans for the erection and endowment of Tulane University (q.v.).

TULANE UNIVERSITY. An institution at New Orleans, La., organized on its present basis in 1884, when the State placed the existing University of Louisiana, chartered in 1845, under the perpetual care of the Board of Administrators of the Tulane Educational Fund. In 1882 Paul Tulane (q.v.) gave his property in that city for the higher education of the "white young persons in the city of New Orleans." His donations up to the time of his death amounted to $1,050,000. In 1886 Mrs. Josephine Louise Newcomb of New York gave the sum of $100,000 to establish the H. Sophie Newcomb Memorial College for the higher education of white girls and young women. A new and thoroughly equipped building for the medical department was given in 1891 by the widow of Dr. Richardson, a former professor, and in 1900 Mrs. Caroline Tilton gave a library building named in honor of her husband. The university consists of the Graduate Department, the College of Arts and Sciences, the College of Technology, the Newcomb Memorial College, the Law Department, and the Medical Department. It confers the bachelor's degree in arts, science, engineering, and law, the master's degree in arts and pharmacy, the doctor's degree in philosophy and medicine, and the degrees of mechanical, civil, chemical, and sugar engineer. All the departments are situated in the city of New Orleans. The campus contains about 18 acres, with 6 acres devoted to athletics. The total attendance in 1903 was 1364, the faculty numbered 91, and the library contained 45,000 volumes. The value of the grounds and buildings was estimated at $830,000, the total valuation of the university property being $2,186,000. The endowment was $1,230,000 and the gross income $129,000.

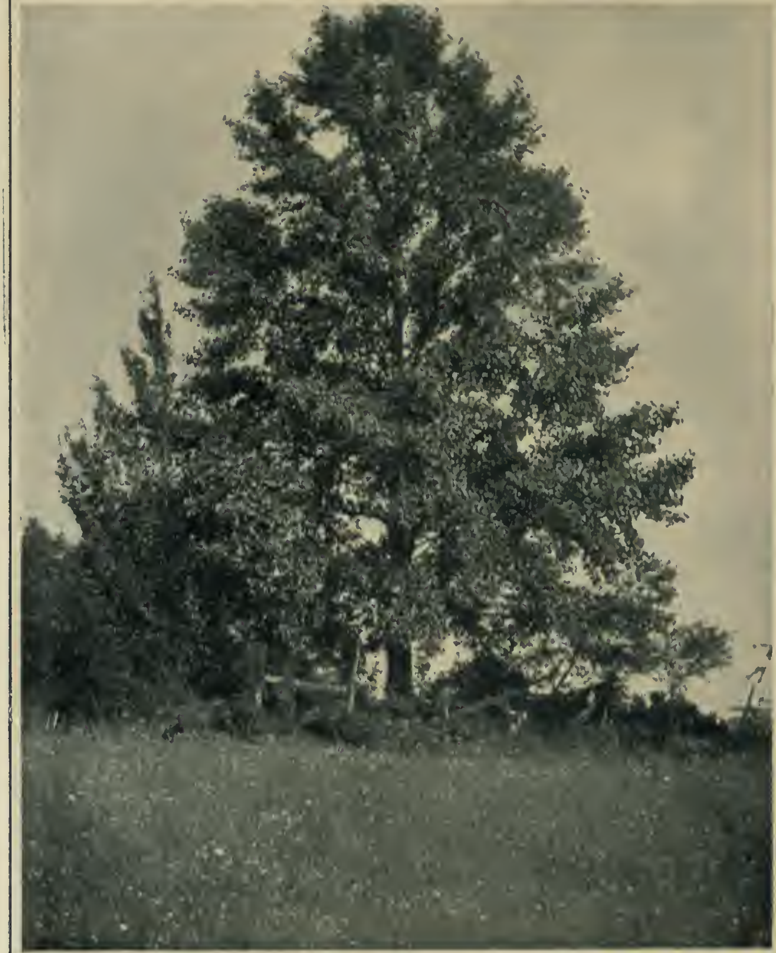
TULASNE, tụ'lȧn', LOUIS RENÉ (1815-85). A French botanist, born at Azay-le-Rideau (Indre-et-Loire). After studying law, he turned his attention to botany and made a specialty of parasite mushrooms, becoming the founder of modern mycology. From 1842 to 1872 he was, at first 'aide naturaliste,' then professor at the Museum of Natural History in Paris, lived afterwards at Cannes, and died at Hyères. His most important publications include: *Histoire et monographie des champignons hypogées* (1851); *Selecta Fungorum Carpologia* (1861-65), with his brother Charles; and many monographs in the *Annales du Muséum, Annales des Sciences Naturelles, Flora Brasiliensis,* and other periodicals. Among several discoveries he made, that of polymorphism of mushrooms created an epoch in the science.

TULCEA, or **TULTCHA,** tōōl'chȧ. A district town of the Dobrudja, Rumania, situated on an arm of the Danube, about 45 miles from the Black Sea (Map: Balkan Peninsula, G 2). It has a good harbor, with an extensive trade in fish, grain, and wool. Population, in 1900, 18,800.

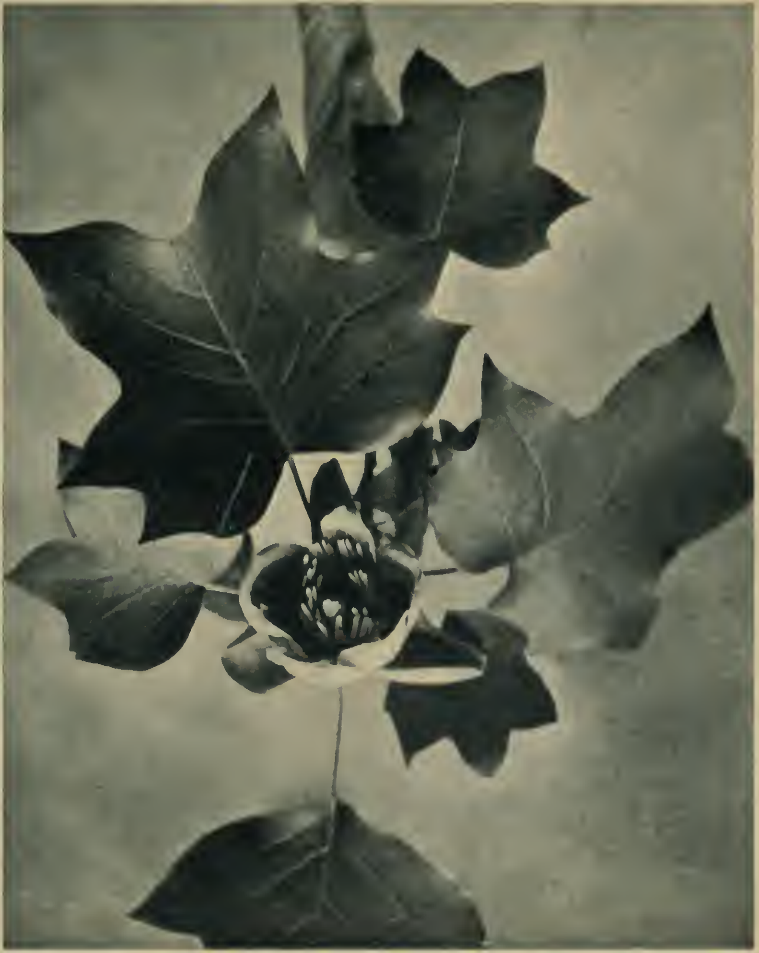
TULIP (OF., Fr. *tulipe,* from *tulipan,* tulip, *tulipant, tulpant, toliban, tolopan,* turban, from Turk. *tulband, dulband,* from Pers. *dulband,* turban), *Tulipa.* A genus of showy hardy plants of the order Liliaceæ, easily recognized by its fleshy brown-skinned bulbs, broad or linear leaves, and generally erect and usually solitary-flowered scapes. About 45 species are described, mostly natives of the warmer parts of Asia and Southern Europe. For several centuries the tulip has been a popular ornamental plant for spring and early summer flowering and has recently been used by florists for winter flowering. The species from which most of the cultivated varieties have been derived, *Tulipa Gesneriana,* is a native of Asia Minor and was brought from Constantinople to Germany by Conrad Gesner in 1559, since when innumerable varieties have been originated, 1800 varieties being offered by Dutch growers, who are the leading producers of these bulbs. The cultivated varieties of tulips are classified by florists as to their color into 'selfs,' flowers of one solid color; 'bizarres,' flowers with a clear yellow base or centre with orange, red, crimson, and other markings; 'roses,' flowers variegated with shades of rose, deep red, or scarlet; and 'byblœmans,' flowers of dark colors such as lilac, purple, brown, and black. Several other species have given rise to cultivated varieties, but to a much more limited extent. *Tulipa suaveolens,* a native of Southeastern Europe, is the wild species from which the early red and orange Duc van Thol tulips have been obtained. They are inferior to the common garden tulip in beauty, but are prized for their fragrance and earliness. (See Colored Plate of LILIACEÆ.) *Tulipa præcox* is the generally cultivated form of *Tulipa Oculus-solis,* a beautiful species from Southern France, characterized by a large black spot with a yellow border at the

TULIP (*Tulipa Gesneriana*).

TULIP TREE



TULIP TREE (Liriodendron tulipifera).



FLOWERING BRANCH.

base of each petal. *Tulipa Greigi*, a native of Turkestan, is a very fine species from which several cultivated forms have been developed. The natural species are rarely grown. Tulips are cultivated in gardens on all kinds of soils and in all positions, but they prefer a rich, sandy loam. The bulbs or offsets are planted in mid-autumn and the flowers appear in spring. When the plants have blossomed and the leaves have begun to dry the bulbs are taken up, dried in a cool airy place, and stored in a dry place until planting time. For pot culture tulips are treated like hyacinths. Young plants are also obtained by sowing the seed in light sandy soil under a cold frame in late winter. Seedlings seldom flower before they are five years old and are rarely stable; that is, after flowering one or more times they 'break' or develop a new form of color, which remains stable not only with the individual bulb, but with its offsets.

During the first half of the seventeenth century interest in the tulip rose to a speculative basis which has since been dubbed 'tulipomania.' Bulbs sold for fabulous prices, even 13,000 florins ($5,200) being paid for a single specimen of *Semper Augustus*. Indeed, ownership in individual bulbs was divided into shares; bulbs were sold before their existence and by men who possessed none; and of some varieties far more were sold than existed. The craze was short-lived, but during its progress it financially ruined many families.

TULIP TREE (*Liriodendron tulipifera*). A beautiful North American tree of the natural order Magnoliaceæ, found from Vermont to Michigan and south to Florida, Mississippi, and Arkansas, having a stem sometimes 100 to 140 feet high, and 5 to 9 feet thick, with a grayish-brown cracked bark, and many gnarled and brittle branches. The solitary terminal flowers resemble tulips. The bark has a bitter, aromatic taste, like other members of the Magnoliaceæ. The tulip tree is one of the most beautiful ornaments of pleasure-grounds. In some parts of the Mississippi Valley it forms considerable forests, seldom or never occurring alone, but in mixed woods. The heart-wood is yellow, the sap-wood white. The timber is easily wrought, takes a good polish, and is much used for house carpentry and other purposes where a light wood is desired. Fossil leaves of ancestors of the tulip tree are found in abundance in the North American and Arctic Cretaceous rocks. These earliest representatives had leaves that were not so distinctly lobed and that resembled, in their entire margins, more nearly those of the very young individuals than those of the full-grown trees of the modern plant.

TULL, Jethro (1674-1741). A noted British agriculturist and writer. He was born at Basildon, Berkshire, and entered Oxford in 1691, but two years later took up the study of law at Gray's Inn. In 1699, shortly after becoming a barrister, he settled upon a farm at Howberry, where, having trouble in making his laborers carry out his advanced ideas, he endeavored to make implements which would do the work "more faithfully than such hands would do." The results of his experiments are set forth in his *Horse-Hoing Husbandry, or an Essay on the Principles of Tilling and Vegetation* (1733; 2d ed., with addenda, 1743; 3d ed. 1751). French translations appeared in 1753 and 1757 and a new and somewhat altered edition was put forth by William Cobbett in 1822. This work, which is the first of its kind, exercised a profound influence on methods of soil management, and upon it Tull's fame chiefly rests. See Tillage.

TULLA, tụl'lȧ, Johann Gottfried (1770-1828). A German engineer. He was educated in Heidelberg and Freiburg, and after filling various engineering appointments became chief engineer of the construction of water and road ways for the Grand Duchy of Baden in 1813. He was the founder of the Engineer School of Baden, and subsequent to 1818 had much to do with the preparation of the plans for the deepening of the channel of the River Rhine. His writings include *Ueber die zweckmässigste Behandlung des Rheins* (1822), and *Ueber die Rektifikation des Rheins* (1825).

TULLE, tụl. The capital of the Department of Corrèze, France, 106 miles by rail southwest of Clermont-Ferrand, in the deep valley of the Corrèze (Map: France, H 6). It is a picturesque town with quaint houses. The cathedral (fifteenth century), with a fine bell tower, and the abbott's house (fifteenth century), are worthy of notice. A large Government firearms factory is situated in the suburb of Souilhac. From Tulle first came the famous machine-made lace of that name. Population, in 1891, 15,384; in 1901, 17,412.

TUL'LIA. In the legendary history of Rome, one of the two daughters of Servius Tullius, the wife of Aruns, son of Tarquinius Priscus. She murdered her husband and married his brother Lucius, whom she had persuaded to kill his wife. She then instigated the murder of Servius, and on her return from the senate house, where she had greeted her husband as king, drove her chariot over her father's corpse.

TULLIANUM. See Mamertine Prison.

TULLIBEE (North American Indian name). A well-marked and valuable whitefish (*Argyrosomus tullibee*) of the Great Lakes, Lake of the Woods, and northward. It is bluish with white sides showing silvery stripes.

TUL'LIVER, Maggie. The heroine of George Eliot's *Mill on the Floss*. She is the daughter of the miller, and with her brother is drowned by a tidal wave.

TUL'LOCH, John (1823-86). A Scottish scholar and educator. He was born at Dron, Perthshire, was educated at Saint Andrews, and ordained at Dundee, in 1845, as a minister in the Church of Scotland, and became principal of Saint Mary's College, in the University of Saint Andrews. In 1859 he was appointed one of her Majesty's chaplains for Scotland. He was highly appreciated as a broad-minded, progressive theologian, was moderator of the General Assembly in 1878, was appointed dean of the chapel royal and dean of the Thistle in 1882, and died at Torquay. Among his works are: *Theism* (1855); *Leaders of the Reformation* (1859; 3d ed. 1883); *English Puritanism and Its Leaders* (1861); *Beginning Life* (1862); *Rational Theology and Christian Philosophy in England in the Seventeenth Century* (1872; 2d ed. 1874); *The Christian Doctrine of Sin* (1876); *Modern Theories in*

Philosophy and Religion (1884); *Movements of Religious Thought in Britain During the Nineteenth Century* (1885). Consult his *Life* by Mrs. Oliphant (London, 1888; 3d ed. 1889).

TULTCHIN, tōōl′chĕn. A town in the Govment of Podolia, South Russia, about 100 miles east of Kamenetz-Podolsk. Population, in 1897, 19,202.

TULUS, tōō′lōōz. One of the civilized, or half-civilized, Dravidian peoples of Hindustan. They inhabit the coast region about Mangalore, and number some 350,000. Their language is closely related to ancient Kanarese. Consult: Brigel, *Grammar of the Tulu Language* (Mangalore, 1872); Männer, *Tulu-English and English-Tulu Dictionary* (ib., 1886-88).

TUMACO, tōō-mä′kō. A town of the Department of Cauca, Colombia, 150 miles southwest of Popayán, on the Pacific coast (Map: Colombia, B 3). It is the most southerly port of Colombia, and has an extensive local steamer trade with Guayaquil and Panama. Population, about 6000.

TÚMBEZ, tōōm′bâth. A seaport in the Department of Piura, Peru, 80 miles southwest of Guayaquil (Map: Peru, A 4). The town was an important port of the Incas and the landing place of Pizarro. Population, about 2000.

TUMBLE-BUG. See Dung-Beetle.

TUMBLEWEEDS. Plants, chiefly annuals, especially abundant in prairie regions. They scatter their seeds as they are rolled or tumbled from place to place by the wind. See Seed.

TUMBOA. See Gnetaceæ.

TUMOR (Lat., swelling, state of being swollen). In medicine, an abnormal increase in size of an area of tissue or of an organ; a swelling, excluding swellings occurring in the course of simple inflammation. In pathology, a tumor is an overgrowth or hypertrophy, deviating in size and shape from the normal, with an inherent power and method of growth, this growth being independent of the rest of the body. Pathologists include under the term tumor ulcerations and their boundaries, when such boundaries are composed in part, at least, of new tissue. Pathologically, then, a tumor is a growth of new tissue in the body which causes local increase in the size of the part or organ in which it occurs. Tumors are distinctly pathological formations, subserving no useful physiological purposes; in fact, usually growing at the expense of useful tissues and organs.

The tissues of which tumors are composed conform to the same general types as are normally found in the body, with the exception that in the case of some tumors there is a tendency toward the reversion of the tissues to embryonic forms. Tumors usually originate in tissues which are of like structure with that of the tumor itself. Thus connective-tissue tumors usually take their origin in connective tissue, epithelial tumors in epithelium, etc. When such tumors remain confined to the tissues in which they originate they are known as homologous tumors. When, however, they spread to surrounding tissues of a different type, or when, as occurs in the case of malignant tumors, new tumors are started in distant tissues and organs by means of the dissemination of bits of tissue from the primary growth through the blood and lymph, they are known as heterologous tumors.

Some tumors are congenial, notably the nævi or vascular tumors. In some cases there appears to be a distinct hereditary tendency to tumor formation; yet ideas as to the heredity of cancer are grossly exaggerated in the minds of the laity, for, while the occurrence of cancer in several generations has been observed, the absence of cancer in the children and grandchildren of persons who have been afflicted with the most malignant forms has been equally noted. Inflammation resulting from injury, especially from long-continued slight irritation, seems to be a frequent cause of tumor formation, injuries to bone being quite frequently followed by the development of osteo-sarcoma. Also injury, as for example from a blow or from a fall, not infrequently precedes the development of cancer of that organ. Cancer of the tongue or lip is often apparently traceable to the constant irritation of a broken clay pipe or of a rough tooth. In general it would seem that tumors of the connective-tissue type (sarcoma) most frequently follow a single injury, as for example from a blow, while tumors of the epithelial type (epithelioma, carcinoma) are more apt to occur as the result of frequently repeated slight irritations. Chronic inflammation seems to bear some causative relation to tumor formation. This is evident in the frequent association of carcinoma of the liver with cirrhosis of that organ. Again, malignant tumors or cancer not infrequently find their starting point in such local malformations as skin nævi. Age and sex also play important rôles among the predisposing causes of tumors. Thus epithelial cancer or carcinoma is rare in persons under thirty years of age. Cancer of the breast is far more common in the female, this being undoubtedly due to the greater functional activity of that organ in the female. Cancer of the tongue and lip is, on the other hand, much more common in the male. This is probably due to the fact that frequent irritation from smoking is much more common in that sex.

As to the primary causative factor in the production of tumors we have as yet very imperfect knowledge. Of the many theories which have been advanced in explanation of tumor growth, probably the most ingenious and the one to which at present greatest credence is given is one advanced by Cohnheim. According to his theory, during embryonal development some cells stop developing. These cells may either remain in among tissues of their own kind or may become displaced in the course of further development of the surrounding tissues and so come to lie among other tissues. Such cells lie dormant for long periods until something in their environment calls them into activity, when they proceed to develop with all the potential growth of young embryonal cells. Furthermore, being unlimited by the wear and tear of physiological function, as is the case with normal tissues and organs, they are free to devote their entire energies to growth. For these two reasons, the high potentiality for growth of embryonal tissue and the lack of any control of the growth by the requirements of function, tumor tissue, especially of the embryonal type, is apt to be characterized by a sort of irregular, wild cell-growth quite different from the orderly arrangement of cells in normal tissues. While Cohnheim's hypothesis offers a very satisfactory explanation of most of the phenomena connected with the growth of tumors, it must be remembered that it is as yet purely a theory, with absolutely no basis in known facts; that no one has ever been able to demonstrate any of these little islands of embryonal tissue lying dormant and waiting to be excited into tumor formation. Bacteria as the excitants of tumor formation have been exploited by some investigators. While some at present believe that the true cause of cancer will ultimately be found to be bacterial in nature, the majority tend to the opinion that the presence of bacteria in tumors is an external accidental occurrence rather than an internal causative factor.

Tumors grow (1) by direct extension from the periphery, and (2) by a growth of the tumor at its centre and a consequent pushing outward of its peripheral parts, or 'central growth.' (3) Tumors also extend by what is known as metastasis. This with the formation of what are known as metastatic tumors occurs by the dissemination of cancer cells by means of the blood and lymph. In this way bits of cancer tissue are carried to remote parts of the body. This metastasis from a single primary focus may occur in any tissue or organ, and quite commonly occurs in many tissues and organs either in succession or at approximately the same time. It is one of the surest evidences of the malignancy of the original tumor. These cancer cells lodging in the tissues set up new centres of growth, of the same nature as the mother growth. As the process of growth goes on in tumors so also does the process of degeneration. Tumors may ulcerate or become gangrenous, abcesses may form in them, and they may undergo fatty or calcareous degeneration. Degenerative changes are more frequent in the softer more rapidly growing forms.

Various classifications of tumors have been suggested, all of which are more or less unsatisfactory. Clinically, tumors are frequently simply divided into two classes: (1) benign tumors, or tumors which are in themselves harmless, and (2) malignant tumors, as cancer and sarcoma. The most common and as yet most satisfactory classification of tumors is morphological, based upon their structure relative to the normal body tissues. The following is the classification given in Delafield and Prudden's *Handbook of Pathological Anatomy and Histology* (1902):

CONNECTIVE-TISSUE TYPE.

Normal Tissue.	*Form of Tumor.*
Fibrillar connective tissue:	Fibroma.
Mucous tissue:	Myxoma.
Embryonal connective tissue:	Sarcoma.
Endothelial cells:	Endothelioma.
Fat-tissue:	Lipoma.
Cartilage:	Chondroma.
Bone:	Osteoma.
Neuroglia:	Glioma.
MUSCLE-TISSUE TYPE.	
Smooth-muscle tissue:	Leiomyoma.
Striated-muscle tissue:	Rhabdomyoma.
NERVE-TISSUE TYPE.	
Neuroglia.	
VASCULAR-TISSUE TYPE.	
Blood vessels:	Angioma.
Lymph vessels:	Lymphangioma.
EPITHELIAL-TISSUE TYPE.	
Glands:	Adenoma.
Various forms of epithelial cells and associated tissues:	Carcinoma.

Classification according to histogenesis (developmental history of the tissues) has been attempted; and while there are reasons for believing that embyrology may ultimately furnish the proper basis for tumor classification, that which it has thus far furnished is less satisfactory from a practical standpoint than the morphological classification. When, as is not infrequently the case, more than one kind of tissue is present in a tumor, a combination of terms is used to designate its nature. Thus a combination of a tumor composed of embryonal connective tissue with a bony tumor is known as an osteo-sarcoma; a muscle-tissue tumor in which much more than the usual amount of connective tissue is present, as a fibro-myoma, etc. In addition to the new growths included in the classification given there are other forms of tumors or of structures sometimes called tumors which do not fall within any of the subdivisions of the classification. Among these may be mentioned cysts of various kinds, including the so-called 'dermoid cyst' and teratoma; such congenital tumors as moles, nævi, and angiomata, etc. The peculiar placental tissue tumor known as deciduoma may also be mentioned.

NON-MALIGNANT TUMORS. These are composed of tissues of the types found in the adult and are in themselves not dangerous to life, although sometimes serious from pressure upon or involvement of important organs. They do not as a rule grow as rapidly as do malignant tumors: they do not tend to recur when completely removed, do not form metastases, do not involve neighboring lymph glands, and do not as a rule interfere with the general health of the patient.

Fibroma.—This tumor is composed of fibrillar connective tissue of the type found in the adult. Fibromata vary even more greatly in consistency than does ordinary fibrous tissue, those containing many fibres and few cells being hard and firm, *fibroma durum;* those containing proportionately many cells being soft, *fibroma molle.* They are commonly inclosed in a definite fibrous capsule. The softer fibromata are frequently very vascular, while the harder forms usually contain few vessels. They are found in the skin and subcutaneous connective tissue, in the connective tissue framework of the various organs, in the mucous membranes, in the intermuscular septa, in nerve sheaths, etc. Mucous polypi of the nose are examples of this kind of tumor.

Myxoma.—Myxomata are tumors composed of tissue which resembles a type of tissue found only in extremely small amount in the adult and known as mucous tissue. Mucous tissue is therefore essentially embryonic. These tumors resemble the fibromata in structure, being made up of connective-tissue cells with a fibrillar intercellular substance. The softer tumors are known as *myxoma gelatinosum*, or *myxoma molle,* while those of greater consistency are known as *myxoma medullare.* Myxoma is of comparatively rare occurrence in pure form. More commonly myxomata are combined with tumor tissue of other types to form complex tumors of which the most common are lipo-myxoma and fibro-myxoma. They most frequently develop in fat.

Lipoma.—Lipomata are fatty tumors. They may be quite firm from the presence of fibrous tissue, *fibro-lipoma*, or soft, *lipoma molle.* Lipoma is a very common form of tumor, being often superficial, developing in the subcutaneous fat. Lipomata may, however, develop anywhere where fat is found and consequently have a wide distribution. They are generally inclosed in firm fibrous capsules and occur usually on the shoulders, back, or forearms.

Chondroma.—These are tumors in which the new-formed tissue resembles cartilage of either the hyalin or fibrous variety.

Osteoma.—Osteomata or bony tumors are rather rare as pure tumors. Associated with other forms of tumor tissue (as osteo-sarcoma, osteo-fibroma, etc.), they are more common. Osteomata as a rule develop in bone. Less commonly they originate in other tissues.

Glioma.—Gliomata are connective-tissue tumors which follow the structure of the nervous system connective tissue, or neuroglia. Gliomata are soft and usually vascular, thus predisposing to hemorrhage. They are also extremely liable to fatty degeneration. As a pure type they are rare. Associated with other forms of connective-tissue new growths, the glyo-sarcoma, glyo-myxoma, etc., they are more common. They occur chiefly in these parts of the nervous system where neuroglia is found, e.g. in the brain and cord, the ganglia, and in the optic and olfactory nerves.

Myoma.—Myomata are tumors whose tissue elements are analogous to those found in muscle tissue. Like normal muscle, they may be divided into two forms, one in which the tissue elements are smooth, or involuntary muscle, the other in which the tissue elements are striated, or voluntary muscle. To the former the name 'leiomyoma' or 'myoma levicellulare' has been given, to the latter the name of 'rhabdomyoma' or 'myoma striocellulare.' Myoma is rare.

Neuroma.—Neuromata are divided into true neuromata and the so-called false neuromata. True neuromata are extremely rare. They consist of nerve tissue and may be of the ganglionic type in which new nerve cells develop, or of the fibrillar type which consist of new-formed nerve fibres. Neuromata may be single or multiple, the latter frequently occurring along the branches of distribution of a single peripheral nerve. They occur in stumps after amputation of a limb and are often extremely painful. The 'false neuromata' are not neuromata at all, but fibromata, sarcomata, myxomata, etc., of the connective tissue of the nerve trunks.

Angioma.—These tumors consist of newly formed blood or lymph vessels and are of two kinds, hæmangioma and lymphangioma. The former are subdivided into simple angioma or *angioma telangiectoides* and *angioma cavernosum.* The simple angiomata are composed of masses of blood vessels, mainly capillaries, held together by connective tissue. The so-called 'strawberry' marks or vascular nævi, usually of the face, are congenital tumors of this variety.

Tumors Sometimes Benign, Sometimes Malignant. *Endothelioma.*—These tumors originate from that type of connective tissue known as endothelium which forms the linings of blood vessels, lymphatics, etc. On account of their extremely cellular character and on account of the reduction of their intercellular basement substance to a minimum, these tumors bear a close morphological resemblance to the carcinomata, among which they are often classed. Endotheliomata are most common in the pleura, peritoneum, dura mater, and pia mater. Less frequently they occur in brain, liver, ovaries, testicle, lymph nodes, salivary glands, bone, and skin. They may be large or small, single or multiple, and may form metastases.

Adenoma.—Adenomata are epithelial tumors in which the epithelium is glandular in type and is arranged in more or less distinct alveoli. They thus correspond in structure to a gland. The alveoli are supported as tumors in the irregularity of the arrangement of their component elements. Blocking up of the ducts of the glandular tissue sometimes leads to an accumulation of secretion within the alveoli and the formation of cysts. When this cyst formation is a prominent feature of the growth the term cyst-adenoma is used to designate the tumor. Of these the most important is the multilocular cyst-adenoma of the ovary. Most adenomata are non-malignant, rather slow growing tumors. The most common sites are the ovary, mammary gland, kidney, liver, submaxillary, sublingual, parotid, thyroid, and lachrymal. They also occur in those mucous membranes which are supplied with glands, as for example the mucous membranes of the stomach, intestines, nose, pharynx, etc. The most common sites of malignant adenomata are the stomach, intestines, mammary gland thyroid, and uterus.

Malignant Tumors. *Sarcoma.*—Sarcomata are tumors of the connective-tissue group. They differ from connective-tissue tumors in that the connective tissue of which the sarcomata are composed is of the embryonal form. This has a very distinct bearing upon their malignancy, for, as has been already mentioned, embryonal tissues possess much greater powers of growth than do adult tissues. Sarcomata are usually classified according to the character and arrangement of their cellular elements. Thus we have small round-celled, large round-celled, small spindle-celled, large spindle-celled, giant-celled or myeloid, stellate-celled sarcoma, etc. The ends of long bones like the tibia and humerus are frequently affected. The mammary glands are sometimes the sites of sarcoma, as also the sheaths of peripheral nerves. Sarcoma is as a rule an affection of early life. From ten to forty it is most common, and uncommon after the latter age. The two sexes are about equally susceptible.

Carcinoma.—Carcinomata are malignant tumors of epithelial tissue. The epithelium is as varied in character as is normal epithelium. The epithelial elements are supported by a more or less abundant connective-tissue framework, or stroma, which forms bundles of fibres irregular in arrangement, and in the meshes of which are cavities or alveoli in which the epithelial cells lie loosely without any definite arrangement. In general the epithelial cells conform to the different normal types; but we find, as is the case with all cancerous growths, an irregularity as to shape, size, and arrangement which is much more marked than in normal epithelium. And even in a carcinoma where a particular type of cell predominates, other forms of cell are frequently intermingled with the predominating form.

Carcinoma occurs as a primary tumor in tissues of epiblastic origin. It originates in any of the various forms of epithelium. It is not believed to occur as a primary tumor in such tissues as bone, muscle, etc., which originate in other embryonic layers. Carcinoma may, however, involve any of the body tissues. When it involves tissues other than epithelial, it is probable that the growth is secondary, the primary tumor in epithelium being so small as to have passed unrecognized.

The very hard and firm form of carcinoma so common in the female breast is known as 'scirrhous cancer' or fibro-carcinoma. Its hardness is due to the large amount of dense fibrous tissue, the cellular elements being comparatively few. Very soft carcinomata, made up almost entirely of cells with a minimum amount of connective tissue, are called 'medullary cancer' or *carcinoma molle.* Melano-carcinomata are tumors in which more or less brown or black pigment is deposited in the cells or in the connective-tissue stroma. Carcinomata whose cells have undergone mucoid degeneration or whose stroma is of the type found in mucous connective tissue are known as 'carcinoma myxomatodes.' Gelatinous carcinoma is a form of carcinoma in which the cells become filled with a translucent gelatinous material. In some tumors these droplets of gelatinous substance, which have taken the place of the epithelial cells, coalesce to form considerable areas of gelatinous material. These areas frequently give an alveolar appearance, for which reason this form of carcinoma is frequently referred to as 'alveolar carcinoma.'

Epithelioma is a form of carcinoma which originates in squamous epithelium. The structure of the tumor tissue corresponds roughly to that of squamous epithelium as seen in the skin and mucous membranes. Thus there are flattened squamous surface cells, irregular cells such as are found in the deeper layers of the skin, 'prickle' cells, cuboidal cells, etc. Not infrequently squamous cells are packed in together in crescentic forms known as epithelial 'pearls.' Epithelioma or 'epithelial cancer' is most common around the orifices of the body where skin and mucous membranes unite, as for example around the openings of the mouth, nose, eyes, vagina, etc. The malignancy of an epithelioma depends much upon the growth powers of its cells and the extent to which these cells tend to infiltrate surrounding tissues. In general it may be said that epitheliomata are the most slow growing and least malignant of all forms of cancer. They may, however, recur unless completely removed and may form metastases.

Malignancy of Tumors. Many tumors which are in themselves benign in character may be dangerous to life from their position and consequent interference with the functions of important organs. Such tumors, although sometimes causing death, are not classed as malignant tumors. Malignant tumors proper present certain well-defined characteristics of their malignancy. Among these may be mentioned, first, their tendency to local recurrence after removal. This has led to the rule of the surgeon when operating on cancer to cut wide of the growth, even though the tumor may seem small and insignificant, in the hope of removing all trace of cancerous tissue even at the sacrifice of some healthy tissue. This local recurrence after apparently complete removal is undoubtedly due to the fact that cancer cells have extended out beyond the limits of the visible tumor. It is customary in some cases to have immediate microscopical examination made of the periphery of the mass removed, to determine the presence or absence of cancer cells at the outer limits of the operation. Secondly may be mentioned the tendency of a malignant tumor to extend by direct continuity of growth to surrounding tissues. In 'discontinuous peripheral growth' there are at first microscopic extensions outward of cancer cells from the periphery of the tumor. These grow and form nodules near, though at first separated from, the main tumor mass, but which afterwards spread and usually join the original tumor. A third and very characteristic mark of malignancy in a tumor is the formation of what are known as metastatic tumors. These are secondary tumors of the same general nature as the parent growth. They may occur in any tissue or organ, no matter how distant, and are the result of cancer cells disseminated through the blood and lymph. These cells, lodging, form the starting points of new or secondary or metastatic growths. These secondary growths may also act as new centres of infection from which other metastatic tumors may arise. A fourth evidence of malignancy is the effect of the presence of the cancer upon the general health of the patient. General impairment of the patient's health is due to many factors, such as the drain upon the whole system of a rapid new growth, the absorption of injurious matter from the tumor itself, the effect of suppuration or necrosis, etc., and is known as 'cancerous cachexia.'

Development and Treatment of Certain Tumors. Carcinoma, or scirrhous cancer, is the form most frequently seen in the breast, where it is invariably primary. It follows a blow or other injury, in many cases; often no cause can be assigned. It most commonly commences as a small, circumscribed tumor, round, hard, slowly growing, and with little or no pain. As it increases in size it becomes irregular, granular, and adherent to the adjacent parts. Infiltration of the surrounding structures follows, the pectoral muscles may become involved, and the skin may become attached. The skin also becomes stretched and shining, stiff and brawny. Œdema of the arm follows, with enlargement of the axillary glands. The pain now becomes intense and fairly constant, extending not only to the shoulder, but down the arm to the hand. The nipple, as in some non-malignant tumors, becomes retracted and deeply attached. As the process goes on the cellular tissue, intercostal muscles, and ribs may become attacked, the pleura may be invaded, and hydrothorax as well as visceral deposits may follow.

The duration of life after the occurrence of scirrhus of the breast is about three years. In old people the progress is slow, and in a few recorded cases life was prolonged for ten years. Most cases occur between the ages of thirty and forty-five years. The treatment consists of removal of the growth as early as found. In most cases the whole breast should be removed, and the axilla be laid open, that all enlarged lymphatic glands may be excised. Caustics are rarely successful. Quacks are prone to diagnose simple fibromata as cancers, and then cure them with caustics. The use of light has proved of increasing efficacy in the removal of malignant growths, and it is confidently expected that Finsen's light or the X-ray will become a substitute for the knife. See PHOTOTHERAPY; X-RAY.

Epithelioma, or 'epithelial cancer,' is often diagnosed from other tumors with much difficulty. The following points are of assistance: (1) It occurs almost invariably on muco-cutaneous surfaces. (2) It ulcerates very early. (3) Ulceration follows upon the new growth so rapidly that it seems to spread by ulceration. (4) It arises after local irritation. (5) There is no metastasis to internal organs in the vast majority of cases of epithelioma. It is common in middle-aged or elderly people. Epithelioma of the lip, an ordinary form, follows smoking (and hence is called 'smokers' cancer'), or irritation from a broken tooth, intermittent pressure of some article held in the mouth, as a painter's dust-brush, etc. It commences generally as a small wart or flat tubercle with hard edges and a suppurating surface. Ulceration spreads, the edges of the ulcer being hard and thickened. It scabs over and the scab scales off again. Glands in the neck become enlarged, and the muscles of the face become involved. Early excision of a liberal V-shaped section of the lip, the larger part being removed from the vermillion border, and the cut edges being stitched together afterward, is the proper treatment. Frequently from three to seven years pass before recurrence in the scar follows, or recurrence may never take place. In some instances the ligature, or the écraseur, or caustic is preferable. The X-ray or Finsen's light may also succeed.

Consult: Delafield and Prudden, *Handbook of Pathological Anatomy and Histology* (New York, 1901); Virchow, *Die krankhaften Geschwülste* (Berlin, 1900); Park, *Surgery by American Authors* (Philadelphia, 1901).

TUNA. See PRICKLY PEAR.

TUN'BRIDGE. A market town in Kent, England, on the Medway, 27 miles southeast of London (Map: England, G 5). The manufacture of toys, boxes, and articles of wood in Tunbridge ware, a mosaic veneer of beech, holly, etc., is a specialty. A notable feature is the remains of a mediæval castle, which stands on the Medway, near the entrance of the town. It has a noble gate tower of great size, richly ornamented. Among other structures are the parish church, a large restored building, and the grammar school, founded in 1553, with an endowment of £5500 a year. Population, in 1901, 12,736.

TUNBRIDGE WELLS. An English inland watering-place, on the border of Kent and Sussex. five miles south of Tunbridge (Map: England, G 5). Its picturesque surroundings, healthful climate, and chalybeate springs have rendered it a fashionable resort since the seventeenth century. It has a large trade in the various articles made of Tunbridge ware. The wells, discovered in 1606, are situated at the head of a promenade called the Pantiles. The principal buildings are the corn exchange, town hall, public hall, sanatorium, and mechanics' institute. The town was incorporated in 1889; it owns an excellent water supply, sewage farms, electric lighting works, and a cemetery. Population, in 1891, 29,254; in 1901, 33,388. Consult Ward, *Surrey and Sussex* (London, 1897).

TUNDRA (Russ., from Finnish *tuntur*, marshy plain). The name given to regions in Arctic America, Asia, and Europe, characterized as swamps of bog moss on which the snow-white reindeer moss and various kinds of lichens flourish. A luxuriant growth of flowering plants is also a characteristic of some of the tundras. The tundras are visited by wild birds in the summer, at which time they are inaccessible morasses, but in the winter they may be readily crossed. The soil at a depth of one or two feet below the surface remains frozen throughout the year, and the thickness of the vegetable growth increases annually, so that the surface of the tundra slowly rises. The rivers that flow through the tundras expose a great depth of layers of ice and frozen soil, in which the bones of the mammoth, the rhinoceros, and other extinct animals are sometimes found. See ALASKA; SIBERIA.

TUNGSTEN (Swed. *tungsten*, from *tung*, heavy + *sten*, stone), or WOLFRAM. A metallic element discovered by d'Elhujar in 1781. It is not found native, but occurs as the tungstate of iron and manganese in the mineral *wolframite*, as the calcium tungstate or *scheelite*, as the trioxide or *wolfram ochre*, and in small quantities in other rare minerals. The metal itself may be prepared by heating the trioxide with carbon or in a current of hydrogen, or by heating the chloride in vapor of sodium.

Tungsten (symbol, W (wolfram); atomic weight, 184.83) is a bright, steel-gray, hard, brittle, crystalline substance, with a specific gravity of 19.12. It melts only at the strongest white heat. It is chiefly used to increase the hardness and tenacity of steel and thus improve it as a material for hard tools. Tungsten combines with oxygen to form a dioxide and a trioxide, the latter of which unites with water to form tungstic acid, which in turn combines with bases to form a series of salts called *tungstates*. Of these the sodium tungstate is sometimes used to replace sodium stannate as a mordant in dyeing and printing. Fibres dipped in a solution of this salt are rendered fireproof.

TUNGSTITE. A mineral tungsten trioxide crystallized in the orthorhombic system. It is of a bright-yellow or green color. It is found with other tunsten minerals in Cornwall and Cumberland, England, and as a coating or in cavities in Monroe, Conn., and Cabarrus County, N. C. The preparation of artificial crystals of this mineral has been reported.

TUNGUS, tụn'gụz. A group of peoples of the Ural-Altaic or Sibiric stock embracing the tribes of the Tungus proper, whose territory extends from the Yenesei to the Pacific and from the Arctic Ocean as far south as latitude 40°, and the Manchus. The Tungus proper consist of the northern Tungus, comprising the Olchas or Mangun, at the mouth of the Amur, the Oroks in the northern part of the island of Saghalien, the Orochons, on both banks of the Amur, the Manegers, on the left bank of the Amur east of the Orochons, and the Olennyié or Reindeer Tungus; the southern Tungus, including the Golds of the lower Amur and the Ussuri, the Oroches on the coast, and the Daurians, or Solon-Daurs, mixed with Mongols in Kulja; and the maritime Tungus or Lamuts of the shores of the Sea of Okhotsk. Among some of the Tungus Shamanism of a primitive sort prevails. The influence of the Russians, which began in the middle of the seventeenth century, is felt chiefly in the social life of the people. The Golds of the Amur, who have long been under the influence of China, have developed an exceedingly interesting ornamental art. They show considerable capacity for civilization. The Manchus are being more and more absorbed by the Chinese, whom their ancestors once conquered. The Tungus generally are of medium height, but the Manchus are often very tall. The skull-form tends to be mesocephalic. Consult: Hiekisch, *Die Tungusen* (Saint Petersburg, 1879); Schrenck, *Reisen und Forschungen im Amurlande* (ib., 1881-91); Castrén, *Grundzüge einer tungusischen Sprachlehre* (ib., 1856).

TUNGUSKA, tụn-gōō'skȧ. A name given to each of the three large eastern tributaries of the Yenisei River in Siberia. They are distinguished as the Upper, Middle, and Lower Tunguska. The first is more commonly known as the Angara (q.v.), the second as the Stony Tunguska, and the third as the Lower Tunguska.

TUNGUSKA, Lower. The northernmost of the three chief tributaries of the Yenisei River in Siberia (Map: Asia, K 2). It rises on the Vitim Plateau in the Government of Irkutsk, about 200 miles northwest of Lake Baikal, and flows first north, then northwest, joining the Yenisei near Turukhansk, not far from the Arctic Circle, after a course of 1600 miles. Its upper course flows between low banks covered with pine forests, but lower down the banks become higher and rocky, and the river penetrates a range of mountains in a series of rapids. The river is navigable about 450 miles, but it is frozen in its lower course for seven months in the year. The ice here blocks the upper waters in the spring, causing extensive inundations. The Lower Tunguska comes within 14 miles of the Lena River.

TUNÍCA, tōō-nē'kȧ. A North American Indian linguistic stock. See Toníca.

TUNICATA (Lat. nom. pl. of *tunicatus*, p. p. of *tunicare*, to clothe with a tunic, from *tunica*, tunic). The single class of the Urochorda (q.v.), containing small marine animals inclosed in a soft elastic tunic, which opens by two apertures (oral and anal), and contains tunicin, a substance resembling cellulose. The tunic is usually thick, tough, and leathery, but may be very thin and delicate, especially in some of the smaller forms. The mouth, supplied with tactile organs, opens into a capacious pharynx, which contracts abruptly into a narrow œsophagus, then expands into a stomach, followed by a more or less coiled intestine that terminates close to the atrial pore or orifice (the other opening in the tunic). The walls of the pharynx are perforated by numerous slits, through which the water, entering at the mouth passes out into the cavity of the tunic and thence escapes through the atrial pore, carrying with it the waste matter, reproductive products, etc. The pharynx is thus an important respiratory organ and is correspondingly richly supplied with blood vessels. The heart is peculiar, in that it reverses its beating, pumping the blood in one direction for a time, then pausing and presently pumping the blood in the other direction for an equal length of time. The nervous system is greatly reduced, and sense organs, except those of touch, are generally wanting. The muscular system is well developed in some forms, especially in the tunic, but in others it is reduced and serves chiefly for closing the oral and atrial pores. Reproduction is not only by eggs, but takes place in many forms also by budding. In size and color, the tunicates offer the greatest possible diversity. The smallest forms are, as individuals, only a few millimeters long, though the colonies which they compose are often many inches in diameter. The largest individuals are six or eight inches high, though some forms are on stalks of much greater length. In color we find some species jet black and some pure white, and others fire red, but dull shades of greenish, grayish, or brownish are more common. Many of the free-swimming forms are almost transparent and nearly colorless.

The number of species of tunicates is large and the classification has varied greatly with different writers. They are a comparatively well defined group and are now considered as a considerably degenerated offshoot of the branch from which the Chordata have arisen. (See Ascidian.) The tunicates may be conveniently divided into three orders, the Larvalia, the Thaliacea, and the Ascidiacea. The Larvalia are a very small group, containing only one family and few species, remarkable for their small size and free-swimming habits, and the retention throughout life of certain characters which in the other orders occur only temporarily during their development. These larval characters are especially the tadpole form with a tail, the nerve cord, and the persistent notochord or urochord. The Thaliacea are also free-swimming, but are much larger and more degenerate or specialized forms. There are three families, one of which contains the beautiful salpas (q.v.) The order Ascidiacea contains three suborders and a dozen or more families. One suborder is free-swimming like the salpas, and so is called the Salpiformes; the second, called Compositæ, contains fixed forms which multiply extensively by budding and thus form compound organisms, the individuals of which are usually very small; the third suborder, the Simplices, are almost always fixed individuals (see Ascidian); but in many cases large numbers of individuals are united by a common stolon from which they have arisen by budding, and these forms are sometimes known as social ascidians. The Simplices are better known, popularly, than the other suborders, and many of them have popular names, as sea-pork, sea-peach, sea-potato, and sea-squirt.

Consult Herdman, "Report on the Tunicata," in *Challenger Reports*, vol. vi. (London, 1888).

TUNING. The process of bringing into perfect musical accord the strings, pipes or membranes which constitute tone-producing elements of the various musical instruments. As a rule the wind instruments do not require special tuning, for their pitch is constant. Keyed instruments (the piano and organ) require only occasional regulation of their strings and pipes; but the stringed instruments need to be tuned constantly. See MUSICAL INSTRUMENTS; PITCH; TEMPERAMENT.

TUNING-FORK. A contrivance for regulating the pitch of the voice or of a musical instrument. It consists of two prongs of steel springing from a handle, and so adjusted as to produce a fixed note when struck. It is tuned in a^1, which has 435 double or 870 single vibrations per second. The *tuning-cone* is a hollow, metal cone used in tuning the metal flue-pipes of an organ. To lower the pitch of a pipe, the inverted cone is pushed down over its top; to raise the pitch, the point of the cone is inserted in the pipe.

TU'NIS (Fr. *Tunisie*). A French protectorate in North Africa. It is the most northern of African countries, and is bounded on the north and east by the Mediterranean Sea, on the south by Tripoli and the Sahara, and on the west by Algeria (Map: Africa, E 1). Its boundaries are still indefinite, but the area is estimated at 51,000 square miles. Tunis is physically continuous with the rest of Northwestern Africa. The northern part is a mountainous plateau constituting the eastern extension of the Algerian coast range and the main range of the Atlas Mountains. Its elevation is on an average about 1500-2000 feet, rising in the peak of Sidi Ali, and in other summits to heights of 5700-6500 feet. This plateau region is fairly well watered by numerous small streams, many of which are perennial, the vegetation in the northern mountains being abundant, with dense forests. The chief stream is the Mejerda, the ancient Bagradas. The southern half of the plateau, generally treeless, is covered with esparto grass. On the north coast the plateau falls abruptly in steep cliffs toward the sea; on the east coast, however, there is a low region about 60 miles wide, fertile in the north, but becoming arid in the south. The southern half of Tunis belongs to the Sahara region, and, with the exception of a group of mountains in the southeast, is generally low, in some places even below sea level. In its northern part is the great salt marsh of the Jerid, surrounded by numerous hot springs, which are used for irrigation. The date palm is here indigenous, and grows in large numbers, but the rest of the Sahara region is arid. The climate of Tunis is healthful, with a temperature ranging from 50° to 96°. The rainfall averages 22 inches in the north, and is there fairly regular. In the south years may pass without any regular rains, though occasionally there are heavy showers which raise the average to nearly ten inches. The flora and fauna are almost identical with those of Algeria (q.v.). Geologically Tunis is of comparatively recent formation, the mountains being mostly Tertiary, the coast region Quaternary, and parts of the plateau Cretaceous.

The chief mineral products are zinc, lead, iron, salt, gypsum, phosphates, and marble. Agriculture, the main industry, shows signs of progress. Cereals and the vine are mainly cultivated in the northern part, where the holdings are small. Farther south the holdings are large and devoted to stock-breeding and the cultivation of olives (about 500,000 acres) and date palms. The chief products are olives and olive oil, grain, fruits, and cork. The leading acreages in 1900 were 1,075,000 each for wheat and for barley. Large numbers of sheep, goats, cattle, camels, asses, and mules are reared. Tunis has practically no industries except the native or household. Carpets, saddles, and other leather articles and woolen goods are produced. The fisheries, controlled by the Italians, are active and yield principally allaches, sardines, and sponges. There are sixteen ports, three of them excellent. In 1901 they registered an entering tonnage of 2,724,092—about one-half French. The trade is increasing, but chiefly in imports, the exports in 1901 having been only about 60 per cent. of the imports. The total commerce in 1895 amounted to about $16,400,000; in 1901, to $20,760,000. Olives and olive oil, cereals, animals and animal products represent the leading items of the exports; cereals and textiles (notably cottons) those of the imports. Nearly one-half the total trade is with France. There are 576 miles of railway—all controlled by the French.

The French protectorate dates from 1881. At the nominal head of the Government is the native Bey, assisted by nine ministers—seven French and two native—who administer nine departments. There is also the Minister of Foreign Affairs, who is the French Resident-General. He is virtually the Viceroy. All foreigners are governed directly by the French. Tunis has thirteen civil and two military districts and a military post—all in charge of French representatives. French tribunals of justice deal with cases involving foreigners and native courts, with those of the Tunisians. The French army stationed here numbers about 20,000 men. The capital is Tunis. The budget for 1901 balanced at $8,000,000; for 1902, at $10,800,000—including the large items connected with the State railways (nearly 50 per cent.). The other prominent items are expenditures in connection with the debt. The debt was consolidated in 1884, and amounted to $27,768,740. In 1888 it was put in the form of a 3½ per cent. loan guaranteed by France. The coinage, weights, and measures are for the most part French.

The population is estimated at about 1,900,000 and consists chiefly of Berbers and Arabs. They profess Mohammedanism. The foreign population in 1901 was composed mainly of 67,420 Italians and 38,889 French. There are numerous French as well as Mohammedan schools, a Mohammedan university in Tunis, and a college. Tunis is as rich in antiquities as almost any part of Italy. Punic, Roman, and Byzantine ruins abound, the two former classes representing magnificent epochs. The site of Carthage is still marked by the remains of substructures. A fine museum of relics has been established here. The Bardo collection near the capital is valuable.

The early history of Tunis is connected with that of Carthage (q.v.). After the fall of Carthage the region became the Roman province of Africa (Africa in the narrower sense), subdivided into the northern district of Zeugitana and the southern district of Byzacium (Provincia Byzacena). Carthage was rebuilt, and in the second and third centuries of the Christian Era was one of the most important cities of the Roman Empire. The Romans were vanquished by the Vandals under Genseric in 429. The Vandals held the country until their King, Gelimer, was conquered and taken prisoner in 534 by Belisarius (q.v.), the general of the Byzantine Emperor Justinian. Tunis then remained under Byzantine rule until the conquest by the Arabs in the seventh century. Under Mohammedan rule the city of Kairwan rose to great splendor. After having formed for more than a century a part of the dominions of the caliphs, the country was ruled successively by the dynasties of the Aglabites, Fatimites, Almohades, and Merinides. In the middle of the twelfth century it was for a short time under the rule of Roger II. of Sicily. In 1270 Louis IX. of France, having undertaken a crusade, died during his invasion of Tunis, and in 1390 the French under the Duke of Bourbon were again unsuccessful, being repulsed at Mahdiya. In the fourteenth century Tunis became independent under the Hafsite rulers and had an era of comparative prosperity. In 1535 Charles V. undertook an expedition against the famous corsair Khair-ed-Din (Barbarossa), who had established himself at Tunis, captured the city, and liberated over 20,000 Christian slaves. In 1575 Sinan Pasha conquered the country and incorporated it with the Ottoman Empire. The government was placed in the hands of a Turkish pasha, a divan or council, composed of the officers of the Turkish garrison, and the commander of the janizaries.

After a few years, however, an insurrection of the soldiery broke out, and a new government was established, the head of which was a 'dey' possessing limited authority, the chief power being at first exercised by the military divan. But gradually an officer, with the title of 'bey,' whose original functions were confined to the collection of tribute and taxes, acquired a supremacy over the other authorities, and finally obtained a kind of hereditary sovereignty. The beys of Tunis made conquests on the mainland and piratical enterprises against Christian powers at sea. During the eighteenth century Tunis became tributary to Algeria. About the beginning of the nineteenth century Hamuda Pasha put an end to this dependence, subdued the Turkish militia, and created a native Tunisian army, in consequence of which Tunis virtually attained independence. The subsequent rulers, Achmet Bey (1837-55), Mohammed Bey (1855-59), and Mohammed Sadyk Bey (1859-82), were liberal, enlightened sovereigns. In 1871 the Sultan renounced the tribute formerly exacted, and fixed the future relations of the Sublime Porte to Tunis. The Bey was to receive his investiture from Constantinople; without the Sultan's authority he could neither declare war, conclude peace, nor cede territory; the Sultan's name was to appear on all the coinage; the army was to be at the disposal of the Porte. In internal matters, however, the power of the Bey was to be absolute. In 1881 France, with the ostensible purpose of chastising the Khrumirs, who had made raids into Algerian territory, sent an expedition into Tunis. At the same time a French squadron appeared before the capital and the Bey was forced to enter into an engagement establishing a French protectorate over the country. Thereupon an insurrection broke out, and it was only after much bloodshed that the French were able to compel submission. In July, 1881, they took Sfax, and in October they occupied Kairwan. By the close of the year the country was subdued. The French protectorate has contributed to the material progress and prosperity of Tunis.

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TUNIS. The capital of Tunis. It is situated near the southwestern extremity of the Lake of Tunis, about three miles from the ruins of ancient Carthage (Map: Africa, F 1). The lagoon or Lake of Tunis is shallow, and communicates with the Gulf of Tunis, an inlet of the Mediterranean, by a narrow strait known as the channel of Goletta. The gulf itself is 45 miles broad at the entrance. The town occupies rising ground, and both the city proper and the suburbs are surrounded by walls. The streets of the inner town are narrow, unpaved, and dirty, but the bazaars are well furnished, and many of the mosques are splendid, particularly the Mosque of Yussuf. The palace of the bey is probably the finest building in Tunis. The citadel, begun by Charles V., and finished by Don John of Austria, is interesting from its collection of old arms. The newer French or foreign quarter, established since 1893, has a European aspect. The city contains a Mohammedan university and a national museum of arts and antiquities. Water is supplied by means of a restored ancient aqueduct from Jebel Zaghwan. Tunis is the commercial centre of the State, and carries on an important trade with Europe and Central Africa. Ocean-going vessels reach the town directly by means of a canal opened in 1893. Tunis has silk and woolen manufactures of shawls, tapestries, mantles, burnooses, caps, turbans, colored cloths; also leather, soap, wax, and olive oil, all of which it exports, together with grain, fruits, cattle, fish, ivory, gold dust, coral, etc. The climate is unhealthful.

Tunis (ancient *Tunes*) was a Carthaginian city, frequently mentioned in connection with the Punic wars. It became important under the Arabs. (See Tunis, Protectorate.) The population is estimated at about 170,000, of which 50,000 are Europeans and 40,000 Jews.

TUNKERS. See German Baptist Brethren.

TUNNEL (OF. *tonnel*, tunnel, tun, pipe, *tonnelle*, arbor, arched vault, tunnel, diminutive of *tonne*, pipe, tun, ML. *tunna*, OHG. *tunna*, Ger. *Tonne*, AS. *tunne*, Eng. *tun*, both the Romance and Germanic words apparently borrowed from Ir., Gael. *tunna*, tun). An artificial gallery, passage, or roadway beneath the ground, under the bed of a stream, or through a hill or mountain. The art of tunneling has been known to man since very early times. A king of Egypt upon ascending the throne began at once to drive the long narrow passage or tunnel leading to the inner chamber of the rock-cut tomb at Thebes which was to form his final resting place. Similar rock-cut tunneling work was performed by the Nubians and Indians in building their temples, by the Aztecs in America, and, in fact, by most of the ancient civilized peoples. The first built up tunnels of which there are any existing records were those constructed by the Assyrians. The vaulted drain or passage under the southeast palace of Nimrud, built by Shalmaneser II. (B.C. 860-824), is in all essentials a true soft-ground tunnel. A much better example is the tunnel under the Euphrates River, which may quite accurately be claimed to be the first subaqueous tunnel of which there exists any record. It was, however, built under the dry bed of the river, the waters of which were temporarily diverted and then turned back into their normal channel after the tunnel work was completed, thus making it a true subfluvial tunnel only when finished. The Euphrates River tunnel was built through soft ground, and was lined with brick masonry, having interior dimensions of 12 feet in width and 15 feet in height. Only hand work was employed by these ancient peoples in their tunnel construction. In soft ground the tools used were the pick and shovels or scoops. For rock work they possessed a greater range of appliances.

Research has shown that among the Egyptians, by whom the art of quarrying was highly developed, use was made of tube drills and saws provided with cutting edges of corundum or other hard, gritty material. The usual tools for rock work were, however, the hammer, the chisel, and wedges; and the excellence and magnitude of the works accomplished with these limited appliances attest the unlimited time and labor which must have been available for their accomplishment.

The Romans should doubtless rank as the greatest tunnel-builders of antiquity in the number, magnitude, and useful character of their works and in the improvements which they devised in the methods of tunnel-building. They introduced fire as an agent for hastening the breaking down of the rock, and also developed the familiar principle of prosecuting the work at several points at once by means of shafts. Their method of operation was simply to build large fires in front of the rock to be broken down, and when it had reached a high temperature to cool it suddenly by throwing water upon the hot surface, thus producing cracks and fissures.

The Roman tunnels were designed for public utility, especially for aqueducts and roads. One of the most notable of the tunnels of larger section is that which gives the road between Naples and Pozzuoli passage through the Posilipo hills. It is excavated through volcanic tufa, and is about 3000 feet long and 25 feet wide, with a section of the form of a pointed arch. In order to facilitate the illumination of this tunnel, its floor and roof were made gradually converging from the ends toward the middle; at the entrances the section was 75 feet high. This double funnel-like construction caused the rays of light to concentrate as they approach the centre, and thus to improve the natural illumination. This tunnel was probably excavated during the time of Augustus, although some authorities place its construction at an earlier date.

During the Middle Ages the art of tunnel-building was practiced for military purposes, but seldom for the public need and comfort. Every great castle had its private underground passage from the central tower or keep to some distant concealed place to permit the escape of the family and its retainers in case of victory by the enemy, and during the defense to allow of sorties and the entrance of supplies. The tunnel-builders of the Middle Ages added little to the knowledge of the art. Indeed, until the seventeenth century and the introduction of gunpowder no particular improvement was made in the tunneling methods of the Romans. Although gunpowder had been previously employed in mining, the first important use of it in tunnel work was at Malpas, France, in 1679-81; in the tunnel for the Languedoc Canal. This tunnel was 510 feet long, 22 feet wide, and 29 feet high, and was excavated through tufa.

With the advent of gunpowder and canal construction the first strong impetus was given to tunnel-building in its modern sense as a commercial and public utilitarian construction. Canal tunnels of notable size were excavated in France and England during the last half of the seventeenth century. These were all rock or hard-ground tunnels. Indeed, previous to 1800 the soft-ground tunnel was beyond the courage of the engineer except in sections of such small size as hardly to deserve the name of tunnels. In 1803, however, a tunnel of 24 feet wide was excavated through soft soil for the Saint-Augustine Canal in France. Timbering was employed to support the walls and roof as fast as the earth was removed and the masonry lining was built closely following it. From the experience gained in this tunnel were developed the various systems of soft-ground subterranean tunneling since employed. It was through the development of the steam railway, however, that the art of tunneling was to be brought into its present prominence. In 1820-26 two tunnels were built on the Liverpool and Manchester Railway in England. This was the beginning of the rapid development which has made the tunnel one of the most familiar of engineering structures. The first railway tunnel in the United States was built on the Allegheny Portage Railroad in Pennsylvania, in 1831-33; and the first canal tunnel had been completed thirteen years previously (1818-21) by the Schuylkill Navigation Company, near Altoona, Pa.

The art of tunneling entered its last and greatest phase with the construction of the Mont Cenis Tunnel in Europe and the Hoosac Tunnel in America. The Mont Cenis Tunnel was undertaken to facilitate railway communication between Italy and France, or, more properly, between Piedmont and Savoy, the two parts of the kingdom of Victor Emmanuel II. separated by the Alps. It is 7.6 miles long and passes under the Col de Fréjus near Mont Cenis. Work was begun in 1857 and finished in 1870. It was from the close study of some of the difficulties, the great length of the tunnel, and the desire of the engineers to finish it quickly, that all the different improvements were developed which marked this work as a notable step in the advance of the art of tunneling. Thus the first power drill ever used in tunnel work was devised by Sommeiller, one of the engineers. In addition compressed air as a motive power for drills, aspirators to suck the foul air from the excavation, air compressors, turbines, etc., found at Mont Cenis their first application to tunnel construction. This important rôle played by the Mont Cenis Tunnel in Europe in introducing modern methods had its counterpart in America in the Hoosac Tunnel, completed in 1875. In this work there were used for the first time in America power rock-drills, air compressors, nitroglycerin, electricity for firing blasts, etc. There remains now to be noted only the final development in the art of soft-ground submarine tunneling, namely, the use of shield and metal lining. The shield was invented and first used by Sir Marc Isambard Brunel in excavating the first tunnel under the River Thames at London, which was begun in 1825 and opened in 1843. In 1869 Peter William Barlow used an iron lining in connection with a shield in driving the second tunnel under the Thames at London. From these inventions has grown up one of the most notable systems in tunneling now practiced, known as the shield system.

CONSTRUCTION. Tunnels may be classified according to the general nature of the materials penetrated, into hard-rock tunnels and soft-ground tunnels. Whatever the material penetrated, the general methods of construction are the same, but a variety of differences in detail exist. In certain kinds of tunnels, such as subaqueous tunnels and tunnels under city streets, other conditions than the hardness of the material penetrated exercise a controlling influence. For the purpose of description, therefore, it is common to classify tunnels into hard-rock tunnels, soft-ground tunnels, open-cut tunnels, and submarine tunnels. In open-cut tunnels and submarine tunnels the material penetrated may be either rock or earth. When it has been decided to construct a tunnel the first task is to construct a geological map which will show as accurately as may be determined the character and inclination of the earth's strata to be penetrated, the probability of water being encountered, etc., all of which exercise an important influence upon the difficulties and cost of the work. The next step is to establish exactly the centre line of the tunnel; this is done on the surface of the ground and its purpose is to find the exact length of the tunnel and to furnish a reference line by which the excavation is directed. The determination of the centre line is a simple problem in surveying, requiring only skill and exactness for its successful solution; the longer the tunnel, and the higher and more inaccessible the mountain is above it, the more difficult is the work. So perfect, however, has the skill of the surveyor become that it is a common thing to work within a small fraction of a foot in alignment in driving a long mountain tunnel.

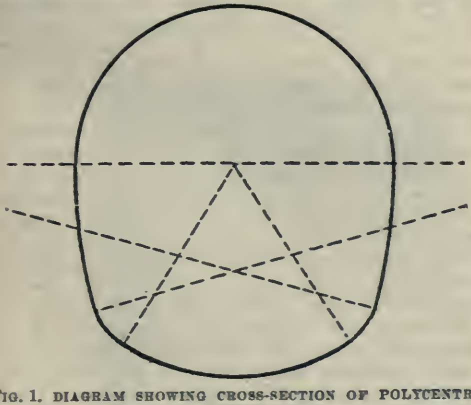


FIG. 1. DIAGRAM SHOWING CROSS-SECTION OF POLYCENTRIC FIGURE.

The centre line being established, the next task is to establish the form and dimensions of the cross-section of the hole or passageway which it is proposed to excavate. The form and dimensions of cross-section adopted are determined by the purpose to which the tunnel is to be put and by the character of the material penetrated. The best one for the majority of conditions, and the one most commonly employed, is the polycentric figure (Fig. 1), in which the number of centres and length of the radii are fixed by the engineer to meet the particular conditions which exist. The dimensions to be given to the cross-section of a tunnel depend upon the purpose for which it is to be used, as will be observed in the succeeding descriptions of prominent tunnels. In all cases the form and the dimensions are those of the inside of the completed tunnel, which is of course the inside of the lining in all cases except those of unlined hard-rock tunnels, where it is the inside of the original excavation.

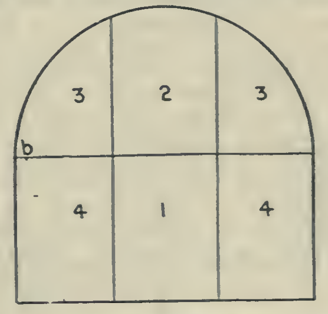


FIG. 2. DIAGRAM SHOWING SEQUENCE OF GALLERIES IN DRIFT METHOD OF HARD-ROCK TUNNELING.

EXCAVATION. The work so far described is of the nature of engineering investigation and design. The actual construction of work consists in excavating in the earth or rock a passageway which follows the established centre line and conforms in dimensions and shape to the established cross-section. In performing this work of excavation the whole area of the cross-section is seldom removed at once, but it is subdivided into two or more galleries, which are excavated in a measure independently of each other and which together form the full cross-section. The objects of thus subdividing the work are several in number, the more important being as follows: By driving a number of galleries each somewhat in advance of the succeeding one, several gangs of men can be worked without interfering with each other; the first gallery, being driven far ahead, serves to drain the earth and to disclose in advance the nature of the material that will be encountered; in soft material several small galleries can be driven and timbered with much less danger of caving than can one large gallery. The number and arrangement of the galleries vary with the materials penetrated and with the system of tunneling adopted. The first gallery excavated is called a heading when it is situated at the top of the cross-section, and a drift when it is situated at the bottom of the cross-section. The excavation of the main sections is termed enlarging the profile.

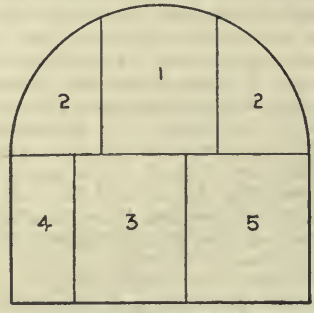


FIG. 3. DIAGRAM SHOWING SEQUENCE OF GALLERIES IN EUROPEAN HARD-ROCK TUNNEL.

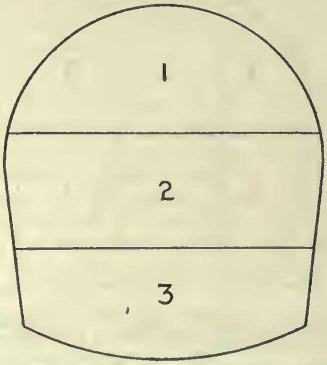


FIG. 4. DIAGRAM SHOWING SEQUENCE OF GALLERIES IN AMERICAN HEADING METHOD OF HARD ROCK TUNNELING.

Two general methods of excavating rock tunnels are considered practical by engineers; in one the profile is enlarged from a drift and in the other it is enlarged from a heading. The sketch Fig. 2 shows the usual sequence of galleries by which the full cross-section is enlarged from a drift. This method of excavation is quite commonly practiced in Europe, but is seldom employed in America. Among the most notable tunnels built by enlarging a drift are the Mont Cenis and the Simplon, both of which are more fully described farther on in this article. The more common method of tunneling through hard rock is to begin the work by a heading instead of by a drift. This heading may be of small dimensions and the remainder of the section may be removed in successive small parts, or it may be the full width of the section and the enlargement completed in one other cut. When the tunnel is excavated by means of several cuts, which is the method usually employed in Europe, the sequence of galleries is indicated by Fig. 3. When the excavation is made by a single wide heading and a single other cut for removing the bench, which is the method preferred by American engineers, the sequence of galleries is the simple one indicated by Fig. 4. The Saint Gotthard Tunnel, described farther on, is one of the most notable tunnels excavated by enlarging a heading by means of several cuts; the Cascade Tunnel in Montana is a notable example of the wide heading and single-bench method.

In all rock tunnel work the various galleries are excavated by drilling and blasting the rock. The most difficult gallery to excavate is the first heading or drift, as the case may be. Based on the mode of blasting employed, there are two methods of driving the advance gallery, known as the circular and the centre-cut methods. In the first method a set of holes are first drilled near the centre of the front in such a manner that they inclose a cone of rock; the holes, starting at the perimeter of the base of the cone, converge toward a junction at its apex. Seldom more than four to six holes are comprised in the first set. Around these first holes are driven a ring of holes which inclose a cylinder of rock, and, if necessary, succeeding rings of holes are driven outside the first ring. These holes are blasted in the order in which they are driven, the first set taking out a cone of rock, the second set enlarging this cone to a cylinder, and the other sets enlarging this cylinder. These holes are seldom driven deeper than four or five feet. In the centre-cut method, which is the one commonly employed in America, the holes are arranged in vertical rows and are driven from 15 feet to 20 feet deep. The two centre rows of holes converge toward each other so as to take out a wedge of rock, but the others are bored 'straight' or parallel with the vertical plane of the tunnel. In conclusion it may be stated that the present high development of labor-saving machinery for excavating rock makes this material one of the safest and easiest to tunnel, with which the engineer ordinarily has to deal. A necessary equipment for tunneling through rock requires a steam or a water-power plant for pumping air or water under pressure, and in large tunnels these power plants are often of considerable size. See **DRILLS**; **BLASTING**.

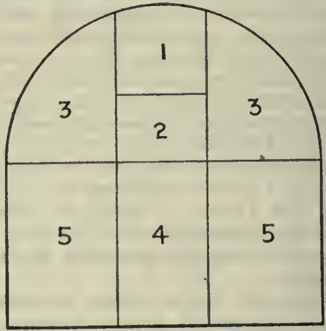


FIG. 5. DIAGRAM SHOWING SEQUENCE OF GALLERIES IN BELGIAN METHOD OF SOFT GROUND TUNNELING.

There are a variety of methods of tunneling through soft ground. Some of these, like the open-cut method and the shield method, differ entirely, while in others, like the Belgian, German, English, Austrian, and Italian methods, the difference consists simply in the different order in which the drifts and headings are driven, in the difference in the number and size of these advance galleries, and in the different forms of strutting framework employed. The shield system is considered separately under the succeeding heading of *Submarine Tunnels*. The other methods may be described briefly as follows: The Belgian method of tunneling is the one most commonly employed in soft soils. It consists in excavating the upper part of the section first; then building the masonry arch which is supported upon the unexcavated ground; and finally in excavating the lower portion of the section and building the side walls and floor or invert. The sequence of galleries is shown by Fig. 5. In the German method two drifts are first opened at each side of the tunnel near the bottom. Other galleries are excavated one above the other on each side to extend or heighten the first two until all the perimeter is open except across the bottom. The masonry lining is then built from the bottom upward on each side of the crown of the arch, and then the centre core is removed and the invert is built. The sequence of galleries is shown by Fig. 6. In the English and Austrian methods short lengths of the whole sectional profile are excavated before beginning the masonry. In the English method the lengths of section excavated vary from 10 to 25 feet. The masonry invert is built first, then the side walls, and finally the roof arch. The excavators and masons work alternately, the excavation being stopped while the masonry is being built and vice versa. The Austrian method differs in two particulars from the English; the length of section opened is made great enough to allow the excavators to continue work ahead of the masons, and the side walls and roof are built before the invert. The Italian method is very seldom employed because of its cost, but it can often be used successfully in very soft ground when other methods fail. It consists in excavating the lower half of the section and building the invert and side walls and then filling the space between the walls in again except for a narrow passageway for the cars for handling structural material and removing the waste; next the upper half of the section is excavated, as in the Belgian method, and the arch is built; and finally the filling in the lower part is permanently removed. Tunnels through quicksand are driven by one of the previously described soft-ground methods after draining away the water, or else as submarine tunnels.

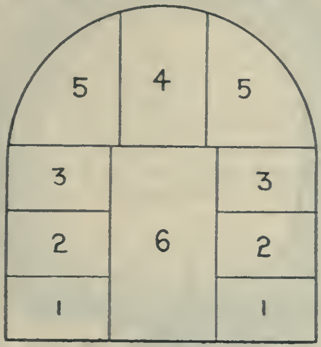


FIG. 6. DIAGRAM SHOWING SEQUENCE OF GALLERIES IN GERMAN METHOD OF SOFT-GROUND TUNNELING.

In short tunnels or tunnels of great depth beneath the surface the excavation is carried on from the two ends only, but in long tunnels when the depth is not too great shafts are sunk at intervals along the tunnel line, and excavation is carried forward in both directions from the foot of each shaft as well as from the two ends. Tunnel shafts are merely vertical walls, and they may be either temporary or permanent. Temporary shafts are usually made rectangular in section and are filled in after the tunnel is completed; permanent shafts are usually made circular, lined with brickwork, and left open to supply ventilation. When shafts are used, elevators operated by hoisting engines have to be employed to hoist out the cars loaded with excavated material.

TIMBERING AND LINING. The purpose of timbering or strutting in tunnel work is to prevent the caving in of the roof and side walls of the excavation previous to the construction of the

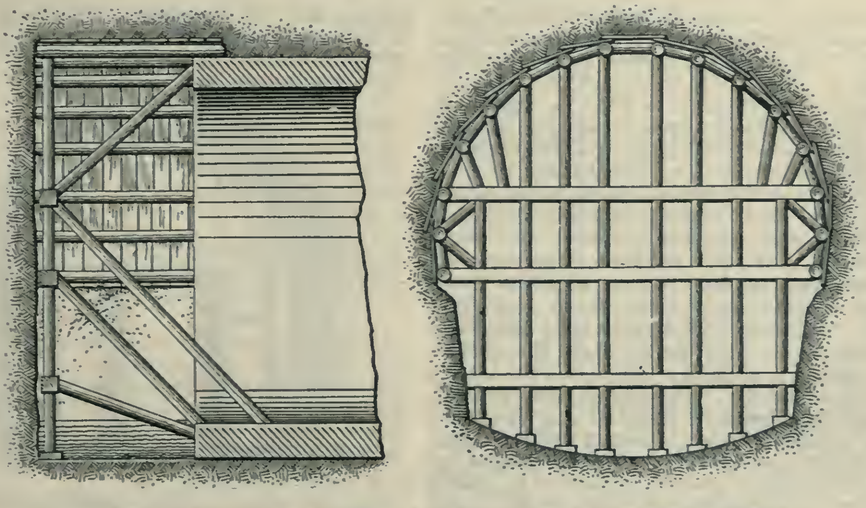


FIG. 7. SYSTEM OF STRUTTING PRACTICED IN ENGLISH METHOD OF SOFT-GROUND TUNNELING.

lining. Timber is nearly always employed for strutting in tunnel work, but iron strutting of special form is sometimes employed. The method of strutting employed depends upon the nature of the material penetrated. (Fig. 7.) In the hard, firm rock no strutting is employed; when the rock is cracked or shelly in spots only, an occasional prop and beam is all that is necessary; in soft and broken rock and in soft ground the framing is continuous, and in very soft material often forms practically a water-tight lining. Tunnels are lined with timber (Fig. 8), with masonry (Figs. 9 and 10), and with cast-iron cylinders. Timber lining is used only in America and is intended to be replaced by masonry at some future date. The most common form of masonry lining is brickwork or a brickwork roof arch with stone masonry side walls. In recent years monolithic linings of concrete have been considerably used.

Iron lining is practically limited to submarine tunnels driven by the shield system. In masonry-lined tunnels niches (Fig. 11) are built into the side walls at intervals to serve as places of refuge and in some cases for the storage of tools and supplies. The ends of the tunnel lining nearly always terminate in a portal designed and constructed with some pretensions to architectural beauty.

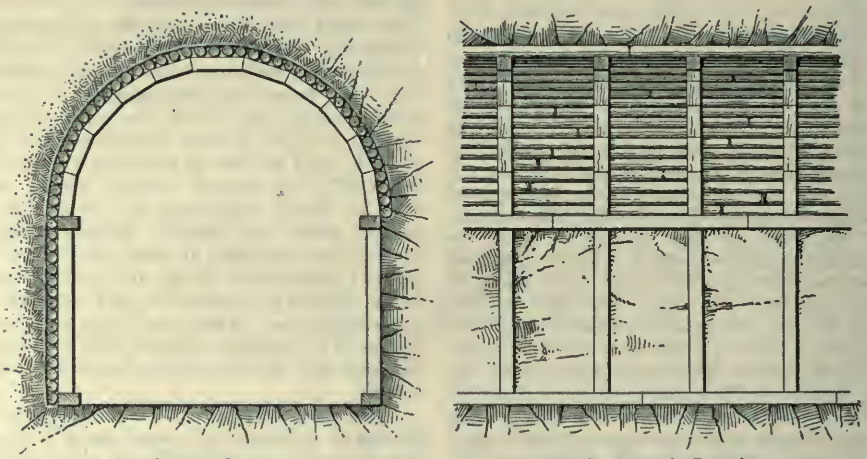

Cross Section. Longitudinal Section,

FIG. 8. A TYPICAL FORM OF TIMBER LINING FOR TUNNELS.

OPEN-CUT TUNNELING. When a tunnel or rapid transit subway has to be constructed at a small depth below the surface, the excavation is generally performed more economically by making an open cut, building the lining inside it, and filling in the space outside the lining, than it is by subterranean tunneling proper. The necessary condition of small depth which makes open-cut tunneling desirable is most generally found in constructing rapid transit tunnels under city streets. This fact introduces the chief difficulties encountered in such work, since the surface traffic makes it necessary to obstruct the streets as little as possible. The two methods of open-cut tunneling commonly practiced may be classed as the longitudinal-trench method and the transverse-trench method. The simplest manner by which to construct open-cut tunnels is to open a single cut or trench the full width of the tunnel masonry. This trench is strutted by means of side struttings of vertical planks held in place by transverse beams extending across the trench and abutting against longitudinal timbers laid against the strutting planks. The lining is built in this trench and then filled around and above with well-rammed earth, after which the surface

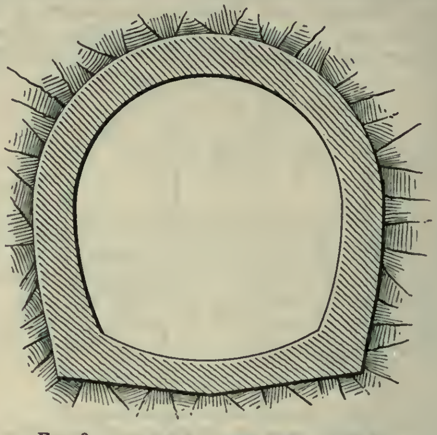


FIG. 9. CONCRETE LINING FOR TUNNELS.

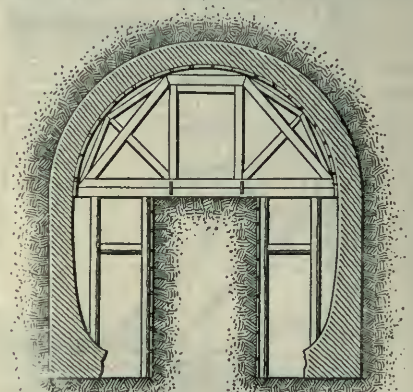


FIG. 10. TYPICAL MASONRY LINING FOR TUNNELS.

of the ground is restored. Generally the trench is opened in short lengths and each length is completed ready for surface traffic before the adjacent length is opened. Another form of longitudinal trench method is to open two narrow parallel trenches in which are built the side walls. The soil between these walls is then removed to a sufficient depth to permit the roof to be built and covered over, and the final process is to take out the core of earth inclosed by the side walls and roof. Generally one side wall and one-half of the roof arch are completed and covered over before the other side wall and half arch are begun. By this arrangement of the work one-half of the street is always unobstructed.

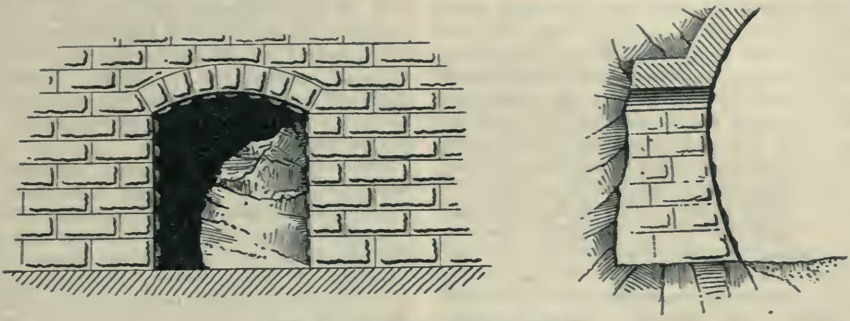


FIG. 11. MASONRY WORK IN TUNNEL.

In the transverse-trench method a trench about 12 feet wide is opened across the street, and in this trench a short length or 'slice' of the subway is built. Owing to the small size of the opening, it is possible to cover it with a timber platform which carries the street traffic during construction. This method was extensively used in constructing the subway at Boston, Mass., and at New York.

Submarine Tunneling. Submarine or subaqueous tunnels are tunnels excavated under the bed of a river or other body of water, generally for the purpose of providing land communication between the opposite shores. Inflowing water, which is always a serious difficulty in tunnel work everywhere, is here the most serious problem with which the engineer has to deal. Where the tunnel is deep below the stream bed and penetrates a material impervious to water it may be excavated by any of the methods commonly employed in subterranean work. When, however, the opposite conditions exist, resort is had to the use of compressed air or to the shield system or to a combination of the two. In the compressed-air method the forward end of the tunnel where excavation is progressing is filled with air under sufficient pressure to counterbalance the pressure of the water which seeks to enter. In the shield system the work is carried on by the aid of a rather elaborate mechanical device commonly called a shield. The importance of this invention to the tunnel-builder can hardly be overestimated.

The shield devised by Barlow already referred to was greatly improved by Mr. J. H. Greathead, and was first used in building the London Tower tunnel begun in 1869. The remarkable success of this work led to the rapid adoption of the shield system for tunnel work in England and America. Briefly described, the modern tunnel shield is a steel plate cylinder, with its forward edge strengthened and sharpened to form a cutting edge. The rear end extends backward so as to overlap the completed lining of the cast-iron rings. Around its inside hydraulic jacks are attached at frequent intervals so that their piston rods bear against the front edge of the completed lining. By applying power to the jacks their piston rods pass with great force against the immovable lining and thrust the cylinder forward into the soft earth. Generally the cylinder has a vertical position or diaphragm near the front end, which prevents the soft earth from rushing back into it except as it is allowed by opening suitable doors. In operation the cylinder is thrust forward until its sharp cutting edge penetrates the earth a little distance. Workmen then withdraw the earth in small quantities through the openings in the diaphragm. After enough material has been thus withdrawn to leave the front of the shield clear, the shield is again thrust ahead and more earth is removed. As fast as the shield moves ahead the lining is erected under the shelter of its tail end. A constant repetition of these processes completes the tunnel. When the earth is very soft and carries much water, compressed air is often used in connection with the shield. The shield system of tunneling has been extensively used in England and America and to a less extent in most other civilized countries.

Notable Tunnels. The number of tunnels notable because of their length, the difficulties encountered in their construction or for other reasons, has become so great that mention can be made here of only a few of them which are most celebrated. The Mont Cenis Tunnel through the Alps places France in direct communication with Italy. It passes from a point near Modane, in France, under the Col de Fréjus, about 18 miles west of the actual Mont Cenis, into Italian territory, at a point near Bardonecchia, about 24 miles from Susa. The length of the tunnel between extremities is 7.6016 miles. It is formed with a rising gradient from each end, at the rate of about 1 in 45½ from Modane and 1 in 2000 from Bardonecchia, the summit or meeting of the gradients being half way through the tunnel. The railway does not enter at the extremities of the tunnel, but joins it by means of special curved sections of tunnel at each end. The total length of tunnel traversed by trains is 7.9806 miles. The following is the geological formation of the rock traversed by the direct tunnel advancing from the north end: Carbonaceous schist, 1.3027 miles; quartz, 0.2414 miles; limestone, 0.2210 miles; calcareous schist, 5.8365 miles. The tunnel on leaving Modane is of the following dimensions: 25 feet 3½ inches wide at the bottom, 26 feet 2¾ inches wide in the broadest point, and 24 feet 7½ inches high, the arch being semicircular. At Bardonecchia the height is greater by 11¾ inches and the arch is made elliptical to enable it to resist the greater strain caused by a different inclination of the strata. The tunnel is lined with the exception of about 300 yards on the north side. The side walls are 8 feet 6 inches thick throughout. The arch to the south side is constructed principally of brick, and to the north side of stone, a brick key being applied throughout. There are side paths of flagstones 20 inches wide.

Work was begun in 1857, and for three years hand labor was used entirely, but it was planned from the beginning by the engineers, Sommeiler, Grandis, and Grattoni, to introduce machinery ultimately. In 1861 power drills were put at work at the south end, and in 1862 the north end was similarly equipped. The drills used were operated by compressed air and they and also the compressors used were invented by Sommeiler. The tunnel was completed and opened for traffic in 1872. In 1872, however, work was begun on the *Saint Gotthard* railway tunnel through the Alps between Italy and France, which far exceeded the Mont Cenis in magnitude. This tunnel crosses the mountains between Goeschenen and Airolo, and is 9.25 miles long. The excavation was through rock consisting chiefly of gneiss, mica schist, serpentine, and hornblende, the strata having an inclination of from 45° to 90°. At many points the rock was fissured and disintegrated easily, and water was encountered in large quantities, causing much trouble. In this work, as at Mont Cenis, power drills and compressed air were used, but in a much improved form as a result of the previous experience and years of study. The excavation was lined throughout with masonry, the side walls being of rubble stone and the roof arch of brick. Along the bottom there was a culvert of brickwork. The Mont Cenis Tunnel had been excavated by means of a drift as an advance gallery, but at Saint Gotthard the advance gallery was a top centre heading. Water power, secured by draining near-by mountain torrents, was used to compress the air used in operating the drills and for driving the compressed-air locomotives used in hauling the débris from the excavation. The tunnel was opened for traffic in 1882.

The third great Alpine tunnel is the *Simplon Tunnel,* nearing completion in 1904. Many schemes for the connection of Italy and Switzerland by a railway near the Simplon Road Pass have been devised. The scheme which was put forward in 1881 by the Jura-Simplon Railway, consisted broadly of piercing the Alps between Brigue, in the Rhone Valley, and Iselle, on the Italian side, from which village the railway descends to the southern terminus at Domo d'Ossola, a distance of about 11 miles. Starting from Brigue, the new line, running gently up the valley for 1¼ miles, on account of the proximity of the Rhone, enters the tunnel on a curve to the right of 1050 feet radius. At a distance of 153 yards from the entrance, the straight portion of the tunnel commences, and extends 12 miles. The line then curves to the left with a radius of 1311 feet before emerging. Commencing at the northern entrance, a gradient of 1 in 500 miles for a length of 5½ miles to a level length of 550 yards in the centre, and then a gradient 1 in 143 descends to the Italian side. The tunnel will be a double tunnel. That is, there will eventually be two parallel tunnels, having their centres 50 feet apart, each carrying one line of railway; but at the present time only one tunnel, that known as No. 1, has been excavated to full size, No. 2 being left, masonry-lined where necessary, for future developments. By means of cross headings every 220 yards, the problems of transport and ventilation are greatly facilitated. In cross-section tunnel No. 1 is 13 feet 7 inches wide at the bottom, and 16 feet 5 inches wide at the widest part, with a total height of 18 feet above rail level. The material penetrated is rock. Rotary drills operated by hydraulic pressure were used, there being an elaborate water-power plant at each end of the tunnel.

The three great European railway tunnels which have been described find their nearest counterpart in America in the Hoosac Tunnel, the Stampede Tunnel, and the Cascade Tunnel. The *Hoosac Tunnel* is on the line of the Fitchburg Railroad in Massachusetts, and passes through a southern extension of the Green Mountains known as the Hoosac Mountains. It is 4¾ miles long, and was driven from the two ends and from an intermediate shaft 1028 feet deep. Work was begun originally in 1855 and was carried on intermittently, there being many long delays due to lack of funds and the obstacles encountered. The tunnel proper was completed in 1873, but several additional years were consumed in the masonry work. The cost of the Hoosac Tunnel was about $11,000,000. The tunnel is 24 feet wide in the widest part, and 22 feet 8 inches high, and carries two lines of railway track. The Stampede Tunnel carries the Northern Pacific Railway through the Cascade Mountains, and was begun in 1886. From the time it was determined to make Puget Sound the western terminus of the Northern Pacific Railway, the question of a feasible route across the Cascade Range was prominently before the company. Between the years 1873 and 1884, several proposed routes were examined by the company's engineers, of which those via the Natchess, Stampede, and Snoqualmie passes were prominent. The *Stampede* route, lying between the other two, was finally recommended, and was formally adopted by the company in 1884. Each of the routes named required a tunnel through the backbone of the Cascade Range; but the Stampede route was the longest of the three. The altitude of the mountain beneath which it was necessary to tunnel was 3970 feet above sea level, and the greatest thickness over the top of the tunnel is 1400 feet, the average depth being about 1200 feet. The elevation of the east portal of the tunnel above the sea is 2827 feet, and that of the west portal is 2800 feet. Work was begun in February, 1886. Probably no other tunnel was ever undertaken where the difficulties and cost of reaching the site and preparing for work were so great as at the Stampede Tunnel. The distance from the nearest railway to the east portal was 82 miles, and to the west portal it was 87 miles, and all men, plant, and material had to be conveyed these distances on wagons and sleds. By the terms of the contract the size of the tunnel was 16½ feet wide and 22 feet high. The method of driving it was as follows: An 8-foot heading was driven along the top of the tunnel and was kept about 30 feet in advance of the bench where the tunnel was excavated to its full width. With the exception of about 500 feet inward from each portal, where the rock was firm and stable, the entire tunnel was timbered as fast as the work progressed. The timbering made it necessary to enlarge the section called for by the contracts to a width of 19½ feet and a height of 23 feet. 10 in. The total length of the tunnel was 9850 feet, with a rising grade from each end toward the middle. Power drills operated by compressed air were used. The amount of explosive used was 309,625 pounds. The total cost of the tunnel was $1,160,000.

The *Cascade Tunnel* carries the Great Northern Railway through the summit of the Cascade Range in Montana. This tunnel is of particular interest because of the representative illustration which it affords of modern rock-tunneling methods and machinery in the United States. The crossing of the summit proper of the Cascade Mountains since the construction of the Pacific extension of the Great Northern Railway in 1891-92 was effected by means of a switchback. This switchback was built merely as a temporary line. Business conditions, however, did not justify the construction of a tunnel between 1892 and 1897, but in the latter year orders were given to commence the work and push it as fast as possible to completion. The length of the tunnel is 13,813 feet, of which about 400 feet (or 200 feet at each end) is an extension of the permanent lining, to take the place of the wooden snow shed, but the length of the tunnel proper, from face to face of portals, is 2.61 miles. The width in the clear, inside of the permanent lining, is 16 feet, and the height from top of rail to bottom of arch is 21 feet 6 inches. For the first 500 feet at the west portal, the tunnel was driven through a slide composed of gravel and large boulders. This ground was heavily impregnated with water, and the pressure from above was tremendous. The presence of the large boulders made it difficult to drive poling boards, and a hole a few inches in diameter, if left open, would soon let in sand enough to fill the heading. To carry this heavy ground required three concentric sets of timbers, as well as tie-rods, connecting the wall plates.

The ordinary American system of tunnel excavation was employed. The overhead heading was taken out to the full size of the rock section, 10 × 20 feet, and the bench taken out in two lifts. Rock from the heading and top bench was wheeled in barrows, out onto a large traveling carriage called a 'jumbo,' where it was dumped through chutes into the muck cars. Material from the lower bench was shoveled directly into the cars. On a secondary floor, under the main floor of the 'jumbo,' was a hoist operated by compressed air, which was used to load large pieces of rock, some of them weighing six tons, on the flat cars. This obviated the necessity of blockholing large pieces of rock, to enable them to be handled. This cable and hoist was also used to move the 'jumbo' back from the rock face when blasting was to be done. Compressed air, at 100 pounds' pressure, operated drills, hoists, and pumps with the exception of one large pump which was operated by electricity. Four vertical columns in the heading carried six 3¼-inch Rand 'Slugger' drills. From 24 to 28 holes, 12 feet deep, were drilled in the breast, and fired by electricity, in three rounds. Holes were drilled to lift the top bench, and vertical holes for the main or lower bench, enough to break the rock to subgrade. Altogether an average of fourteen 3¼-inch drills were used in each heading and benches.

All hauling out of muck, and hauling in of concrete, was done with electric motors, of which eight were in service. Six of these were constructed at the tunnel machine shop. One of these motors hauled loaded trains of from 16 to 20 dump cars, of 1 cubic yard capacity, up the 1.7 per cent. grade, at 10 miles per hour. The foul air was exhausted from the heading through 24-inch galvanized iron pipe, by means of a No. 9 Sturtevant fan, running at 1700 revolutions.

The tunnel is permanently lined throughout its entire length with concrete, this lining being nowhere less than 23 inches thick, and in places 3½ feet thick. Where the section was larger than would admit of solid concrete, it was backfilled with spawls and broken stone, the result being a monolith of concrete from portal to portal. The tunnel excavation proper was commenced August 20, 1897, and completed October 13, 1900. The average monthly progress in the tunnel was 350 feet; average daily progress 11.53 feet. The work of concrete lining the tunnel was commenced November 17, 1899, and completed November 17, 1900. The average monthly progress was 1115 feet.

Probably the most notable submarine tunnel through rock is that under the river Severn in England, which is known as the *Severn Tunnel*. The Great Western Railway system west of Bristol was formerly separated south of Gloucester by the Severn and its estuary, from the lines between Gloucester and the South Wales ports, as well as from the western lines between Hereford and North Wales, Liverpool, Manchester, and the north. This want of connection was only partly remedied by a steam ferry across the estuary of the Severn. A tunnel under the Severn was, accordingly, proposed in 1871 to provide for through traffic, and was authorized in 1872. Work was begun in 1873. The site selected for the tunnel was about two miles below the mouth of the Wye, where the width of the estuary at high tide is about 2¼ miles. The strata traversed by the tunnel consist of conglomerate, limestone, carboniferous beds, sandstone, marl, gravel, and sand; the least thickness of soil between the top of the tunnel and the deepest part of the channel is 44¾ feet. The total length of the tunnel is 4 miles, 624 yards. The tunnel was excavated from four shafts, work being commenced in 1873 and completed in 1886. Great difficulty was experienced with water, which flooded the workings on several occasions. On one of these occasions a diver was employed to enter the tunnel and close a bulkhead door, which he did by carrying a knapsack filled with compressed oxygen to sustain life during his submarine journey.

Another subaqueous tunnel through rock is the *Mersey Tunnel*, about one mile long, connecting Liverpool and Birkenhead. In this work a ventilating tunnel of smaller size than the main tunnel was excavated under the main tunnel by a rotary boring machine which cut out the passageway to full size at one operation. Except for the Mersey Tunnel, which is a passenger tunnel, all the tunnels previously described are for railway purposes. They are also all rock tunnels.

Among the many important railway tunnels which have been built through soft ground only two will be mentioned. The *Baltimore Belt Tunnel,* 8350 feet long, in Baltimore, Md., was excavated through water-bearing sand, loam, clay, and gravel by the German method of soft-ground tunneling. It provides for a double-track railway line. The *Saint Clair Tunnel* carries the double tracks of the Grand Trunk Railway under the Saint Clair River between Michigan and Canada. In 1886 the Saint Clair Tunnel Company was formed to build this tunnel. Borings showed the materials to be penetrated to be a soft blue clay throughout at the site chosen, which was just below Sarnia and Port Huron. The excavation consisted of an open cutting on the American side 2500 feet long; a tunnel 6000 feet long under the river, and an open cutting on the Canadian side 3100 feet long. Work was begun by means of two shore shafts in 1888, but these were abandoned, and in 1889 work was commenced on the cuttings. These were completed so that shields were started on the tunnel proper in the same year. The shields used were 21½ feet outside diameter, and the cylindrical shell consisted of 1-inch steel plates. The cylinder was stiffened by five diaphragms dividing it into twelve cells. In front the shield had a cutting edge, and at the back it was prolonged 4 feet to cover the lining of the tunnel. As the shield was shoved forward a paste of cement and water was forced out through holes left in the lining to fill the space left between the lining and the clay. The excavation was done in front of the shields, which were then forced forward by hydraulic jacks, and the erection of the permanent cast-iron lining followed up, the ring being erected inside the tail of the shield. There were 24 hydraulic jacks at the back of each shield, each capable of exerting a power of 125 tons, but the greatest total power used did not exceed 1800 tons. The lining is 21 feet in outside diameter. Each ring of lining is 18 inches long, measured on the line of the tunnel, and is made up of 13 segments and a key piece. Each segment weighs 1050 pounds, and the total weight of cast iron in the lining is 27,000 tons. The Baltimore Belt Line tunnel is a fairly representative example of railway tunneling through soft ground on land, and the Saint Clair Tunnel is an equally good example of railway tunneling under water by means of the shield method.

Next to their use for railways, tunnels are more frequently built to conduct water than for any other purpose, perhaps. A good example of rock tunneling for this purpose is afforded by the *Niagara Tunnel,* built to carry the water away from the wheel pit of the Niagara Power Company at Niagara Falls, N. Y. This tunnel is 7600 feet long, 19 feet wide, and 21 feet high, and runs through solid limestone rock. The Chicago water-works tunnels, through which the city of Chicago draws its water supply from Lake Michigan, constitute the most elaborate system of water-supply tunnels anywhere in the world. They comprise 21.97 miles of subaqueous tunnel and 15.92 miles of land tunnel. The subaqueous tunnels are as follows:

	Diameter, ft.	Length, ft.	Cost	Capacity, gallons
Lake View.	6	9,999	$701,792	45,000,000
Chicago Ave....	5	10,567	464,866	170,000,000
	7	10,560	415,709	
	7	10,908	299,897	
Twelfth St. or Four-mile	8	9,139	1,104,744	95,000,000
	6	25,200		
Hyde Park or Sixty-eighth St................	7	12,353	741,371	105,000,000
	5	8,132		
	6	5,026		
Northeast..........	10	14,108	610,560	200,000,000
Total (21.97) miles..........	......	115,992	$4,338,939	615,000,000

At Milwaukee, Wis., there is a water-supply tunnel 3200 feet long and 7½ feet in diameter lined with brick masonry throughout, completed in 1895. At Cleveland, O., a water-supply tunnel 26,000 feet long and 9 feet in diameter has recently been constructed, and two other older tunnels are also in use, one being 5 feet in diameter for 6662 feet and 5½ and 6 feet in diameter for 2580 feet, and the other being 7 feet in diameter and 9200 feet long. One of the most notable water-supply tunnels in the world is that which brings water to New York City, and which is known as the *Croton Aqueduct.* (See AQUEDUCT.) This tunnel is 33 miles long and about 14 feet high and 14 feet wide; it was built through rock. The *Vyrnwy Aqueduct,* 77 miles long, for bringing water to the city of Liverpool, England, has three tunnels. The first and longest is the Hirnant Tunnel, 2 miles 3 furlongs in length through solid rock. The second is the Cynynion Tunnel at mile 16. It is seven furlongs long; but the aqueduct only comes out of the tunnel to pass in a siphon across a valley, entering the Llanforda Tunnel, which is one mile long. These tunnels are circular in section and 7 feet in diameter. The third tunnel is that under the River Mersey, which is 805 feet long and lined with iron rings 10 feet in diameter on the outside.

Within recent years many important tunnels have been constructed to carry rapid transit railways under city streets. Some of these, like the London tunnels, have been deep tunnels, but others, like those at Boston, Paris, and New York, have been constructed for the most part by open-cut methods at a small depth below the surface. The *City and South London Railway,* in London, was begun in 1886 and completed in 1890, electricity being ultimately adopted as the means of traction. It is 3⅙ miles long from the city to the Swan at Stockwell, and is entirely underground. Briefly the road consists of two 10 feet 6 inch cast-iron lined tunnels substantially parallel to each other, which converge into a single tunnel at the termini to permit the transfer of trains from one line to the other. These tunnels were constructed by means of the shield system. The *Waterloo and City Railway* in London extends from the Waterloo station of the Southwestern Railway to the Mansion House, a distance of 1 mile 4 furlongs and 150 yards. It consists of two parallel circular tunnels 12 feet 1¾ inches interior diameter except at the curves, where the dimension is increased to 12 feet 9 inches. The tunnels were driven by the shield method, work having been begun in 1894 and completed in

1897. A single electric railway track in each tunnel forms a double-track railway between the termini named. The *Central London Railway* runs from Shepherds Bush to the Bank, a distance of 5¾ miles, the whole distance being in deep tunnel at depths varying from 60 to 90 feet. It consists, like the two roads previously mentioned, of two parallel circular tunnels. Each tunnel is 11½ feet in diameter and has a cast-iron lining. The shield system of construction was employed. To be added to these tunnels are the Metropolitan District railways, parts of which are underground, begun in 1853, the Waterloo and Baker Street Railway, and the projected Euston and Hempstead Railway.

The longest of the London tunnels is the *Blackwall Tunnel* for street traffic under the River Thames. The total length of this work is 6200 feet, of which 3088 feet are tunnel proper, 1,370 feet are open cut roofed over, and 1742 feet are open cut without covering. The exterior diameter of the tunnel is 27 feet. It was driven by means of a shield 27 feet 9 inches in diameter and 18½ feet long, with two diaphragms, from horizontal partitions or stages and four vertical partitions. The lining is of cast-iron rings. Work was begun in 1892 and completed in 1897. The tunnel provides a roadway 16 feet wide and two sidewalks each 3 feet 1½ inches wide. In Glasgow, Scotland, the *Glasgow City and District Railway* has a length of 3.123 miles. Of this distance one mile is deep tunnel, and 3483 feet are tunnel built by the open-cut method. Work was begun in 1883 and completed in 1886. The *Glasgow Central Railway* has 0.84 of a mile of deep tunnel and 3.13 miles of open-cut tunnel. The *Glasgow District Subway*, 6½ miles long, consists of two parallel circular cast-iron lined tunnels 11 feet in interior diameter. The tunnels were driven by the shield method. Construction was begun in 1891 and completed in 1894. The *Metropolitan Railway* of Paris, comprising altogether some 40 miles of projected railway, completed in 1900 the main line from the Porte de Vincennes to the Porte Maillot and the Porte Dauphine, 8.7 miles. This is entirely underground. In the tunnel excavation the Berlier type of shields ordinarily were used; but progress by this means was found too slow, and open, timbered excavation of the ordinary type was employed. The so-called Belgian method of tunneling was used; the arch was first built and then the side walls were erected by underpinning the arch. After the earthen core was removed the bottom arch, or invert, was set in place. At the stations, however, the side walls were first constructed and upon them the arch, or metallic roof, was built. The removal of the earth from the core then took place, as in a tunnel, and the last stage was the construction of the invert. The line is double-track electric railway throughout.

The *Boston Subway*, begun in 1894, is practically the underground tunnel of the surface electric lines entering the business district of the city of Boston. The portion of the line completed in 1898 was 10,810 feet long, divided between double-track and four-track tunnel. The bulk of the tunnel was built by open-cut methods, but on certain portions the shield system was employed. In 1900 work was begun on a 1¼-mile extension of the original line under Boston Harbor to East Boston. The East Boston tunnel has a polycentric cross-section 23½ feet wide and 20½ feet high and is lined with concrete masonry. The double-track subway section is approximately rectangular and 24 feet wide by 14 feet high, while the four-track section is a similar form, but twice as wide. The lining consists of concrete side walls and brick roof arches supported by columns and I-beams of steel.

The *New York Rapid Transit Railway*, as contracted for in 1899, comprises some 20½ miles of line mostly in tunnel. A four-track line runs from the City Hall to 103d Street, and then divides into two double-track lines running to Bronx Park and to Spuyten Duyvil, respectively. The cross-section of the underground line will be of three different types; rectangular section will be used for the greater part of the road. The dimensions adopted for two tracks are 25 × 13 feet, and for four tracks, 50 × 13 feet. The barrel-vault section, composed of a polycentric arch, is 24 feet wide and 16 feet high. The circular sections are 15 feet in diameter, two tunnels being built side by side for double-track line. The work was done partly by open-cut methods and partly underground, according to the depth of the line below the surface.

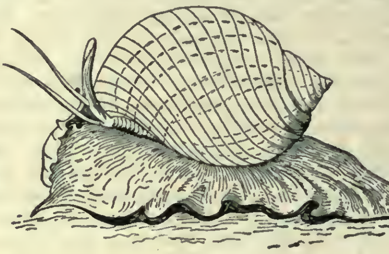
Among other notable tunnels the following may be briefly mentioned: *Arlberg Tunnel*, in Austria, begun in 1880 and completed in 1884 for a double-track railway, 6.38 miles long. *Tequixquiac Tunnel*, begun in 1888 to drain the valley of Mexico, 6 miles long and about 14 feet wide and 14 feet high, completed in 1898. *Trans-Andean Railway Tunnel*, through the summit of the Andes on the railway line between Buenos Ayres and Santiago, three miles long, at an elevation of 10,460 feet above the sea. *First Thames Tunnel* at London, England, begun in 1825 and completed in 1843, 1200 feet long with two parallel ways of horseshoe section, each 13¾ feet wide and 16⅓ feet high. *East River Gas Tunnel*, between New York and Brooklyn, 2516 feet long and 10 feet 2 inches in diameter, begun in 1892 and completed in 1894. *Khojak Tunnel*, on the Northwestern State Railway in India, 12,870 feet long, begun in 1889 and completed in 1891. *Strickler Tunnel*, for the water supply of Colorado Springs, Colo., 6441 feet long, with a section 4 × 7 feet through the rock. *Gravehölz Tunnel*, on the Bergen Railway, in Norway, single track, 17,400 feet long. *Busk Tunnel*, on the Colorado Midland Railway, in Colorado, 9094 feet long, with a section 15 feet wide and 21 feet high through rock.

BIBLIOGRAPHY. The literature on tunneling which is readily available is exceedingly limited. The most comprehensive book on the subject is Drinker, *Tunneling* (New York, 1874), which is now out of print. The book which ranks next in importance is Simms, *Practical Tunneling* (ib., 1896). The most recent book on the subject is Prelini, *Tunneling* (ib., 1901), which is a thoroughly up to date text-book of some 300 pages. Legouez, *De l'emploi du boudier dans la construction des souterraines* (Paris, 1897), is a comprehensive treatise on the shield system of tunneling. Among the works describing individual tunnels are: Von Rosenberg, *The Vorburg Tunnel* (New York, 1887); Walker, *The Severn Tunnel* (London, 1888); Burr, *Tunneling Under the Hudson River* (New York, 1885); Sutro, *The Sutro Tunnel* (ib., 1887).

Among foreign books on tunnels the following are notable: La Dame, *Les grands tunnels des Alpes et du Jura* (Paris, 1889); Rziha, *Lehrbuch der gesamten Tunnel-Baukunst* (Berlin, 1874); Danino, *Gallerie della traversata dell' Appenino, nella linea Foglio* (Rome and Naples, 1875). The *Proceedings* of the various societies and the engineering papers contain many descriptions of important tunnel works.

TUNNY (from OF. *ton*, *thon*, Fr. *thon*, from Lat. *thunnus*, *thynnus*, from Gk. θύννος, *thynnos*, θῦνος, *thynos*, tunny, from θύνειν, *thynein*, to dart along), or Horse Mackerel. The largest species of mackerel (*Thunnus thynnus*), also called 'tuna,' and 'great albacore.' It has the typical form of mackerel (q.v.), except that its body is thicker, and the tail is widely forked, becoming crescent-shaped. It is pelagic, and occurs in all the warm seas, attaining a length of 10 feet and a weight of 1500 pounds. The flesh, even of the larger specimens, is highly esteemed, and in Southern Europe it has become the object of important fisheries. Tunny fisheries were early established by the Phœnicians, and salted tunny was much esteemed by the Romans. The fish are captured by nets, and in addition to the large sale of them fresh, vast numbers are disposed of by canning. Every part of the body is utilized, the various parts being packed and sold separately, especially in Italy, under distinctive names. A closely related species is the long-finned albacore (*Germo alalunga*), very common in the Mediterranean and widely distributed elsewhere, and extremely abundant in the spawning season on the southern coast of California. It is about three feet long, and very handsome, but its flesh is poor. See Plate of Mackerels.

TUN-SHELL. One of the large, thin, globose, finely ribbed shells of the gastropod mollusks of the family Doliidæ, closely related to the helmet-shells and cowries (qq.v.). They are mainly tropical, but a well-known one (*Dolium galea*) inhabits the Mediterranean, and becomes ten inches in length, making it the largest mollusk of that region. The fig-shells (q.v.) also belong to this family.



TUN-SHELL.

TUN'STALL. A modern manufacturing and market town in Staffordshire, England, four miles north-northeast of Newcastle-under-Lyme (Map: England, D 3). It has collieries, chemical works, iron foundries, and manufactures of pottery and tiles. The chief building is the town hall. Population, in 1901, 19,490.

TUNSTALL or **TONSTALL,** Cuthbert (1474-1559). An English bishop and author. He was born at Hackforth, Yorkshire; was educated at Oxford and Cambridge, and studied at Padua; became rector of Harrow-on-the-Hill, 1511; Archdeacon of Chester, 1515, and was appointed Master of the Rolls in 1516, after his return as commissioner to Brussels, where he made the acquaintance of Erasmus and negotiated two treaties with Charles I. of Spain, afterwards Charles V. He was appointed Dean of Salisbury, 1521; Bishop of London in 1522; Lord Privy Seal in 1523; Ambassador to Spain in 1525, and to France in 1527, and became Bishop of Durham in 1530. He was deprived of his bishopric in 1552, and committed to the Tower on a charge of treason; was reinstated by Mary, but, declining the oath of supremacy to Elizabeth, was again deprived in 1559, shortly before his death. He was considered one of the ripest scholars and wisest diplomats of his period, and was the author of various theological and educational works, including *In Laudem Matrimonii, Oratio* (1518); *De Arte Supputandi Libri Quatuor* (1522), an arithmetical treatise frequently republished (1522); and *De Veritate, Corporis et Sanguinis Domini nostri Jesu Christi in Eucharistia* (1551), one of the best contemporary statements of the doctrine of the Eucharist.

TUPAC AMARU II. (1742-1781). A Peruvian revolutionist, whose real name was José Gabriel Condorcanqui, and who has been called 'the last of the Incas,' though it seems he did not himself lay claim to that title. He was born at Tinta (south of Cuzco), and was directly descended from the original Incas. Under the Spaniards he ruled several villages, and in 1780, after failing to get better treatment for the Indians, organized a rebellion in which 60,000 natives joined. During the next three months the insurgents got control of all the country between Lake Titicaca and Cuzco, but in 1781 Tupac was defeated and captured, and with most of the members of his family, was executed with frightful torture, as were also his cousin, Diego, and others of his family. It has been estimated that, during this war, 80,000 Indians were killed, the Spaniards' object apparently being to exterminate the Inca race. Fernando, Tupac's son, was condemned to life imprisonment, and sent to Spain when a child ten years old. His fate is not known, although in 1828, a man calling himself Fernando Tupac Amaru was pensioned at Buenos Ayres, and afterwards was a monk at Lima.

TUPAIA, or **BANXRING.** See Tree-Shrew.

TUPELO (North American Indian name), *Nyssa*. A genus of trees of the natural order Cornaceæ, natives of North America, chiefly of the southern parts of the United States. *Nyssa multiflora*, which attains a height of 60 to 70 feet, is often called black gum tree (q.v.). *Nyssa aquatica*, referred by some botanists to *Nyssa uniflora*, by others to *Nyssa multiflora*, is the large tupelo, a lofty and beautiful tree, remarkable for the extraordinary enlargement of the base of the trunk, which is sometimes 8 to 9 feet in diameter, while at no great height the diameter diminishes to 15 or 20 inches. The fruit (drupe) resembles a small olive, and was preserved in the same way by the French settlers in America.

TUPÍ, tōō-pē′ (allies, or village), or Tupinamba. An ancient tribe from which the widespread Tupían stock (q.v.) takes its name, and whose language is the basis of the *lingoa geral* or Indian trade language of the Amazon region. At the period of the first Portuguese occupation of Brazil, about 1550, they were one of the most populous and powerful tribes of the country, occupying the territory about the mouth of the Amazon and extending far southward along the coast. Being broken and driven back by the whites, they retired from the coast region into the interior, the bands taking different names. In 1640 some of them were still settled, under their own name, along the Lower Amazon from Pará up to the entrance of the Madeira. They cultivated corn and manioc, but lived chiefly by hunting and fishing. Their religion was a simple animism, with but little ceremonial. Those yet remaining in the same vicinity are now called, improperly, Tapuya (q.v.). They are all civilized, quiet, and intelligent. Physically, they are strong and compactly built, and supply the bulk of the crews for the Amazon River trade.

TUPÍAN STOCK, or Tupí-Guarani. The most widespread and important linguistic stock of South America. When the Portuguese took possession of Brazil the Tupían tribes held the greater portion of the territory from the Rio de la Plata (Paraguay or Paraná) on the south to the Amazon on the north, and extended an unknown distance inland, in some places even to the eastern slope of the Andes. The two principal tribes were the Tupí (q.v.), about the mouth of the Amazon, and the Guarani (q.v.), on the Lower Paraguay. Of the numerous other cognate tribes, the most important were the Chiriguano, Guarayo, Munduruců (q.v.), Mura (q.v.), and Omagua (q.v.). Many of the eastern tribes were gathered into missions by the Jesuits at an early period, the Guarani missions in particular at one time containing more than 300,000 Indians; but through the raids of the slave-hunters and the subsequent expulsion of the Jesuits, the missions were finally broken up, the more civilized Indians remaining to be incorporated with the Spanish settlements, while others retired far into the unexplored western wilderness. In general culture the Tupían tribes as a rule were superior to the other aborigines of Brazil, though much inferior to the Quichua of Peru. They practiced agriculture to some extent, raising corn, manioc, and tobacco, and were expert stone-workers, hammock-weavers, and makers of pottery. They kept monkeys and peccaries for food, but their main dependence was upon hunting and fishing. Their houses were light structures, usually communal, and most of them went entirely naked. With the exception of the Omagua, who had acquired considerable of the Quichua culture, they had no metals. The Tupían languages have been extensively cultivated, the Guarani having been adopted by the Jesuits for use in all the missions of the Paraguay, while the Tupí, in its corrupted form, is still the trade medium throughout the Amazon region. Consult: Adam, *Matériaux pour servir à l'établissement d'une grammaire comparée des dialectes de la famille Tupí* (Paris, 1896).

TUP′MAN, Tracy. In Dickens's *Pickwick Papers,* a susceptible member of the Pickwick Club.

TUP′PER, Sir Charles (1821—). A Canadian statesman. He was born at Amherst, Nova Scotia, where he was educated, and he studied medicine in Edinburgh. He settled in his native place as a medical practitioner; in 1862 was appointed Governor of Dalhousie College, Halifax, and was president of the Canadian Medical Association from 1867 to 1870. In 1835 he had been elected member of the Nova Scotia Provincial Assembly, and for two terms was secretary, and from 1864 to 1867 Premier. He took a prominent part in Canadian federation, and in the building of the Canadian Pacific Railway. After the union he was President of the Council from 1870 to 1872; Minister of Inland Revenue, 1872; Minister of Customs, 1873; Minister of Public Works, 1878; and Minister of Railways and Canals, 1879. In the latter year he was made a Knight Commander of Saint Michael and Saint George, having been a C. B. since 1867. After representing his native country first in the provincial and then in the Dominion Parliament for twenty-eight consecutive years, he resigned in 1884 on proceeding to London as High Commissioner for Canada, an appointment he again received in 1888. He was one of the British plenipotentiaries on the Fisheries Commission at Washington, 1887-88, which effected an agreement concerning the Canadian fisheries dispute, and in 1888 he received the honor of a baronetcy. In 1896 he succeeded Sir Mackenzie Bowell as Premier, but resigned six months later, after the Conservative defeat over the question of religious education. At the general election in 1900 he was rejected by Cape Breton, the scene of his continuous electoral triumphs during forty years, and retired to private life.

TUPPER, Sir Charles Hibbert (1855—). A Canadian Cabinet Minister, born at Amherst, Nova Scotia. He studied at McGill and Harvard universities, and in 1878 was admitted to the bar. In 1882 he was returned to the Dominion Parliament, and subsequently also in 1887, 1888, 1891, and 1896-1900. From 1888 to 1895 he was Minister of Marine and Fisheries, and from 1895 to 1896 was Minister of Justice and Attorney-General. In 1893 he served as agent for the British Government in the Paris tribunal of arbitration on the Bering Sea question.

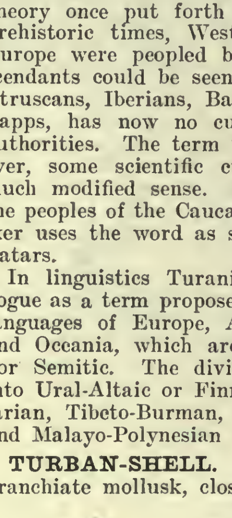
TUPPER, Martin Farquhar (1810-89). An English versifier, born in London. His father, Martin Tupper, was a well-known London surgeon belonging to a German family which had long been settled in Guernsey. Martin was educated at the Charterhouse, and at Christ Church, Oxford. In 1832 he entered Lincoln's Inn, where he was called to the bar three years later. He never practiced law, but turned at once to literature. He twice visited the United States (1851 and 1876). He died at Albury, near Guildford, November 29, 1889. Tupper published thirty-nine volumes. His first work, a collection of poems called *Sacra Poesis* (1832), attracted slight attention. This was followed by *Geraldine* (1838), a ludicrous attempt to complete Coleridge's *Christabel.* In the same year appeared the first installment of *Proverbial Philosophy* in verse. The work was continued and completed in 1876. The earlier parts were enormously popular. Large sections of the poems were also translated into German, French, and Danish. It is now hard to account for this vogue, as the poem is the merest commonplace. Consult the autobiography, *My Life as an Author* (London, 1886), and the reviews in contemporary periodicals, especially *Fraser's Magazine* (October, 1852).

TURACO, tōō-rä'kō (African name). A bird of the African family Musophagidæ or plantain-eaters (q.v.). The species are numerous, of large size, and brilliant plumage, and have strong, thick bills, more or less curved on the top, the cutting edges jagged or finely serrated, so as to render them very efficient instruments for cutting soft vegetable substances, on which they feed. The colors are chiefly bright green, verditer-blue, crimson, and yellow; red and green predominate. These birds have an elegant helmet-like crest, which they elevate when excited. One of the largest species is the giant turacou (*Corythæola cristata*), of Western and Central Africa, which is 28 inches long. It is verditer-blue, without red, but the tail has a broad, black, subterminal bar, and the bill is red and yellow.

TURANIAN. A term formerly applied loosely to all Asiatic peoples, excepting those of Indo-Germanic or Semitic stock. In the early Iranian chronicles of the Persian era the term Turan, in contrast with Iran (the home of the Aryan Iranians), was given to the region to the northeast, including modern Turkestan, the home of non-Aryan, nomadic, uncivilized peoples. The theory once put forth according to which, in prehistoric times, Western Asia and most of Europe were peopled by Turanians, whose descendants could be seen in Pelasgians, Hittites, Etruscans, Iberians, Basques, Picts, Finns, and Lapps, has now no currency among the best authorities. The term Turanian still has, however, some scientific currency, although in a much modified sense. Thus De Morgan styles the peoples of the Caucasus Turanians, and Deniker uses the word as synonymous with Turko-Tatars.

In linguistics Turanian formerly had some vogue as a term proposed by Max Müller for all languages of Europe, Asia (excepting China), and Oceania, which are neither Indo-Germanic nor Semitic. The division of these languages into Ural-Altaic or Finno-Ugric, Dravidian, Kolarian, Tibeto-Burman, Khasi, Tai, Mon-Anam, and Malayo-Polynesian is now adopted.

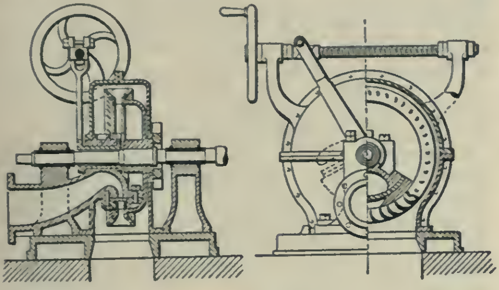
TURBAN-SHELL. An herbivorous scutibranchiate mollusk, closely allied in habits and structure to the top-shell (q.v.). It takes its name from a resemblance in the shell to an Oriental turban, and when denuded of its outer coating is richly pearly, making it one of the shells most widely sold as an ornament. In the Orient, where most of the species live, the animals are often eaten. The aperture is large and flaring, and the operculum calcareous. The typical genus, Turbo, the genus Phasianella (see PHEASANT-SHELL), and the spiny genus Delphinula, constitute the family Turbinidæ, which may be traced back to Ordovician time, and especially flourished during the Silurian period.


A TYPICAL TURBAN (*Turbo argyrostomus*).

TURBELLARIA (Neo-Lat. nom. pl., from Lat. *turba*, disturbance, crowd; referring to the whirlpools caused by the movements of their cilia). The first and most highly organized of the three classes of flatworms, composed of free-living worms. The body epithelium is densely ciliated. The turbellarian worms are found in both salt and fresh water in the warmer parts of the world, and in moist places on land in the tropics. They are usually of small size, less than two inches long, but some species are four or five inches long. The body is generally very flat and leaf-like, but in some species, especially among the land forms, is narrow, elongated, and slightly arched. The colors are sometimes dull, but many of the marine forms are brightly colored, and are very beautiful objects. Most of the Turbellaria are carnivorous, and are very active, especially in swimming. The class is divisible into three orders, based chiefly on the arrangement of the intestine. See PLANARIAN.

TUR'BERVILLE, GEORGE (c.1540-c.1610). An English poet of an ancient Dorset family. He was born at Whitchurch, in Dorsetshire, and was educated at Winchester, and at New College, Oxford, of which he became a fellow in 1561. Leaving Oxford the next year without a degree, he studied law at one of the inns of court in London. In 1568 he accompanied Thomas Randolph, a special ambassador of the Queen, to Russia, where he wrote verses describing the manners of the people (reprinted in Hakluyt's *Voyages*, 1589). Of his later life nothing is known. He probably died about 1610. Tuberville occupies a rather interesting place in English literature, as a translator from the Latin and the Italian, and as one of the first among English poets to employ the ottava rima (q.v.) and blank verse (q.v.). Chief among his works are *Epitaphs, Epigrams, Songs, and Sonnets* (1567, in Chalmer's *British Poets*, vol. ii., London, 1810); *The Booke of Faulconrie, or Hawking*, with which is bound *The Noble Art of Venerie, or Hunting*, ascribed to Turberville (1575; enlarged 1611); *Tragical Tales* from the Italian, with original epitaphs and sonnets (1587; reprinted, Edinburgh, 1837); and *The Heroycall Epistles of Ovidius in English* (1567). To Turberville have been doubtfully ascribed two versions of Tasso's *Jerusalem Delivered* (manuscript in Bodleian Library at Oxford). Selections from Turberville's poems are in *Early English Poetry*, edited by H. M. Fitzgibbon (London, 1887).

TURBINE (Fr. *turbine*, from Lat. *turbo*, *turben*, wheel, whirlwind, from *turbare*, to disturb, move, from *turba*, disturbance, crowd). A motor for utilizing the energy of water by causing it to flow through curved buckets or channels on which it exerts a reactionary pressure constituting the motive force. Turbines may be divided, as regards their construction, into radial, axial, and combined or mixed flow. In *radial turbines* the water in passing through the wheel flows in a direction at right angles to the axis of rotation, or approximately radially. In *axial turbines*, or parallel-flow turbines, the water flows through in a direction generally parallel with the axis of rotation. In *combined or mixed flow turbines*, both the previously described systems are combined. Another classification of turbines is also employed, namely, reaction turbines and impulse turbines. In a *reaction turbine* all parts are entirely filled or 'drowned' with moving water; in the *impulse turbine* the construction is such that the buckets are only partly occupied by the water passing through them, the atmosphere having free access to the remaining space. A reaction turbine is driven by the dynamic pressure of the flowing water, which at the same time may be under a certain static pressure, due to the fact that the inflow takes place under pressure, since the wheel is always filled with water. In the impulse turbine the inflow takes place freely against air pressure only. Most turbines are built on the reaction principle, but any turbine may be made to work either as a reaction turbine or an impulse turbine.



IMPULSE TURBINE.

Structurally, a turbine consists (1) of a ring or a pair of rings, to which are attached curved vanes arranged uniformly around the circumference, revolving on a shaft or spindle to which the ring or pair of rings is connected by a boss and arms or other suitable means, and (2) of a casing which incloses the part just described, and which generally is provided with guide vanes between which the water enters the wheel, and which cause the water to enter in the desired direction. The supply of water to the turbine is regulated by a gate or gates, which can partially or entirely close the orifice where the water enters or leaves. The guides and wheel with the gates and the surrounding cases are made of iron. Numerous forms of turbines with different kinds of gates and different proportions of guides and vanes are on the market. They are made of all sizes from 6 to 60 inches in diameter, and larger sizes are built for special cases. On account of their cheapness, durability, compactness, and high efficiency, turbines are now more extensively used than all other kinds of hydraulic motors. See WATER-WHEEL and HYDRAULIC PRESSURE ENGINE.

The three kinds of turbines, namely, radial, axial, and combined, may be mounted on either vertical or horizontal shafts, and the water may flow through them in both directions. Thus in a radial turbine the water may flow inward from the circumference to the centre, or outward from the centre toward the circumference; in an axial turbine it may flow from the top downward or from the bottom upward; and in a combined turbine it may flow inward and up or down or outward and up or down. Ordinarily turbines are mounted on vertical shafts and water flows through them either inward, outward, or downward. In all cases the water should leave the turbine with low velocity, or, in other words, the most of the energy should have been taken up in passing through the wheel. The three ordinary forms of turbine are often called by the names of those who first invented or perfected them; thus the outward-flow turbine is called the Fourneyron turbine, the inward-flow turbine is called the Francis turbine, and the downward-flow turbine is called the Jonval turbine. Besides these there is the combined turbine, in which ordinarily the flow is usually inward and downward. The usual efficiency of turbines at full gate is from 70 per cent. to 85 per cent. of the power theoretically available.

The speed of rotation of a turbine is regulated by opening and closing the gate which admits the water to the wheel. Where the power used fluctuates the speed will fluctuate unless some method is adopted to adapt the power developed to the power utilized. This is usually done by means of a governor, which is so devised that when little power is being used the resulting increase in speed will actuate it to close partly the gate, and when much power is being used the decrease in speed will actuate it to open the gate wider. The wheel and the shaft which it carries have to be supported from a bearing near the top, but more often they are carried on a sort of point bearing at the bottom. At Niagara Falls the weight of the wheel and shaft is supported by the upward pressure of the water against a disk in the top of the wheel case. For every turbine there is a certain velocity of rotation which gives a higher efficiency and power than any other velocity, and this may be calculated mathematically when the form and dimensions of the vanes and guides are known, or it may be determined experimentally. The theory of turbines is a complicated subject, and the reader interested in investigating it should consult one of the following books: Merriman, *Treatise on Hydraulic Motors* (New York, 1900); Bodmer, *Hydraulic Motors, Turbines, and Pressure Engines* (New York, 1889). A description of a number of the most used turbines is given in Frizell, *Water Power* (New York, 1901). See WATER POWER and WATER WHEELS. STEAM TURBINES are described under that title.

TURBIT. A fancy breed of domestic pigeons, varying in colors and crest, with a flattened head, very small beak, ruffled breast, and other oddities. See Colored Plate of PIGEONS.

TURBOT (OF. *turbot*, from Lat. *turbo*, top). The most valuable of the flatfishes (*Rhombus maximus*), and one of the most toothsome of all fishes. It abounds off the northern coast of Europe, and attains a large size, sometimes 70 to 90 pounds in weight. Its form is shorter, broader, and deeper than that of almost any other flatfish. It is brown in color on the upper surface, which is studded with hard roundish tubercles. Like the other flatfishes, it generally keeps close to the bottom of the sea; and is found chiefly on banks where there is a considerable depth of water. See FLATFISH; and Plate of FLATFISH AND FLOUNDERS.

TURCARET. A comedy by Lesage (1709), satirizing the corruption of the French financiers and the foibles of the time. The title character is an illiterate stock-jobber, whose name has become proverbial for a rich vulgarian.

TURENNE, tụ'rĕn', HENRI DE LATOUR D'AUVERGNE, Viscount de (1611-75). A Marshal of France. He was born at Sedan, September 11, 1611, the second son of Henry, Duke of Bouillon, and was brought up in the Reformed faith. He entered the French army in 1630, served with distinction under Bernhard of Weimar in 1637-38, and his victory over the Spaniards before Casale in 1640 added to his laurels. He conquered Roussillon from the Spaniards in 1642, and was rewarded with the baton of a Marshal of France. At the close of 1643 he was placed at the head of the army operating in Germany, where the French had sustained a great defeat at the hands of the Bavarians and Imperialists. Together with the Duke of Enghien (later Condé) he fought against General Mercy at Freiburg in August, 1644. After suffering defeat at Marienthal, May 5, 1645, at the hands of Mercy, he shared in Condé's victory near Nördlingen, August 3d. The next year Turenne united with the Swedes to complete the conquest of Bavaria, and by his successes hastened the close of the Thirty Years' War (1648). Under the influence of his elder brother and the Duchess of Longueville (q.v.) he joined the Fronde (q.v.), but, together with his Spanish allies, was defeated by Duplessis at Rethel in December, 1650. In the following year he became reconciled with the Court, and successfully commanded the royal armies against Condé, who had in the meanwhile gone over to the Fronde. In 1667, on the outbreak of the so-called War of Devolution (see LOUIS XIV.), the King gave him the supreme command of the army, with which he overran Flanders and Franche-Comté. Louis XIV. succeeded in inducing him to embrace the Catholic faith (1668). Turenne's campaign in Holland (1672) was a triumphant one; and the Elector of Brandenburg, who had ventured to side with the Dutch, was forced to sue for peace. In the following campaign, however, Turenne was outmanœuvred by the Imperialist general, Montecuculi. In 1674 he laid waste the Palatinate and defeated the Duke of Lorraine at Sinzheim. Forced from Alsace by superior forces, Turenne executed a masterly retreat, and found safety behind the Vosges Mountains; then in a midwinter campaign he succeeded in reconquering the country after two decisive victories at Mühlhausen and Türkheim. Once more he crossed the Rhine to take up the game against his old rival, Montecuculi, but was killed while reconnoitring before Sasbach, near Offenburg, July 27, 1675. He was buried at Saint-Denis, and his body was placed by Napoleon in the Invalides. Turenne left memoirs of his campaigns from 1643 to 1658, which are of considerable interest to the student of military history (Paris, 1782; new edition 1872). For his biography, consult Armagnac (Tours, 1880), Duruy (5th ed., Paris., 1889), Hozier (London, 1885), and Ramsey (ib., 1774). Consult also: Neuber, *Turenne alse Kriegstheoretiker und Feldherr* (Vienna, 1869); and Roy, *Turenne, sa vie et les institutions de son temps* (Paris, 1895).

TURGAI, to͞or-gī'. A territory of Russian Central Asia, an administrative division of the Governor-Generalship of the Steppes, bounded by the Government of Orenburg (European Russia) on the north, the Territory of Akmolinsk on the east, the Territory of Syr Darya and the Sea of Aral on the south, and the Territory of Ural on the west (Map: Asia, F 3). Area estimated at 176,300 square miles. The larger part is flat, with sandy deserts in the south. The western part is covered with the Mugajar Mountains, offshoots of the Ural system. The region is watered by the Ural and the Tobol, which are almost waterless during the dry season. The flora is poor and the forests are few. The fauna, on the other hand, is very rich, especially in furbearing animals. The climate is continental, with extremely hot summers and severe winters.

Agriculture is as yet little developed. The nomadic Kirghizes are engaged principally in stock-raising and hunting. The mineral deposits of the region, which include iron, copper, silver, coal, etc., are practically untouched. The natives export small articles of metal, saddles, musical instruments, carpets, etc. There are also exported furs and animal products. The barter system still prevails. Population, in 1897, 453,123—Kirghizes, over 400,000, and Russians, about 30,000.

TURGENIEFF, tụr-gĕn'yĕf, ALEXANDER IVANOVITCH (1784-1845). A Russian historian. He traveled extensively in Germany, Italy, France, and Denmark, making investigations in regard to the mediæval history of Russia. He published *Historiæ Russiæ Monumenta* (2 vols. 1841-42) and a *Supplementum* (1848).

TURGENIEFF, IVAN SERGEYEVITCH (1818-83). A Russian novelist. He was born at Orel, the son of a wealthy nobleman. At home he learned German and French, besides some English, while a self-taught serf implanted in him a love for the Russian poets. Neglected by his parents, the boy made many friends among the peasants, and became a keen observer of their life. At fifteen he passed a brilliant entrance examination at the University of Moscow, and entered the University of Saint Petersburg a year later. Here he came to know Pushkin, Byelinski, and other literary lights. After graduating, he went to Berlin to complete his study of classical philology under Boeckh and Zumpt, of history under Ranke, and of philosophy under Werder. He returned to Saint Petersburg in 1841. His relations with his mother, formerly strained, were now openly broken off on account of her treatment of the serfs. He had to take service as a Government clerk, but soon gave up his position and set himself to write. His poem *Parasha* (1845) was heartily praised by Byelinski. But it was the great success of *Kolosoff* (1846) and *Khor and Kalinytch* (1847) that induced him to write the *Annals of a Sportsman* (1847-51). These sketches, pervaded with the spirit of humanity and a sincere love for the oppressed peasants, became the favorite book of Alexander II., then heir to the throne. When Turgenieff's mother died in 1850 he immediately liberated all the serfs belonging to the estate. Meanwhile, he had incurred the suspicion of the Government by a sojourn abroad in 1848 and later; and in 1852, after the publication of an article, liberal in tone, on the death of Gogol, he was forbidden to leave his estate. After two years he was pardoned through the influence of powerful friends, and left Russia in 1855. The remainder of his life was spent abroad, mainly in Paris, in close friendship with the famous singer Pauline Viardot-Garcia and her family. Of his few visits to Russia, that in 1879, and especially that in 1880, when he was fêted as no one else at the Pushkin festival, were the most memorable. In 1881 he visited Russia for the last time. He died at his Bougival villa, near Paris, in 1883, and was buried at Saint Petersburg in the Volkoff Cemetery, the funeral procession exceeding anything of the kind previously witnessed in Russia.

The great fame of Turgenieff rests on his *Yakoff Pasynkoff* (1855); *Rudin, Faust* (1856); *Asya* (1858); *Nobles' Nest, or Liza* (1859); *On the Eve, First Love* (1860), and *Fathers and Sons* (1862). The works of the preceding period were devoted to pleading the cause of the serfs against their owners; in these later works, Turgenieff turned to the mental and moral bankruptcy of the upper classes as resulting from a life of idleness amid hundreds of overworked serfs. *Fathers and Sons* marks an important point in Turgenieff's career. Its hero, Bazaroff, a young student disdaining all but utilitarian science, was called by the author by the newly coined name *nihilist*, meaning 'a man who looks at everything from a critical point of view.' With one or two exceptions the radical critics savagely attacked what was considered a caricature on the young generation. With the reactionaries Nihilism soon became equivalent to 'respect for nothing,' or 'political unreliability,' and this helped to widen still further the breach with the liberals. The animosity of Turgenieff's critics turned the melancholy manifest in his earlier works into pessimism, and his *Smoke* (1867) depicted the whole liberal movement of 'the sixties' as a mirage. *Virgin Soil* (1876) pictured the 'new' generation of 'the seventies.' Here Turgenieff fully applied his favorite division of all people into two types, a classification proclaimed by him in the essay *Hamlet and Don Quixote* in 1860—Hamlet representing endless self-analysis and skepticism; Don Quixote, enthusiastic devotion to the ideal. But Turgenieff, living abroad, could no longer be a faithful painter of the new social currents in Russian life. *Clara Militch* (1883), in spite of its mystical effect, is a story of the real life of the great Russian singer and actress Kadmina, who ended life by suicide on the stage of Kharkoff. His *Senilia*, or *Prose Poems* (1883), are poetic gems in the most perfect prose.

Turgenieff, the lineal literary descendant of Pushkin, is the greatest prose-artist in the history of Russian letters. His figures do not stand out boldly against the background, but form an harmonious organic part of the whole scheme, and as such impress one still more forcibly when the whole scheme is comprehended. The language of Turgenieff has been at once a model and source of despair for the young Russian writers. His influence on modern literature has been very great, and many young French writers consider themselves his pupils. The latest edition of his works appeared in 10 vols. (Saint Petersburg, 1891). An excellent English translation by Constance Garnett appeared in 14 vols. (London, 1894-97), with short introductions to the novels.

TURGENIEFF, Nikolai Ivanovitch (1790-1871). A Russian historian, brother of Alexander Ivanovitch. He studied at Göttingen, entered the civil service, and in 1813 was associated as Russian commissary with Baron Stein in governing the German provinces taken from France. He was afterwards Deputy Secretary of the Interior and Agriculture in Russia. He advocated the emancipation of the serfs, and in 1825 was sentenced to death *in contumaciam*, for his connection with the insurrection of the Decembrists. He lived thenceforth in Paris, where he published *La Russie et les Russes* (1847).

TURGITE (from *Turginsk*, a copper mine in the Ural Mountains). A hydrated ferric oxide that is found massive, with a dull earthy lustre, and is reddish-black to dark-red in color. It is found in the Urals, in Prussia, and in the United States at Salisbury, Conn., where it occurs in large botryoidal masses with limonite. This mineral is regarded as an intermediate stage in the alteration of limonite to hematite by the loss of water, and is a valuable ore of iron.

TURGOR (Lat., a swelling). The condition of a plant cell when it is stretched by the internal pressure of the cell sap. The word is also applied to the stretching force. The mature plant cell usually consists of a protoplasmic body, surrounded by an elastic membrane composed of cellulose and other materials, and inclosing one or more vacuoles filled with water, the cell sap. This is not pure water, but a solution of various substances, whose total osmotic pressure (see Osmosis) is usually equal to 4-6 atmospheres, and sometimes rises as high as 20 atmospheres. Whenever such a cell is surrounded by a solution of lower osmotic pressure, water will enter the cell and find its way to the vacuole. On account of the high osmotic pressure, the protoplasm is driven outward against the cell wall as water enters, and the cell wall itself is stretched (unless this is prevented by the opposing pressure of adjacent cells) until its resilience balances the outward pressure. This stretched state of the cell is favorable for growth (q.v.), and is the opposite of the condition known as plasmolysis (q.v.). Turgor may be reduced by the withdrawal of water from the cell, either by evaporation or by surrounding the cell with a solution of higher osmotic pressure than that inside it. Turgor of all the cells of a tissue renders the mass rigid. By the combined turgidity of all the tissues in the young parts of the plant or those whose cells are thin-walled (e.g. leaves), such parts maintain their normal form. When turgor diminishes, the parts become flaccid.

TURGOT, tụr'gō'. Anne Robert Jacques, Baron de l'Aulne (1727-81). A French economist and statesman. He was born in Paris, May 10, 1727, of an old family of Normandy, and was destined for an ecclesiastical career, but after studying for a time at the Sorbonne, where he won some distinction, he turned from the Church and devoted himself to the study of jurisprudence and political economy. In these fields he allied himself with the philosophical and liberal thought of his time. He was a contributor to the *Encyclopédie* and became a member of the physiocratic school of economists. He became councilor to the Parlement in 1752, and in 1761 was made intendant of Limoges, administering the affairs of that province for thirteen years, and carrying out within this field such reforms as the ancient prejudices would allow. He introduced a more equitable administration of imposts, and succeeded in abolishing the old method of repairing roads and bridges by the compulsory labor of the poor inhabitants of the district, the corvée (q.v.). He also exerted himself for the protection of commerce. A wider field opened before him when he was called into the Ministry after the death of Louis XV. The finances were in the utmost disorder, and the whole social and political system of France needed regeneration and reform. Turgot was first made Minister of Marine, and afterwards Comptroller-General of France, when to fill that post was to be virtually Prime Minister. His first achievement was so far to reduce the expenditure as to leave a surplus of 20 millions of francs a year to be applied to the liquidation of old debts. He augmented the public revenue without imposing new taxes. One of his first measures was the carrying out of free trade in corn throughout the interior of the kingdom. He aimed at establishing complete freedom of trade within the country, and to make the nobility and clergy contribute to the public revenue in the same proportion as the third estate. He wished, by means of provincial assemblies, to accustom the nation to public life, and prepare it for the restoration of the States-General. But the privileged classes whose exemptions were threatened, nobles, courtiers, farmers of the revenue, and financiers, united against him. The King forsook him, and Turgot retired in May, 1776, having held office for only twenty months. After his retirement he again devoted himself to literary pursuits and to his favorite scientific studies. His most important work, *Réflexions sur la formation et la distribution des richesses* (1766), is one of the chief productions of the physiocratic school. (See PHYSIOCRAT.) His complete works were published in nine volumes (Paris, 1808-11), and have since been reprinted. Consult: Condorcet, *Vie de Turgot* (Paris, 1786); Stephens, *The Life and Writings of Turgot* (1895).

TURIN (It. *Torino*). The capital of the Province of Turin, in Piedmont, Italy, situated on the Po, here navigable near the junction of the Dora Riparia, 76 miles west-southwest of Milan (Map: Italy, B 2). Turin is an open unfortified town. It is unique among Italian cities because of its rectangularity of construction—long, straight, in part arcaded streets, rectangular blocks of houses or 'islands,' and regular squares. It is well built, and is embellished with numerous squares, statues and monuments, and beautiful parks. Several churches have been constructed since 1870, and also four public arcades.

The extensive Piazza Castello, in the northeastern part of Turin, lined by arcaded streets, is the centre of the city's life. Thence the most important thoroughfares diverge, the fine Via di Po (the Corso of Turin) leading southeast to one of the four bridges over the Po, and traversing the large Piazza Vittorio Emanuele. In the Piazza Castello rises the mediæval Palazzo Madama, a huge ungainly pile, now occupied by various institutions. Northward looms the royal palace, a plain brick edifice, dating from 1660. Within it are located the valuable royal armory (with many historic relics of interest), a fine collection of coins, etc. Adjoining the palace is the royal park. Near it stands the commonplace Gothic cathedral (fifteenth century) containing the fine impressive chapel of the Santissimo Sudario, treasuring some of the linen reported to have covered the body of the Saviour. The Palazzo Carignano, in the Carignano Square to the south, in which met the Sardinian Chamber of Deputies (1848-59) and the Italian Parliament (1860-64), holds natural history collections. The fine square of San Carlo is situated south of the Castello. The gardens of the Citadella, southwest of the royal palace, as well as the gardens of Carlo Felice, to the south, are both attractive. The public park is in the southeastern part of the city, along the left bank of the Po, where are also located the Botanic Gardens. On the eastern side of the Po rises the wooded Monte Dei Cappuccini, 164 feet above the river. A short distance east of the city, on a height ascended by a cable railroad, is the royal burial church of the House of Savoy—the Superga—a splendid edifice affording a fine view. The most important monuments are those of Duke Victor Amadeus I., King Charles Albert, Duke Emmanuel Philibert, and the imposing monument of Cavour.

Turin is industrially and commercially prosperous. It manufactures mainly steel and iron products, silks, lace, velvet, ribbons, cotton and woolen stuffs, jewelry, porcelain, pianos, and furniture. Prominent among the exports are wine and silk from Piedmont. The transit trade is heavy. The opening of the Simplon tunnel promises greatly to favor the city's trade advantages.

Educationally Turin is prominent. (For the university, with its museums, etc., see TURIN, UNIVERSITY OF.) The valuable National Library has some 250,000 volumes and 4200 manuscripts. Turin has among its numerous educational institutions a royal polytechnic school, an astronomical observatory (in the Palazzo Madama), a royal military school for artillery and engineer officers, a military school and hospital, a Liceo Musicale, an archiepiscopal seminary, an agricultural school, a philharmonic academy, four gymnasia, and an industrial school. In the Palace of the Academy of Sciences are the picture gallery and museums of antiquities and natural history. There are an Italian Industrial Museum, the civic museum, and the museum of the Risorgimento Italiano, in honor of Victor Emmanuel II. The last is located in the modern Mole Antonelliana, a curious tower-shaped edifice, having a total height of 538 feet, thus overtopping the Cologne Cathedral. The Royal Albertine Library, in the royal palace, contains 60,000 volumes and 3000 manuscripts. The Municipal Library has about 75,000 volumes.

Turin is an important military station, owing to its nearness to the French frontier and to the passes of the Western Alps. The budget in 1900 balanced at about $2,700,000. The municipal debt amounts to $5,270,000, but is more than offset by the value of the municipal properties. The population in 1901 was 335,656.

HISTORY. Turin was the chief city of the Ligurian Taurini. It was taken by Hannibal, and became a Roman colony in the time of Augustus, when it received the name of Augusta Taurinorum. It was prominent under the Lombards, became later the seat of marquises, and in the eleventh century passed to the House of Savoy. It has been repeatedly in the hands of the French. Here Prince Eugene won a brilliant victory over the French on September 7, 1706. From 1861 to 1865 Turin was the capital of the new Kingdom of Italy. Consult: Promis, *L'antica Torino* (Turin, 1871); Borbonese, *Toriño illustrata e descritta* (ib., 1884).

TURIN, University of. An Italian university founded in 1405 by Louis of Savoy. It became at once a refuge for the professors at the universities of Pavia and Piacenza, then suffering from civil wars. Toward the latter part of the fifteenth century it shared the general reputation and prosperity of the Italian universities of that period. It comprised two colleges, one founded in 1457 (Collegio Grassi), and one in 1482. The university was reorganized in 1632, and in 1713 the present building was erected. In 1901 there were about 2800 students. The library contains about 260,000 volumes and 3300 manuscripts. There are connected with the university the Collegio Carlo Alberto and the Instituto Dionisio.

TURIN PAPYRUS. A hieratic papyrus, preserved in the Museum of Turin, containing a dynastic list of the kings of Egypt. It formed part of the collection offered for sale to the French Government in 1818, by M. Dovretti, the French Consul-General in Egypt, and was at that time perfectly preserved. The French Government declining to buy it, the papyrus afterwards was acquired by the King of Sardinia, and was finally sent to Turin. It was, however, carelessly packed, and on its arrival it was found to be broken into 164 fragments. Champollion (q.v.) was the first to recognize its nature and value, and in 1824 collected from it between 160 and 180 royal prenomens, but, except in a very few cases, was unable to determine the order of succession. In 1826 Seyffarth (q.v.) attempted to piece together the broken fragments and reconstruct the papyrus, but his attempted restoration is altogether unreliable, partly on account of his limited knowledge of the hieratic character, and partly because a large proportion of the fragments are so minute as to afford little or no indication of their proper order. Subsequent attempts to restore the text have met with little success. In its original condition the Turin Papyrus contained a list of the kings of Egypt, beginning with the mythical period and ending with Dynasties XV. and XVI., with the exact duration of each monarch's reign in years, months, and days. It would supply, if complete, an invaluable guide for the earlier period of Egyptian history, but in its present mutilated state it is of little use for historical and chronological purposes except in the portions covering the thirteenth and fourteenth dynasties, where the text is somewhat better preserved. Elsewhere, the papyrus serves at best to confirm data derived from other sources, and furnishes scarcely any independent information. The text is published in Lepsius, *Auswahl der wichtigsten Urkunden des ägyptischen Alterthums* (Berlin, 1842), and in Wilkinson, *The Fragments of the Hieratic Papyrus at Turin* (London, 1851). Consult: *Transactions of the Royal Society of Literature*, 2d series, vol. i. (London, 1843); *Revue archéologique*, vol. vii. (Paris, 1850); Wiedemann, *Aegyptische Geschichte* (Gotha, 1884-88); Budge, *A History of Egypt* (New York, 1902).

TURK′ESTAN′, *Turk pron.* to͞or′ke-stän′. An extensive region in Central Asia, included between the Russian territory of the Steppes on the north, the Mongolian Desert on the east, Tibet, India, Afghanistan, and Persia on the south, and the Caspian Sea on the west. A portion of Turkestan territory is comprised within Afghanistan. Politically the region is divided into Western or Russian Turkestan and Eastern or Chinese Turkestan. The Russian protectorates of Khiva and Bokhara and the Russian Province of Transcaspia are now considered and treated as separate divisions.

Russian Turkestan. This region embraces the territories of Ferghana, Samarkand, Semiryetchensk, and Syr-Darya (Map: Asia, F 4). Total area, about 411,500 square miles; total population, about 4,888,200. Together with the Transcaspian province and a portion of the Pamir, it constitutes the general government of Russian Turkestan. It is bordered by the territory of the Steppes on the north, Sungaria and Chinese Turkestan on the east, Bokhara and Khiva on the south, and Khiva and the Sea of Aral on the west. The western and northern parts are flat and sandy; the southeastern part is mountainous. In the west and north are the great deserts of Kizil-kum, Mujun-kum, and Kara-kum. In the northeast is the extensive Lake Balkhash. The mountains of the south belong to the three systems of the Hissar, the Alai, and Tian Shan, and form a wild Alpine-like district, interspersed with fertile valleys. The Karatau chain stretches northwest and divides the territory into two parts. There are numerous oases. The Syr-Darya, rising on the central mountain border, flows west through the centre of Ferghana, then northwest along the southwestern side of the Karatau, finally reaching the Sea or Aral. The Ili, an affluent of Lake Balkhash, is the chief river in the East. It flows northwest through the centre of Semiryetchensk. These streams have numerous tributaries. The southern section of Russian Turkestan is subject to earthquakes. The climate is continental. The summers are hot and dry and the winters comparatively severe and accompanied by destructive snowstorms. The flora in the west belongs to the Aral Sea district, in the east to the mid-Asiatic region. The fauna, though essentially of the Central Asiatic type, comprises many tropical representatives, among them the tiger. Salt, coal, and asphalt are obtained, and precious stones are exported.

Numerous irrigation canals tap the rivers and provide agricultural conditions which would otherwise be impossible. This is especially true in the southern part of the country, where the bulk of the population is located. The staple crops are wheat, rice, millet, and oats. Cotton is a promising crop in Ferghana. Rice and cocoon silk are also produced in noteworthy quantities. Various kinds of fruit, including the grape, thrive. Stock-raising, however, is the leading occupation. Great numbers of sheep are reared. There are upward of 1,000,000 camels and over 2,000,000 horses in the country. The domestic industries are widespread, and some of the native products, such as carpets and rugs, are highly valued in Europe. The manufacturing industries properly so called are in their infancy. The exports consist chiefly of raw products, which go largely to Russia. The Transcaspian Railway has been a great pacificator in Russian Turkestan. It reached Samarkand in 1888 and at present extends to Tashkent and Andijan. From Tashkent a line is building northwest to Orenburg on the European frontier, and other lines are in contemplation. While the general administration is intrusted to Russian officials, the natives suffer little interference, and taxation is scarcely more than nominal. Public education is almost entirely in the hands of the native religious bodies, although the Russian Government has shown considerable concern for the instruction of the natives. Turkestan forms one educational district, and had, in 1898, 125 schools with 5560 pupils. The inhabitants are almost wholly Mohammedans. The Kirghizes form about 36 per cent., the Sarts 24 per cent., and the Usbegs and Kiptchaks together 19 per cent. The Russians, therefore, constitute but a small element. The leading cities are Tashkent, the capital, Khokand, Namangan, and Samarkand. Andijan was ruined by an earthquake in 1902.

CHINESE OR EASTERN TURKESTAN. A dependency of China, bordered on the north by Sungaria, on the east by Mongolia, on the south by Tibet, on the southwest by Kashmir, and on the west and northwest by the Pamir and Russian Turkestan. The country is isolated and forbidding in many aspects. It is in the main a large and elevated desert plateau, surrounded by lofty mountain ranges, of which the Tian Shan lines the northern frontier, and the Kuenlun, Altyn Tag, and the spurs of the Karakorum the southern. The southern range reaches more than 18,000 feet. The desert of Gobi occupies a portion of the eastern section. The mean elevation of Chinese Turkestan is assumed to be about 3500 feet, but there are a number of markedly low levels, and along the southern face of the Bogdo-Ola mountains, in the depression of Luktchun, the surface drops 200 feet or more below sea-level. The region is watered chiefly by the Tarim River (q.v.), which rises in the west, and its tributaries. The Tashun-Gobi desert occupies the centre of the eastern part. At the foot of the frontier ranges there are chains of oases which mark the chief caravan routes of the region. Along the foot of the Tian Shan stretches a series of lakes, of which the largest is the Bagrach Kul.

The climate is severe and extremely dry. Domestic animals abound, and the tiger, jackal, wild camel, bear, and wolf are found. The oases and the strips along the base of the mountain ranges alone offer conditions for permanent habitation. The people are engaged principally in agriculture, stock-raising, commerce, and hunting. Cotton, silk, and animal products are exported, and in some of the larger cities, such as Yarkand, Khotan, Aksu, and Kashgar, there are manufactured copper-ware, silk, carpet, felt, and leather goods. There are extensive mineral resources, but mining is engaged in only by the natives and accordingly in a primitive way. Asbestos, sulphur, and saltpetre are obtained. A heavy caravan commerce traverses Eastern Turkestan en route to and from China, this region being in the direct central western route. Administratively, Eastern Turkestan has formed since 1885 a part of the Chinese Province of Sinkiang, and is divided into the three *dao-tais* of Kashgar, Aksu, and Urumchi. The seat of the administration is at Urumchi (qq.v.). The inhabitants are of mixed Aryan and Turanian descent. The most numerous are the Kirghizes, Sarts, Kalmucks, Usbegs, and Tajiks. The language is Eastern Turkish with an admixture of Chinese words.

HISTORY. (See BOKHARA, KHIVA, MONGOLS, SAMARKAND, etc.) The invasion of Central Asia by Russia was begun soon after the conquest of Siberia and the desultory raids on Khiva by pioneers from the north were made as early as the end of the sixteenth century. The expedition into Central Asia sent out by Peter the Great in 1714 ended in disaster, but the submission of the Kirghizes during the eighteenth century gave Russia the territory between the Ural and the Lake of Balkhash. In 1839 a well-equipped Russian army sent against Khiva under the command of Perovski succumbed to cold, hunger, and sickness. By the end of the first half of the nineteenth century Russian forts were established at the mouth of the Syr-Darya and during the following decades a chain of Russian forts was built along the southern frontier. In 1854 a second expedition under Perovski against Khiva met with success. In 1867 the Governor-Generalship of Turkestan was established with Tashkent as the capital. In the following year Samarkand was taken and a treaty of peace was concluded with the Ameer of Bokhara by which Russia acquired a considerable part of the Zerafshan Valley, and Bokhara became practically a vassal State of Russia. In 1873 a Russian expedition forced the Khan of Khiva to cede to Bokhara the Khivan territories on the right bank of the Amu-Darya, which were soon annexed by Russia. In 1876 Russia annexed the Khanate of Khokand (Ferghana). The subjugation of the Tekke-Turkomans was terminated with the capture of Geök-Tepe by Skobeleff in 1881. The Turkomans of Merv submitted in 1884. In 1887 the Afghan boundary was demarcated by an Anglo-Russian commission.

The authentic history of Chinese Turkestan can be traced almost to the beginning of the Christian Era, when the region was partly under the rule of China. Buddhism was then the predominating religion, but there were also sects of Nestorian Christians. In the seventh century the western part of the country fell under the sway of Tibet, whose rule had been extended by the end of the century to the entire region. Islam began to spread over Eastern Turkestan in the tenth century, but even with the conquest of the country by Genghiz-Khan (q.v.) at the beginning of the thirteenth century there was perfect toleration. It was only with the arrival of the mollahs from Bokhara in the fourteenth century that Islam became a cause of strife, and gave rise to the two factions of White and Black Mountaineers, whose struggles gave China an opportunity to reconquer the country at the end of the eighteenth century. The history of Eastern Turkestan during the nineteenth century is largely made up of repeated attempts on the part of the followers of Islam to wrest the country from the rule of China. From 1872 to 1876 Eastern Turkestan was practically independent under Yakub Beg, but the rule of China was restored soon after his death.

Consult: Schuyler, *Notes of a Journey in Russian Turkestan* (London, 1876); Jaworski, *Turkestan* (in Russian, Saint Petersburg, 1889); Albrecht, *Russisch Centralasien* (Hamburg, 1896); Phibbs, *A Visit to the Russians in Central Asia* (London, 1899); Schwarz, *Turkestan* (Berlin, 1900); Kraft, *A travers le Turkestan russe* (Paris, 1901).

TURKESTAN. A town in the Territory of Syr-Darya, Russian Turkestan, situated about 20 miles east of the right bank of the Syr-Darya, about 180 miles northwest of Tashkent (Map: Asia, F 4). The Mosque of Hazret-Yassavi is a noted place of pilgrimage. Population, in 1897, 11,598.

TURKEY, or THE OTTOMAN EMPIRE (so named from its founder, Othman). An empire in Europe, Asia, and Africa, with its capital at Constantinople. The bulk of the territories over which the Turkish Sultan exercises actual sovereignty is Turkey in Asia, which, exclusive of Arabian possessions, has an area of nearly half a million square miles. A broad strip of country extending the whole length of Arabia along the west coast, and containing Mecca, with an area of about 175,000 square miles, is included within the Ottoman Empire. The European territory actually under Turkish rule (including Novibazar) has an area of nearly 70,000 square miles. Bulgaria (with Eastern Rumelia) is tributary to Turkey. Bosnia and Herzegovina, nominally reckoned a part of the Ottoman Empire, virtually belong to Austria-Hungary. Crete is a vassal State of Turkey and Samos pays tribute to the Sultan. Cyprus virtually passed in 1878 from the possession of Turkey to that of England, which turns over part of the revenues to the Sultan. In Africa Turkish rule extends over Tripoli and Barca (Bengazi), the territory claimed (mainly desert) having an area of about 400,000 square miles. Egypt is tributary to Turkey, but is independent of Turkish rule. The Ottoman Empire, with the various tributary States and alienated provinces nominally reckoned as included in it, has an area in round numbers of about 1,500,000 square miles. The Ottoman domain, owing to internal weakness and external aggression, is in a state of disintegration, and is held together less by the cohesive power of the Turkish Government than by the jealousies of the European powers. This article deals especially with Turkey in Europe. For the other parts of the empire, see the articles on ANATOLIA (Asia Minor), SYRIA, ARMENIA, etc.

Turkey in Europe embraces about one-third of the Balkan Peninsula. It is bounded on the east and west by the Black and Adriatic seas, on the north by Bulgaria, Servia, Bosnia, and Montenegro, and on the south by the Sea of Marmora, the Ægean Sea, and Greece.

TOPOGRAPHY. Turkey in Europe shares the topographic characteristics of the whole Balkan Peninsula. It is chiefly covered with mountains, which, generally speaking, extend in parallel chains from northwest to southeast, often, however, interrupted by short, transverse ranges. There are no large plains excepting those of the Maritza Valley and the central coastal plain north of the island of Thasos. The greatest elevations are in the west and south. Here the Albanian-Greek Mountains rise in the Shar-Dagh to a height of about 10,000 feet and to a nearly equal altitude in Mount Olympus. Above the low coasts of the Black Sea rise hills of small elevation, west of which is the fertile valley of the Maritza River. West of the Maritza Valley are the Rhodope Mountains or Despoto-Dagh, towering up on the Bulgarian border to a height nearly equal to that of the western mountains. A little to the southwest is the Perim-Dagh, not greatly inferior in elevation. Mount Athos, at the southeast end of the mountainous peninsula of Chalcidice, which projects into the Ægean, rises steeply to a height of over 6000 feet. In the extreme west is the wild and almost inaccessible mountain land of Albania, descending to the marshy and unhealthful coastal plain of the Adriatic.

The coasts are valuable features for the trade of the country, though the Black Sea coast is poor in havens. The winding river-like strait of the Bosporus, which connects the Black Sea with the Sea of Marmora, and through it with the Mediterranean, has ample depth for the largest vessels. Here is the magnificent harbor of Constantinople, the great meeting place of the Eastern and Western trade. On the strait of the Dardanelles, leading from the Sea of Marmora into the Mediterranean, is the harbor of Gallipoli. The Ægean coast abounds in bays and excellent harbors, of which the chief are Dedeagatch, the outlet of the grain exports of the Maritza Valley, and Saloniki, which shares with Constantinople most of the foreign trade. The Adriatic coast, though less irregular, also has good harbors, none of them, however, being of much modern importance.

HYDROGRAPHY. The principal rivers of European Turkey are the Maritza, the Struma, and the Vardar, flowing into the Ægean Sea. They are of little use for navigation except the lower part of the Maritza. Their great importance is that their alluvium has converted the valleys into very fertile lands, and these valleys are very useful for communication in connection with the overland routes from Western Europe to Constantinople and Saloniki. In Albania, among the limestone mountains, there are only turbulent torrents forcing their way through wild gorges, like the Drin, flowing into the Adriatic Sea. Scattered among the valleys of Turkey are a few lakes and even extensive marshes, partly filling larger lake basins. The largest lake is Scutari, which projects across the frontier into Montenegro.

CLIMATE AND SOIL. Climatic conditions vary greatly in different parts of the country. The mildest regions are on the Ægean Sea, where in the valleys opening to the south the climate is that of the Mediterranean, with mild winters and with the South European flora, including even cotton. The mountainous regions of the interior, largely cut off from the influence of the sea air, have, on the contrary, a very extreme climate, with cold and snowy winters, when the temperature often sinks below zero F., followed by summers so hot that the snow melts even on the loftiest summits. At Constantinople the mean temperature in January is 43° F., and in July 72.5°. The precipitation on the

Adriatic coast is heavy the year around, but decreases toward the east and is small in the southeast. The soils are extremely fertile except among the mountains of the western limestone district.

Flora and Fauna. The typical Mediterranean vegetation is luxurious along the Adriatic coast, but is poorly developed in the south, and is entirely lacking in the interior. The climate, however, permits the cultivation on the southern plains and among the mountain valleys of all the Central European plants, while many of those of South Europe thrive along the Ægean plains. The fruits of Central Europe abound in the interior. Many of the mountains are covered with forests. Animals of European, Asiatic, and Mediterranean origin abound; the wolf and bear are found among the mountains, jackals on the southern plains, and buffaloes and fat-tailed sheep are reared on the same farms with ordinary cattle and sheep.

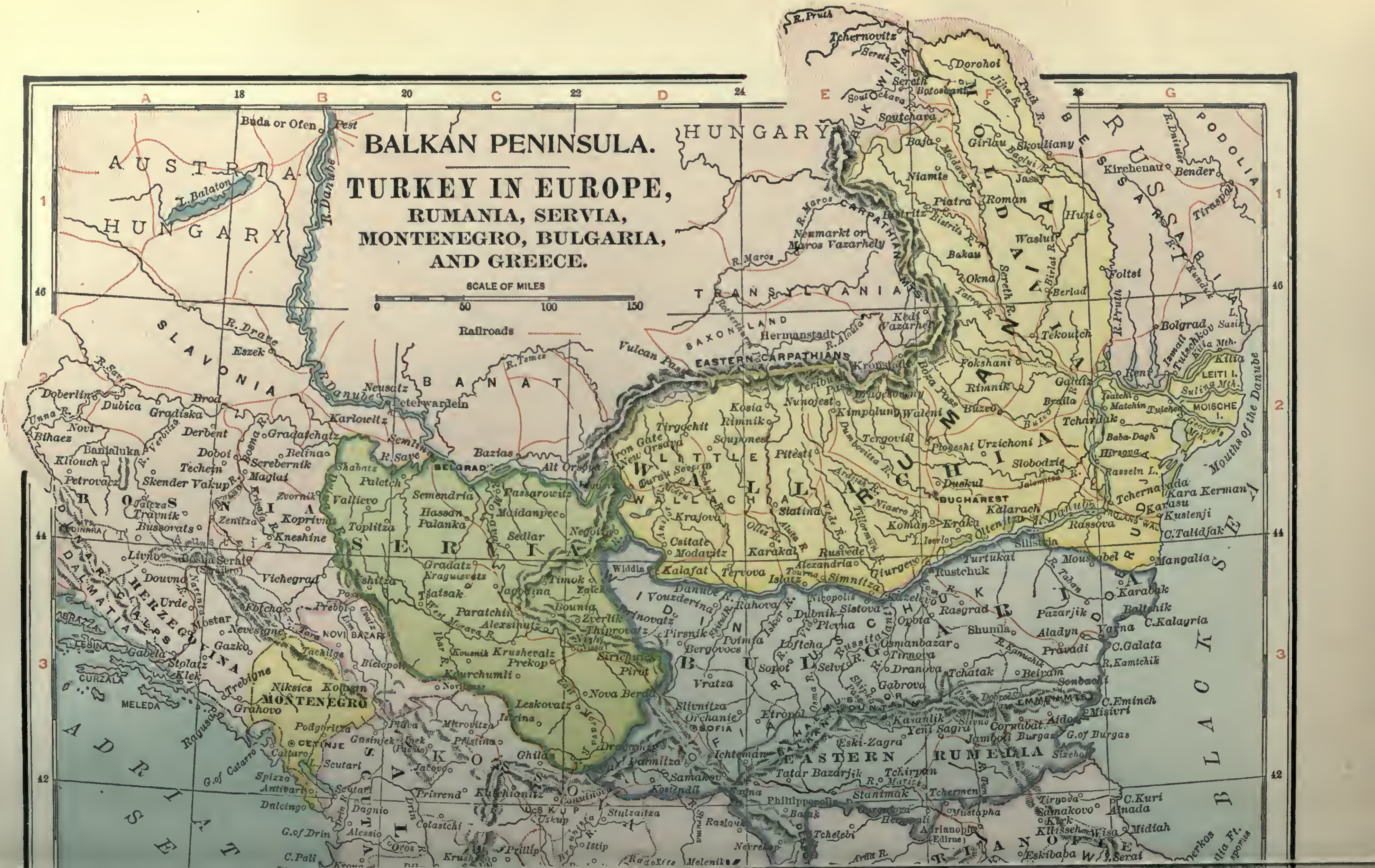
Geology and Mineral Resources. The folded limestone (Dinaric) mountains of Albania extend parallel to the Adriatic coast, showing in many regions the subterranean channels and sink holes peculiar to the Karst. In contrast with these younger folded mountains is the very irregular relief of the intricate mountain region in Thrace and Macedonia, formed of crystalline rocks. In the extreme southeast the whole peninsula on which Constantinople stands belongs geologically to Asia. Its hills are separated from the granitic mountains of Europe by a wide plain covered with recent formations. The rocks on both sides of the Bosporus are Devonian, containing the same fossils, and there is no doubt that this European peninsula was at one time a portion of Asia Minor. Turkey is rich in minerals, especially in the Asiatic provinces, but they are little worked. Considerable manganese ore (45,000 tons in 1898) is mined near Saloniki. In Asia Minor there are mines of chrome, silver-lead ore, copper, antimony, coal, etc. Large quantities of meerschaum are obtained at Eski-Shehr, in Asia Minor. A small royalty is paid on all minerals exported.

Agriculture, etc. Though the inhabitants live almost exclusively by farming and cattle-raising, agriculture is in a very primitive condition. The reasons are the oppressive taxation, which consumes one-third of the harvests, the wretched government, the lack of roads, the low standard of civilization, and the unfavorable division of the soil. As nearly all the land belongs to the Crown or the Church, there is little freehold property, and the peasantry are overwhelmed with poverty. The great ecclesiastical estates (vakuf) are farmed in as primitive a manner as the humblest peasant's leasehold. Fertilizers are rarely applied to the soil. The fact that in spite of these drawbacks the soil is able to produce more than sufficient to meet the wants of the country is proof of the fertility and capabilities of these lands. The chief agricultural productions of Turkey in Europe and Asia are cereals (maize, wheat, and barley being the most important), of which there is usually a surplus for export; wine, figs, and raisins, olives for oil produced on the coasts; roses for the manufacture of attar; tobacco of superior quality; flax, hemp, cotton, opium, and silk. After years of decline the culture of silk in 1895 began to revive, and in 1901 203,675 ounces of silkworm eggs and 11,600,000 pounds of cocoons were produced in the provinces of Brusa and Ismid in Asia Minor. A very small amount of raw silk is consumed in the home industries, the remainder being exported, chiefly to France. Turkey and Bulgaria supply most of the oil of roses in the general trade, and the Turkish production in 1901 was about 5800 pounds. Forestry is entirely unknown, and forests have been preserved only in those districts where the want of roads has made their destruction difficult. Elsewhere wide mountain tracts are perfectly bare and are used for pasturage. Over 3,000,000 acres are still under forests in European Turkey, which is about one-seventh of the forest area of the empire. The raising of live stock is the chief occupation of the inhabitants of the central and western parts of the country. This industry more than meets the local requirements, though little is done to improve the breeds of cattle. The small, but sturdy, Turkish horses are used for riding and as pack animals, and buffaloes for draught purposes. Goats' flesh and mutton are the chief meats consumed, and Albania exports a considerable quantity of wool. The fisheries are prominent, those of the Bosporus alone representing a value of over $1,000,000 a year, while the Mediterranean coast produces sponges of excellent quality, and the Red Sea mother-of-pearl.

Manufactures. The manufacturing industries are chiefly represented by hand-loom weaving and the work of artisans, who transform brass and copper into household utensils. Concessions have been granted for glass manufactures, paper mills, and textile looms, but the numerous attempts to establish factories with Western capital in order to utilize the raw produce of the country have nearly all been wrecked by the pasha system of government and the religious fanaticism of the inhabitants. Constantinople and Saloniki still retain a few steam mills, silk factories, and a factory for fezes, but this national headwear is chiefly imported. Even the few articles in which Turkey formerly claimed preëminence, such as Turkey leather, some grades of silk fabrics, carpets, Turkish yarns, etc., can no longer compete in their own home with the products of foreign factories.

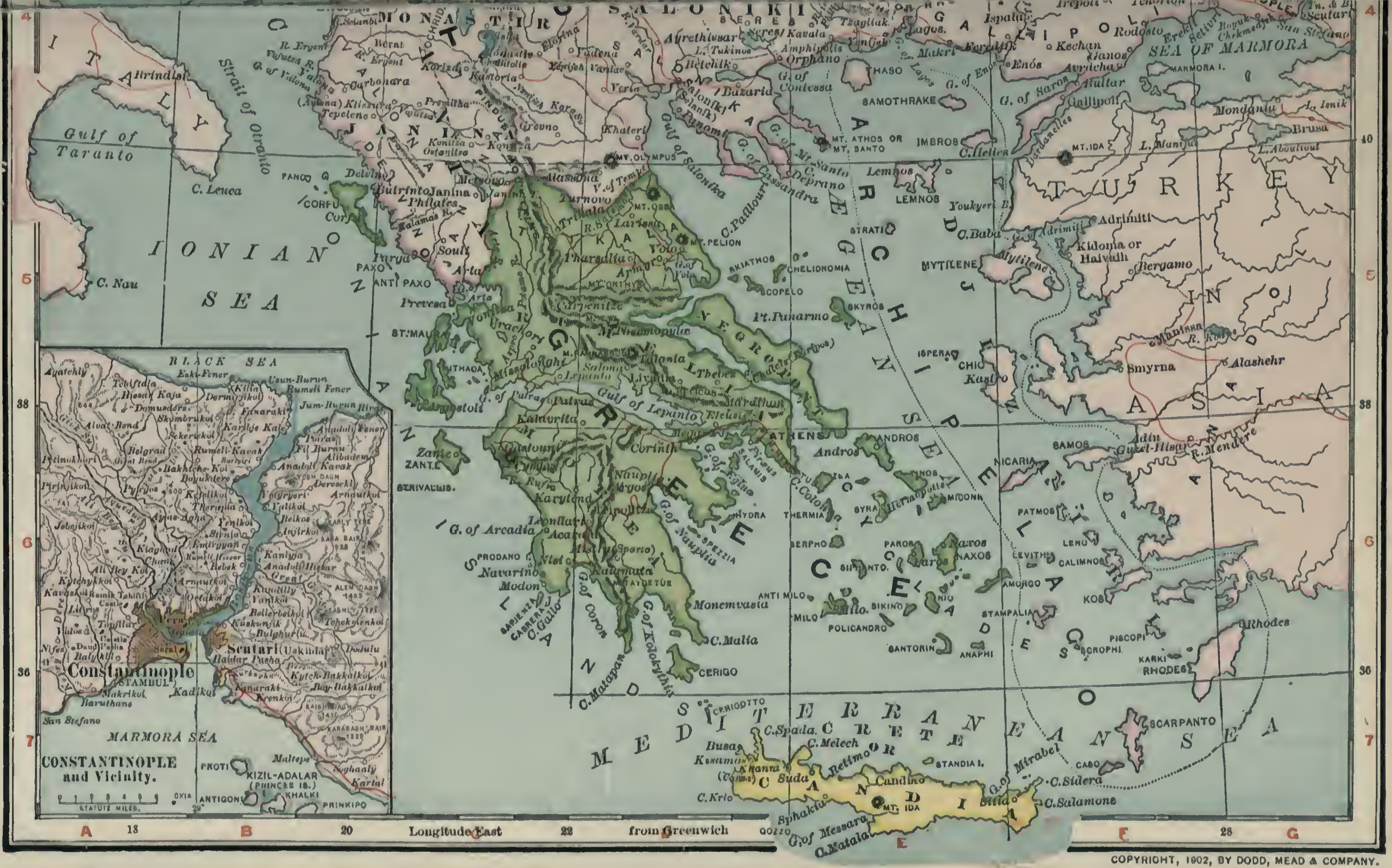
Commerce. The result of the conditions above mentioned is that Turkey is an important market for the manufactures of Western Europe. The Turks are deficient in trading spirit, and both the domestic and the foreign trade are chiefly carried on by Greeks, Jews, Armenians, and other foreigners. In part, Turkey pays for the cotton, the groceries, woolen fabrics, metal goods, general manufactures, and coal and petroleum that it imports with the grain, wool, skins, raw silk, tobacco, wine, southern fruits, gall nuts, attar of roses, leather, and carpets that it sends abroad. The imports are always much larger than the exports. The commercial statistics of Turkey are very unsatisfactory, but the following table shows the approximate amount of its foreign trade, including gold and silver:

	1891	1898	1899
Imports	$100,800,000	$103,100,000	$117,100,000
Exports	56,400,000	64,800,000	59,000,000



BALKAN PENINSULA.

TURKEY IN EUROPE,
RUMANIA, SERVIA,
MONTENEGRO, BULGARIA,
AND GREECE.



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The larger part of this trade is with Great Britain, Austria-Hungary, France, Russia, Italy, and Bulgaria. The trade with the United States is very small, but the exports to this country are steadily growing. The following table shows the trade (in millions of dollars) for six fiscal years, each ending on June 30:

	1898	1899	1900	1901	1902	1903
Imports from U. S...	0.26	0.27	0.25	0.25	0.22	0.49
Exports to U. S.......	2.1	2.4	3.9	3.4	4.9	5.7

Turkey's exports to the United States are chiefly rugs and carpets, tobacco, hides and skins (goat skins), oils, and wool. The small imports from the United States into Turkey include cotton cloths, provisions, a few agricultural implements, and manufactures of iron and steel. All imports pay a tariff of 8 per cent. *ad valorem* except the Government monopolies, tobacco and salt. A duty of 1 per cent. is collected on all exports except cereals.

Transportation and Communication. The chief ports, Constantinople and Saloniki, are in direct rail communication with the rest of Europe by lines extending to Belgrade. There is also a railroad extending westward from the Maritza Valley along the Ægean to Saloniki and thence farther west to Monastir; and a branch road connects Uskub, on the Belgrade-Saloniki road, with Mitrovitza. These railroads, 1269 miles in length, have been a great boon to the internal and foreign commerce of the country, which, however, is still very poorly supplied with means of land transportation. The common roads are scarcely worthy of the name and are used chiefly by pack animals. All land freights are excessive. The maritime trade on the naturally favored south coast is more active. As Turkey's mercantile marine in 1901 included only 107 steamers, of 58,861 tons, and 916 sailing vessels, of 179,883 tons, most of the foreign trade is carried in British, Greek, and other foreign vessels. In the year beginning March, 1897, 188,034 vessels, of 34,332,877 tons, entered and cleared at all the ports of Turkey. Of this number 11,996, of 12,542,149 tons, were employed in the foreign trade and the remainder in the coasting trade. There is a steamship line trading directly between Constantinople and United States ports, which is to some extent stimulating the commercial relations of the two countries.

Government. Turkey is an absolute theocratic monarchy, the executive and religious authority being vested in the Sultan (Padishah), who regards himself as the successor of the caliphs. The succession is vested in the eldest male member of the House of Othman. The form of government takes its inspiration from the Koran and the opinions and sayings of Mohammed, and has been from time to time supplemented by decrees of the various sultans. Attempts to reform the Constitution and bring it into conformity with the constitutions in Western European countries have invariably failed. The will of the Sultan is absolute so long as it does not conflict with the teachings of the Koran. The Sultan is assisted in the administration of affairs by the Grand Vizier, whom he appoints, and who is in turn assisted by a Cabinet of 10 members, consisting of the Ministers of Foreign Affairs, Finance, Justice, War, etc. There are also a Ministry of the Civil List (which has charge of the Imperial domains) and the Ministry of Police. The public functionaries are divided into three classes: those connected with the laws and cults, the governmental department, and the army and navy. The functions of the legislative branch of government are performed by the Sultan together with the Grand Vizier and the Sheikh ul-Islam, who is also an appointee of the Sultan, and is the direct head of the Church. The appointment of the Sheikh ul-Islam, however, is nominally subject to the approval of the Ulema (q.v.), an assembly of the clergy and leading jurists and educators of the Empire. This body is called together by the Mufti (see below). For purposes of local government, the Empire is divided into vilayets (pashaliks), ruled by Valis, or Governor-Generals, appointed by the Sultan. Each Vali is assisted by a provincial council. A few of the provinces are designated as mutessarrifliks. The minor divisions are termed sanjaks, kazas, etc., and are under the supervision of officials appointed by the valis. The Sultan's subjects possess freedom of their persons and nominally equality before the law. The judicial department is in a sense an adjunct of the executive, all executive officials being vested with authority to perform all duties connected with the administration of justice. The learned class of Turks form three sections: those in the service of the cults (Imam), the law expounders (Mufti), and the judges (Kadi). The ideas and practice of justice, both secular and religious, are based on the Koran, and cases are decided according to the compilation which exists of the decisions that have been rendered during the centuries. The highest court is the Court of Appeals in Constantinople, with two chambers. There may be mentioned also the civil courts, criminal courts, and the commercial courts, whose decisions are based on the Code de Commerce. The commercial courts are formed of a president, two judges, and also two merchant judges selected from the colonies of foreigners. The lack of system and the prevalence of corruption in the judicial branch of government have necessitated measures called 'capitulations,' which provide that all foreigners settled in the country who are accused of crime or misdemeanor shall be tried only before courts presided over by their respective consuls. Litigation between foreigners of different nationalities is heard in the court of the defendant, and cases between foreigners and Turks are tried in local courts, to which the foreign consuls have free access. This affords a guaranty that such trials will be legally conducted.

Finance and Banking. The country is very heavily taxed by a variety of imposts, which include tithes, taxes on land, personal property, income, and sheep, as well as payments for exemption from military service, etc. Other sources of revenue are the customs, the tobacco and salt monopolies, stamp tax, special taxes on various businesses such as the manufacture of spirits and the fisheries, taxes on silk products, etc. The revenue amounted in 1899 to $81,893,462 and the expenditures to $81,533,341. The total funded and floating debt in 1902 was more than $710,000,000. The Imperial Ottoman Bank, with a capital of $48,400,000, had on September 30, 1901, a note circulation of $4,484,000, and cash on hand $10,890,000.

DEFENSE. See under ARMIES and NAVIES.

MONEY, WEIGHTS, AND MEASURES. The gold standard is used and the unit of coinage is the piaster—4.4 cents. The national money in the Empire is estimated in round numbers, at: Gold, $150,000,000; silver, $40,000,000. Turkish weights and measures were assimilated to the metric system in 1882, but the change has not generally been adopted.

POPULATION. The estimated population of the so-called Turkish Empire with its tributary States and the other regions nominally included in it was, in 1903, 40,440,957. The population of European Turkey (in the strict sense) is estimated at about 6,000,000, and that of all the countries actually under the rule of the Sultan at about 25,000,000. The population of the Empire without the tributary States is placed at 24,931,600. The largest cities are: Constantinople, Damascus, Smyrna, Bagdad, Aleppo, Beirut, Saloniki, and Adrianople. The list of vilayets and mutessarrifliks with their areas and populations, is as follows:

VILAYETS	Area, sq. miles	Population
In Europe:		
Constantinople	2,702	1,136,000
Adrianople	15,015	1,206,500
Saloniki	13,684	1,165,400
Monastir	10,690	847,400
Kossovo	12,100	961,000
Scutari (Albania)	4,516	322,000
Janina	7,045	648,000
Total in Europe	65,752	6,086,300
In Asia:		
Asia Minor.		
Ismid (mutessarriflik)	4,323	222,800
Brusa (khodavendikyar)	28,486	1,626,900
Bigha (mutessarriflik)	2,625	129,400
Archipelago	2,744	325,900
Smyrna (Aidin)	20,844	1,396,500
Kastamuni	19,184	1,018,900
Angora	26,055	892,900
Konieh	39,779	1,088,000
Adana	14,359	403,400
Sivas	24,240	1,086,500
Trebizond (1898)	11,850	1,163,800
	194,489	9,355,000
Armenia and Kurdistan.		
Erzerum	19,686	597,000
Mamauret-ul-Aziz	13,240	575,300
Diarbekir	13,703	471,500
Bitlis	10,345	398,600
Van	15,517	430,000
	72,491	2,472,400
Mesopotamia.		
Mosul	29,220	300,300
Bagdad	54,503	850,000
Basra	16,482	200,000
	100,205	1,350,300
Syria.		
Aleppo	30,340	995,800
Zor	32,849	100,000
Syria	23,816	955,700
Beirut	11,773	533,600
Jerusalem (mutessariflik)	8,222	333,000
Lebanon	2,509	399,500
	109,509	3,317,600
Arabia.		
Hedjaz (approximate)	96,500	300,000
Asir, Hodeida, Sana, and Tais (all until recently included in the Vilayet of Yemen)	77,200	750,000
	173,700	1,050,000
Total in Asia	650,394	17,545,300
In Africa:		
Tripoli (approximate)	398,900	800,000
Bengazi "		500,000
Total in Africa	398,900	1,300,000

Total of immediate possessions as above:

	Square miles	Population
In Europe	65,752	6,086,300
In Asia	650,394	17,545,300
In Africa	398,900	1,300,000
	1,115,046	24,931,600

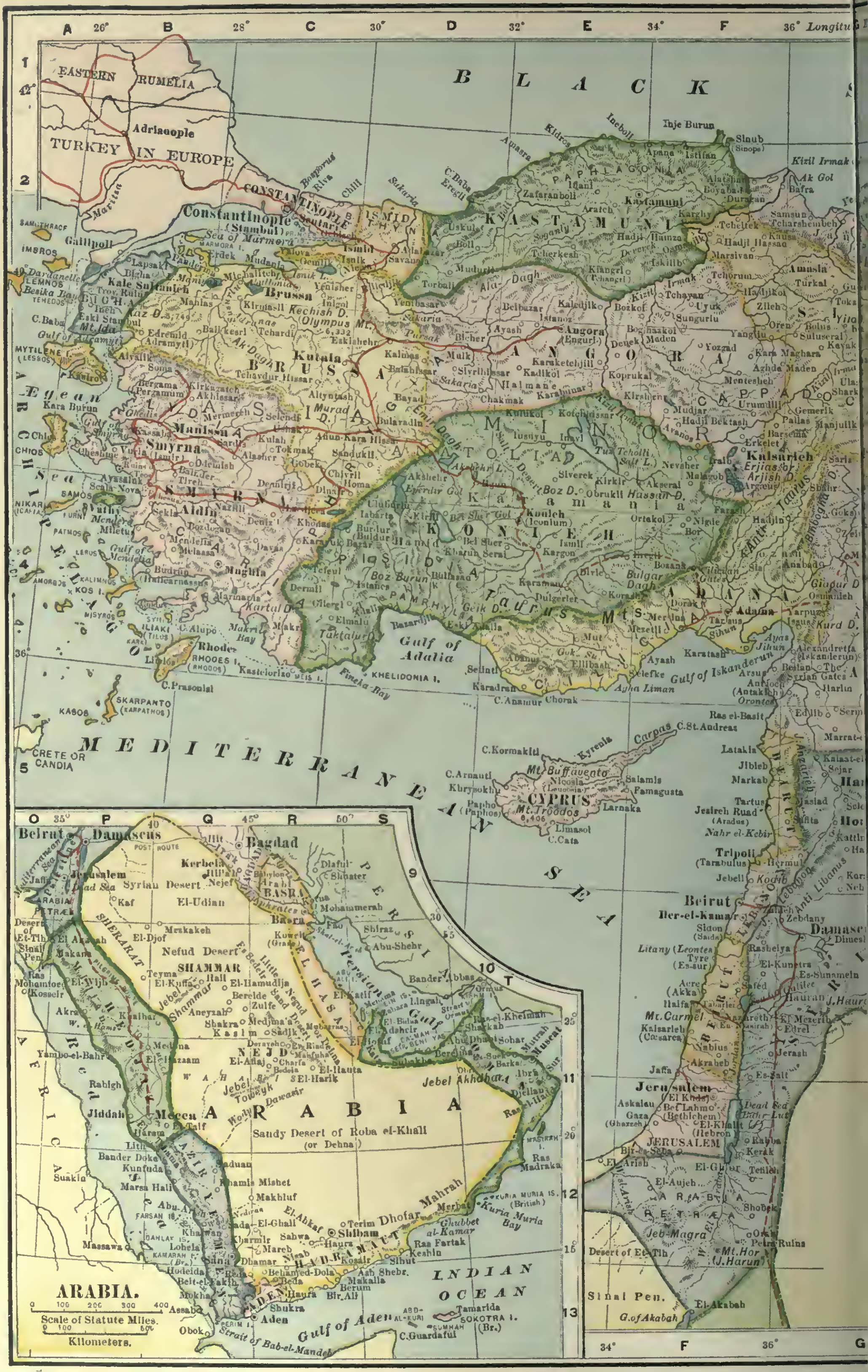
The tributary States and provinces under foreign occupation, with their areas and population according to the most recent census, are:

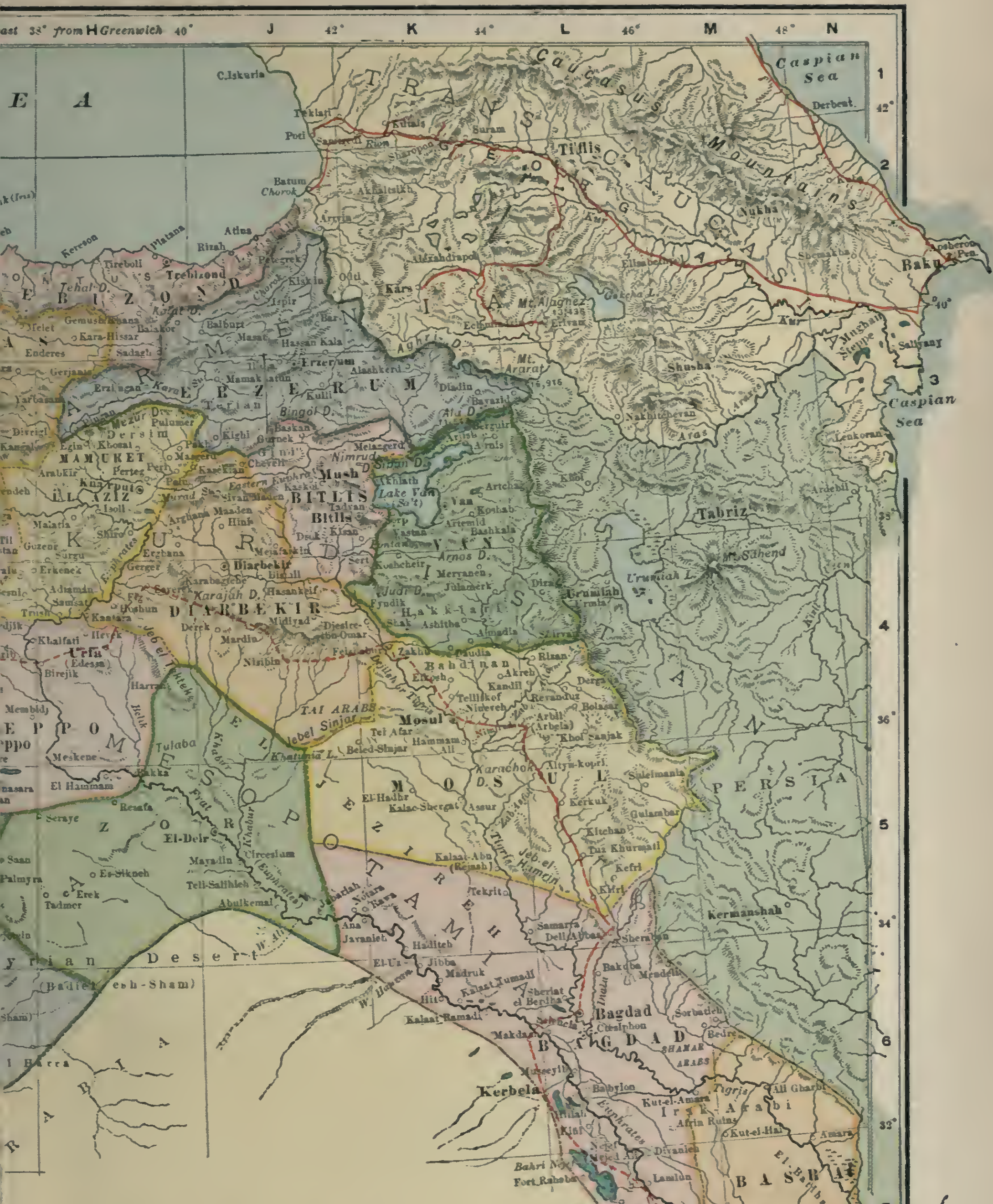
	Sq. miles	Population
Bulgaria (and Eastern Rumelia)	37,860	3,733,189
Bosnia, Herzegovina, and Novibazar	23,570	1,591,046
Crete	3,326	309,253
Samos	180	54,824
Cyprus	3,584	237,022
Egypt	400,000	9,821,045
	468,520	15,746,379

Totals for the Empire: Square miles, 1,583,566; population, 40,677,979.

EDUCATION AND RELIGION. Education is greatly neglected, though public schools are established in most of the towns and colleges and public libraries are attached to most of the large mosques. There are no educational statistics. (See under CONSTANTINOPLE.) Only about one-half of the population are Mohammedans, the remainder being Greek and Roman Catholics, Armenians, Jews, etc. There are 2120 mosques in the Turkish Empire, of which 379 are in Constantinople.

ETHNOLOGY. The Turkish Empire presents an extraordinary medley of nationalities. The ruling race, the Osmanli Turks, whose blood is greatly mixed with various foreign elements (Slavic, Greek, and Albanian in European Turkey), constitute a minority of the population even in the regions actually under the rule of the Sultan. The only section of the Empire in which they are numerically dominant is the interior of Asia Minor. The most important peoples in Asiatic Turkey after the Osmanlis are the Arabs (Syria, Mesopotamia, Arabia), Armenians (who are found in large numbers outside of Armenia), and Kurds. The Greeks and Jews (in addition to the Armenians) are important elements in the urban population of a large part of Asiatic Turkey. There are less than a million persons of Turko-Tatar blood in Turkey in Europe, and these are chiefly in the portions nearest to Asia. The


BLACK SEA
EASTERN RUMELIA
TURKEY IN EUROPE
Adrianople
Constantinople (Stambul)
Sea of Marmora
Gallipoli
Dardanelles
Brussa
Kutaia
BRUSSA
KASTAMUNI
Kastamuni
Sinub (Sinope)
Angora (Engurl)
ANGORA
CAPPADOCIA
Kaisarieh
ASIA MINOR
ANATOLIA
KONIEH
Konieh (Iconium)
Smyrna
Manissa
AIDIN
Aidin
Mughla
Ægean Sea
ARCHIPELAGO
Rhodes
Gulf of Adalia
Taurus Mts.
ADANA
Adana
Gulf of Iskanderun
Alexandretta (Iskanderun)
CYPRUS
Nicosia
Famagusta
Larnaka
Limasol
MEDITERRANEAN SEA
CRETE OR CANDIA
Beirut
Tripoli (Tarabulus)
Damascus
Jerusalem
JERUSALEM
Jaffa
Gaza
Dead Sea
Sinai Pen.
G. of Akabah
El-Akabah
ARABIA PETRÆA
Mt. Hor (J. Harun)
Petra Ruins
ARABIA.
Bagdad
Basra
Persian Gulf
PERSIA
Syrian Desert
Nefud Desert
SHAMMAR
NEJD
EL HASA
ARABIA
HEJAZ
Medina
Mecca
Jiddah
Red Sea
AFRICA
Sandy Desert of Roba el-Khali (or Dehna)
OMAN
Muscat
YEMEN
Sana
HADRAMAUT
Aden
Gulf of Aden
Strait of Bab-el-Mandeb
INDIAN OCEAN
SOKOTRA I. (Br.)
Scale of Statute Miles.
0 100 200 300 400
Kilometers.
0 100 500
A 26° B 28° C 30° D 32° E 34° F 36° Longitude
O 35° P 40 Q 45° R 50° S
34° F 36° G



TURKEY IN ASIA.

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Turks form a large element in the population of Constantinople and Adrianople, in the interior of Thrace, and in parts of Macedonia. All the remainder of the population of European Turkey, with a small exception, is divided between Slavic peoples and those belonging to the Mediterranean race, chiefly Greeks in the south and east, and Albanians (Shkipetars) on the Adriatic. The Slavs of Turkey are of Serb and Bulgarian stock. There are a number of Wallachs (Rumans) in the southwest, who are known as Tsintsars. The Jews are numerous in Constantinople and Saloniki, and the Armenians are also well represented in the urban population of European Turkey. The trade of the Turkish Empire is to a great extent in the hands of the Greeks (who carry on much of the sea trade), Armenians, Jews, and Arabs. For the religion of the non-Turkish inhabitants, see ALBANIA, ARMENIA, KURDS, etc.

HISTORY. In the first half of the thirteenth century, at the time of the Mongol invasions under Genghis Ghan, a small body of Mohammedan Turks moved westward from their home in Iran. and made their way to Asia Minor. Under the lead of Ertogrul, they entered the service of Ala-ed-Din, the Sultan of Iconium (or of Rum, as the State was known to the Moslems), the last surviving remnant of the great empire established by the Seljukian Turks in Western Asia. Ala-ed-Din granted them some land in Phrygia. The son of Ertogrul, Osman or Othman (1288-1326), laid the foundations of the independent power of his tribe (to which his name became attached) on the ruins of the Seljuk dominion in Asia Minor. Osman's son and successor, Orkhan (1326-59), continued the aggressive policy of his father. He made Brusa, the ancient capital of Bithynia, which had been wrested from the Byzantines, his residence, and gained a foothold in Europe by the taking of Gallipoli (1354). Orkhan was the organizer of the Ottoman power. He exacted a tribute of children from conquered Christian peoples, and these, reared as Mohammedans and trained under rigid military discipline, were organized into that efficient fighting machine, the Janizaries (q.v.). He was succeeded by Amurath I. (1359-89), under whom the Ottoman realm became a European as well as an Asiatic power. At this time, by the side of the declining Byzantine or Greek Empire, the Kingdom of Servia had risen to considerable power. Eastward to the Black Sea, south of the Danube, the Bulgarian czars held sway, and beyond the Danube the principalities of Moldavia and Wallachia had been struggling into existence. Venice and Genoa had extended their power and dominion into the eastern Mediterranean. Amurath I. conquered Adrianople in 1361 and made it his capital. The Turks began to close in upon the Byzantine Empire, and the dominion of Constantinople was reduced to Thrace, Macedonia, and parts of Greece. Amurath greatly extended the Turkish dominions in Asia Minor, and in 1389 he broke the power of Servia in the bloody battle of Kossovo. The Sultan was struck down in the moment of victory and was succeeded by his son, Bajazet I. (1389-1402). Bajazet began his reign with the conquest of Bulgaria and with a war against the Wallachs. A crusading army of Hungarians, Poles, and French, under the command of Sigismund, King of Hungary, was totally routed at Nicopolis in 1396. In 1402 Timur with his Mongol horde swept over Asia Minor, overthrew Bajazet at Angora, and carried him off a captive. On the fall of Bajazet (who died in 1403) there was a struggle for dominion between his sons, which lasted a decade. Finally, in 1413 the youngest son, Mohammed I., found himself in undisputed possession of the whole empire. Amurath II. (1421-51) extended the Turkish dominion over Macedonia, conquered part of Greece, waged fierce wars with the Hungarians, over whom he finally triumphed, and attacked the Albanians, although without success. The most memorable event of his reign was his victory over the Hungarians under King Ladislas (q.v.) and Hunyady (q.v.) at Varna in 1444. Mohammed II. (1451-81), the son of Amurath II., prepared immediately on his accession to effect the conquest of Constantinople. The city fell on May 29, 1453, and the Byzantine Empire was at an end. An offshoot from the Greek realm, the Empire of Trebizond, was conquered in 1461, and about the same time the Turks completed the conquest of the Morea. The seat of the Ottoman Empire was transferred from Adrianople to Constantinople. The Turks, merciless as they were toward their conquered foes, allowed the Christian churches to maintain their organization. In 1456 Mohammed II. undertook the siege of Belgrade, the key to Hungary, but the city was delivered by the signal victory of Hunyady. A few years later Servia was incorporated into the Turkish Empire and Bosnia was subdued. In 1470 Negropont (Eubœa) was wrested from the Venetians and in 1475 the Tatar Khan of the Crimea became a vassal of the Ottoman Sultan. Albania, which under the lead of Scanderbeg had long heroically held out against the Turks, was at last subjugated. In 1480 the Knights of Saint John successfully defended Rhodes against a Turkish attack. At this time the Turks obtained a momentary foothold in Italy by the conquest of Otranto. The reign of Bajazet II. (1481-1512), the successor of Mohammed II., was uneventful, but under Selim I. (1512-20) the tide of Ottoman conquest rolled irresistibly eastward and southward. He carried his arms successfully into Persia, conquered Syria (1516), annexed Egypt (1517), and assumed the guardianship of the sanctuary of Mecca, thus proclaiming himself the successor of the caliphs. At this time Moldavia became tributary to the Porte, a position to which the sister principality of Wallachia had been previously reduced.

At the close of Selim's reign, the famous corsair Khair-ed-Din (Barbarossa), who ruled Algeria, placed himself under Turkish suzerainty. Under Solyman the Magnificent (1520-66) the Ottoman Empire stood at the height of its power and splendor. Belgrade was taken in 1521 and Rhodes was conquered in the following year. The victory over the army of Louis II. of Hungary at Mohács in 1526 broke up the Hungarian realm. It was followed by a succession of campaigns against the Hapsburgs, in one of which (1529) Vienna itself was besieged, and which converted the heart of Hungary (including the capital, Buda) into a Turkish province. (See HUNGARY; SOLYMAN II.) Conquests were also made from Persia. On the

Mediterranean Sea the Turks were the undisputed masters. Venice had been gradually stripped of her possessions in the Morea and the Archipelago. Tripoli became subject to Turkey in 1551. Toward the close of Solyman's reign in 1565, a vast Turkish force was beaten back by the heroic defenders of Malta. In the following year the little Hungarian fortress of Szizet long kept at bay the Turkish host which the Sultan had marshaled against the Austrians. Solyman died before the fortress fell. Selim II. (1566-74) undertook to wrest Cyprus from the Venetians and this brought about a Holy League between Venice, Spain, and the Pope, whose fleets inflicted a crushing defeat upon the Turks in the battle of Lepanto (1571). Cyprus, nevertheless, was taken by the Turks. In the reign of Selim II. the subjugation of Yemen was completed, and about the time of his death the Spaniards were driven from Tunis, which became subject to Turkey.

With the disaster at Lepanto the decline of the Ottoman power began. In the line of Osman the first impulse of barbaric vigor had been lost in the effeminacy that attends success. The European nationalities were now establishing their relations on broader grounds of policy and the Ottomon rulers found that diplomacy must in a measure take the place of conquest in the future. Under Amurath III. (1574-95) a war with Persia, in which conquests were made in Armenia, was followed by a contest with Austria, which continued under Mohammed III. (1595-1603) and extended into the reign of Achmet or Ahmed I. (1603-17). At this time Persia rose to a high pitch of power under Abbas the Great, who in 1605 won a great victory over the Turks at Basra, and who wrested large territories from them, even making himself master of Bagdad (1623). The cruel but able and energetic Amurath IV. (1623-40) restored the fortunes of Turkey in the East, retaking Bagdad in 1638. After his death maladministration and internal disorders hastened the decadence of the Empire. In 1656 the Venetians, on whom the Turks had made war for the possession of Crete, appeared in the Dardanelles and defeated the Turkish fleet. The realm was raised for a brief period from this state of depression by the abilities of Mohammed Kiuprili and his son Ahmed (see KIUPRILI), who successively held the position of Grand Vizier during part of the reign of Mohammed IV. (1648-87). They infused fresh vigor into the administration and to some extent enabled the Turkish arms to reassert themselves. A war with Austria, in which the Turks finally suffered a great defeat at the hands of Montecuccoli at Saint Gotthard, on the banks of the Raab (1664), was terminated by a peace slightly advantageous to Turkey. In 1669 the fortress of Candia fell and Venetian rule in Crete came to an end. In the regions to the north of the Black Sea the Turks fought with varying success against the Poles, and it was in the reign of Mohammed IV. that they first came in collision with the rising power of Russia, whose Czar, Feodor II., came off victorious in the conflict. In 1683 the Porte took up the cause of Tökölyi, the leader of the Hungarians in their rising against Leopold I. of Austria, and once more the tide of Moslem invasion rolled up to the gates of Vienna. Kara Mustapha (q.v.), the successor of Ahmed Kiuprili, advanced with a vast army and laid siege to the Hapsburg capital. For a moment the fate of Central Europe hung in the balance, but after the siege had lasted two months, the chivalry of Poland, led by King John Sobieski, and a German army came to the relief of the city, and on September 12th the Turkish army was put to flight in a great battle before its walls. The blow was a crushing one and ended the rôle of Turkey as a formidable aggressive power. Austria, Poland, and Venice now made a great onslaught upon the Ottoman Empire. The Austrians drove the Turks before them in Hungary, capturing city after city. In 1686 Buda, over whose walls the crescent had been displayed for a century and a half, fell into their hands. At the same time John Sobieski overran Moldavia and Wallachia and the Venetians successfully invaded the Morea. In 1695 Peter the Great took up arms against the Turks and in 1696 he wrested Azov from them. The Austrians, under Prince Eugene (q.v.), annihilated the Turkish army opposed to them at Zenta in 1697. In the Peace of Karlowitz in 1699, Turkey was forced to give up all of Hungary between the Danube and the Theiss, to restore to Poland a great part of the Ukraine, acquired in 1672, and to surrender the Morea to the Venetians. In the course of the seventeenth century Turkey had been gradually tightening her hold on Moldavia and Wallachia, which early in the following century were placed under the rule of Fanariot hospodars, appointed by the Porte.

In 1711 Sultan Achmet III. took up arms for Charles XII. of Sweden against Peter the Great of Russia, who had triumphed over his rival at Poltava (1709). The Czar invaded Moldavia, where he was hemmed in by the Turks on the banks of the Pruth, and was glad to purchase peace by the surrender of Azov. In 1715 the Turks reconquered the Morea from the Venetians. The struggle with Austria was renewed in 1716. The Austrian forces under Prince Eugene gained a great victory in the same year at Peterwardein and another in 1717 at Belgrade, which they captured. In the Peace of Passarowitz (1718) the Turks were compelled to cede the Banat, part of Servia (with Belgrade), and parts of Bosnia and Wallachia to Austria. The Morea remained in their hands. In 1736 Russia entered upon her rôle as a great assailant of the Ottoman Empire with the seizing of Azov and the invasion of the Crimea, which were followed by the capture of Otchakov (1737), and a victorious advance into Bessarabia and Moldavia. Austria joined Russia in 1737; but a scheme for the partition of Turkey between the two powers was foiled by the defeats inflicted upon the Austrian armies by the Turks. In the Peace of Belgrade in 1739 Austria relinquished the Servian and Wallachian territories acquired in 1718, while Russia concluded a peace in which she gained but little. Alarmed at the aggressive intervention of the Empress Catharine II. in the affairs of Poland and believing the safety of his realm to be endangered by Russian intrigues, Sultan Mustapha III. ventured in 1768 on a war with Russia, which proved disastrous to Turkey. The Russians advanced victoriously through Moldavia and Wallachia, defeated the Tatar Khan of the Crimea (the vassal of the Sultan), won a victory on the Kagal (in Bessarabia), stormed

Bender, broke into the Crimea, and in 1773-74 advanced into Bulgaria, where, however, the Turkish fortresses withstood their attacks. In 1770 the Russians burned the Turkish fleet at Tchesme. Peace was concluded at Kutchuk-Kainarji in 1774, Turkey renouncing her suzerainty over the Crimea and other Tatar territories in the region of the Black Sea, and according to Russia a sort of protectorate over Moldavia and Wallachia and the free navigation of the Turkish waters. During this war Turkey was to a certain extent crippled by the revolt of the Mameluke Governor of Egypt, Ali Bey (q.v.). In 1787 Sultan Abdul-Hamid I. plunged Turkey into a fresh war with Russia. Joseph II. of Austria seized the opportunity to make a sudden onslaught on the Turkish territories, and fresh disasters befell the Ottoman arms. Potemkin stormed Otchakov (1788); the allies won a great victory at Fokshani (1789); Belgrade and Bender were captured in the same year; and Ismail was stormed by Suvaroff at the close of 1790, the Russians enacting a carnival of blood. Austria, through pressure from Prussia, withdrew from the struggle in 1791 without reaping any benefit from it, and Catharine II. in 1792 concluded the Peace of Jassy with Sultan Selim III., which made the Dniester the boundary between the Muscovite and Ottoman dominions. Rent by internal disorders, Turkey was unable to offer resistance when Bonaparte in 1798 suddenly swooped down upon Egypt, which, under its Mameluke beys, was already almost severed from the Empire. In Syria the advance of the French was stayed by the brave defenders of Acre (1799). Bonaparte returned to France, and in 1801 the English drove the French from Egypt. The downtrodden Servians rose in insurrection in 1804 under the leadership of Czerny George.

Selim III., under the influence of French thought, had conceived extensive ideas of reform, which he endeavored to put in operation when he ascended the throne. Many of his innovations were premature and he aroused the anger of the Janizaries by his attempts at military reorganization. A revolt forced Selim to abdicate in 1807, and placed his nephew, Mustapha IV. (1807-08), on the throne. Mustapha was soon deposed and Mahmud II. (1808-39) was made Sultan. A war begun by Russia in 1806 was terminated by the Treaty of Bucharest in 1812, by which the country between the Dniester and the Pruth was ceded to Russia. The authority of the Sultan was reëstablished in Servia, but the people rose again under Milosh Obrenovitch and achieved a partial independence. Greece threw off the Turkish yoke in 1821 and after an heroic struggle secured its independence through the armed intervention of the European powers in 1827-29. A revolt of the Janizaries in 1825 was successfully met by Mahmud; in 1826 thousands of the famous corps were slain, and the organization was abolished. Russia waged a successful war against Turkey in 1828-29. General Diebitsch advanced as far as Adrianople, and Paskevitch was equally successful in Armenia. In the Peace of Adrianople (1829) Turkey surrendered to Russia the northeastern coastland of the Black Sea and transferred to her the suzerainty over the tribes of the Caucasus; Russia was accorded a regular protectorate over Wallachia and Moldavia, which for a time were reduced to the position of Russian dependencies. Mehemet Ali, Viceroy of Egypt, who had raised himself to an almost independent position, made war in 1831 on his liege lord, the Sultan. The victories of Ibrahim Pasha (1832) secured to the Egyptian ruler the possession of Syria and Cilicia, while Russia took advantage of the desperate state of Turkey to force upon the Sultan the Treaty of Unkiar Skelessi (1833), which closed the Black Sea to the vessels of war of all nations save Russia. In 1839 Mahmud II. made war upon Mehemet Ali. The Turkish army was utterly defeated by Ibrahim Pasha at Nisib (June 24, 1839), and soon after the Turkish fleet was treacherously delivered up to the Egyptians. Only the intervention of the Quadruple Alliance (q.v.) in 1840 prevented the downfall of the Turkish power. Mehemet Ali was forced to relinquish Syria and other territories; he was recognized as hereditary, though tributary, ruler of Egypt. Soon after the beginning of this war Mahmud II. died (July 1, 1839). His son, Abdul-Medjid (1839-61), continued the reforms commenced in the preceding reign. Russia's truculent attitude brought on a war with Turkey in 1853, in which that country would have suffered severely but for the effective intervention in 1854 of England and France, soon joined by Sardinia, all bent on humbling Russia. The allies of the Sultan made the Crimea the scene of their land operations, and in 1855 Sebastopol fell. (See CRIMEAN WAR.) The Treaty of Paris (1856) restored to Turkey the command of both sides of the Lower Danube, excluded the Czar from his assumed protectorate over the Danubian Principalities (Wallachia and Moldavia), and closed the Black Sea against all ships of war. Wallachia and Moldavia secured almost complete independence and were soon united into the Principality of Rumania. The Porte, adopted into the family of European nations, made a proclamation of equal civil rights to all races and creeds in the Turkish dominions. A massacre of Christians in the Lebanon and at Damascus (see DRUSES) provoked Western intervention in 1860. Abdul-Medjid was succeeded by his brother Abdul-Aziz (1861-76).

The Treaty of Paris in 1856 was supposed to have settled the Eastern question (q.v.) by guaranteeing Turkey's integrity, but Russia was merely awaiting an opportunity to press its old policy, and in 1871 the Russian Government seized the opportunity of war between Germany and France to declare that it felt itself no longer bound by that provision of the Paris treaty which forbade Russia to have a fleet in the Black Sea. A London conference sanctioned this stroke of Russian diplomacy. An insurrection in Crete in 1866-68 was suppressed with difficulty. Between 1854 and 1871 the Turkish debt had increased by nearly $600,000,000; and in 1875 the Porte was driven to partial repudiation of its obligations. An insurrection which broke out in Herzegovina in 1875 served to stir up all the neighboring Slavic peoples and was skillfully encouraged by Russian emissaries. In May, 1876, frightful massacres of Christians in Bulgaria took place. At the close of that month Abdul-Aziz was deposed and soon after was found dead. His nephew, Amurath or Murad V., son of Abdul-Medjid, reigned only three months, when he was deposed as an imbecile, and his brother, Abdul-

Hamid II., succeeded to the throne. In July, 1876, Servia and Montenegro declared war against the Porte. Before the end of the year the Servians were utterly defeated, in spite of the help of many Russian volunteers. The state of affairs in the Turkish provinces seemed to call for a conference of the Great Powers at Constantinople. The proposals then made for the better government of the Christian subjects of Turkey were rejected by the Grand Council of the Turkish Empire. Simultaneously, however, with the assembly of the conference the Turkish Government had taken the extraordinary step of bestowing a parliamentary constitution on the Ottoman Empire. The Parliament assembled in March, 1877, but this ostensible remodeling of the political fabric of the Empire did not get beyond its incipiency. Russia took it upon herself to enforce on Turkey the demands made by the Powers, and on April 24, 1877, declared war. (See Russo-Turkish War.) The Turks made a brave stand, but at last succumbed, and at the close of January, 1878, the Russians were almost before the walls of Constantinople. The Treaty of San Stefano was signed on March 3d, but the European Powers intervened and readjusted the whole Eastern question at the Congress of Berlin, Russia being forced to content herself with a much less radical disruption of the Turkish Empire in Europe than she had sought to bring about. See Berlin, Congress of.

For a few years under the settlement effected at Berlin, there was comparative quiet in the Ottoman dominions, although in 1883, in consequence of disturbances in Egypt, and the bad condition of the finances in that province, Great Britain established a control there which practically nullified what little was left of the Ottoman sovereignty. Following on a revolutionary movement at Philippopolis in September, 1885, the Prince of Bulgaria proclaimed the annexation of Eastern Rumelia, and after a decade the Porte was compelled to recognize the change which thus deprived it of its fairest province. In 1895-96 there were massacres of tens of thousands of Armenian Christians, which were connived at by the local officials of the Ottoman Government. The protests of Europe were of no avail, because Abdul-Hamid knew well how to play off the Powers against one another so as to prevent interference of an effective kind. A rising of the Christians against the Mohammedans in Crete (q.v.) followed in 1896, and was the signal for the outbreak of long-repressed hostilities in Greece, which recklessly entered upon war with Turkey in April, 1897. The campaign of a few weeks showed the utter futility of the Greek preparations. (See Greece.) Greece was forced to sue for peace, the terms of which provided for the payment to the Ottoman Government of an indemnity of $18,000,000, and the rectification of the Greco-Turkish frontier in favor of Turkey. Meanwhile Crete was taken in charge by Great Britain, Russia, France, and Italy, and a settlement was finally made in 1898 by which the suzerainty of Turkey was renewed, but the island was given an autonomous government for three years, its executive head being Prince George of Greece, as high commissioner of the four Powers. This settlement was renewed indefinitely upon its expiration in December, 1901. (See Crete.) The peoples of ancient Macedonia have long been restive under Turkish control, and in 1903 there were bloody conflicts and massacres over a large territory. The rivalry of Bulgaria and Greece and the influence of the Great Powers have made a successful revolt difficult.

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TURKEY (abbreviation of *Turkey-cock*, *Turkey-hen*, so called as being supposed to come from Turkey, vaguely applied to Tartary or Asia in general). The turkeys are natives of North and Central America, and the only two species known are the common wild turkey (*Meleagris gallipavo*) with three subspecies and the beautiful Yucatan turkey (*Meleagris ocellatus*). They were once regarded as a distinct family, but are now considered the sole American representatives of the Phasianidæ. The wild turkey is like the domesticated one, but more brightly colored. The ocellated turkey of Central America is a smaller and more beautiful species; the plumage is lustrous, and parts of it are ocellated, like the peacock's feathers; the bare head is blue with orange caruncles. This fine species is confined to Yucatan and Central America. The common wild turkey is still found in Mexico, Texas, and Arizona, and in other parts of the West and South, but is scarce east of the Mississippi and north of Virginia or Kentucky, though it formerly ranged well up into New England.

The domestic turkey, the largest of gallinaceous birds, appears to have been introduced into Europe by the Spaniards early in the sixteenth century. The domestic birds vary greatly in plumage from the tints of the wild species to buff, or brown, or pure white, and occasionally produce a crest. On account of its size, and the excellence of its flesh and eggs, the turkey is one of the most valued kinds of poultry. The management of turkeys differs little from that of the common fowl. The young are tender for the first few weeks, and require care, particularly to keep them from getting wet by running among the wet grass, or the like; but afterwards they are sufficiently hardy. See Colored Plate of Peacock, Turkey, and Guinea-Fowl.

TURKEY BUZZARD. See Vulture.

TURKEY GNAT. An insect (*Simulium pictipes*) of the dipterous family Simuliidæ, identical with the Southern buffalo-gnat, which usually makes its appearance about the time turkeys are setting, and sometimes causes great mortality among those birds. See Black Fly; Buffalo-Gnat.

TURKEY RED. A name applied to one of the most durable and beautiful colors which have been produced on cotton. The process of dyeing cotton Turkey red is said to have been practiced in India from time immemorial; at present, the main seat of the industry is in the neighborhood of Glasgow. The operations are long and tedious, and their effect could scarcely be explained theoretically. Thus no reason could be given for the part of the process which consists in soaking the cloth in olive oil for a considerable length of time; yet this is well known to be one of the most essential operations in the dyeing process and is believed to be the cause of the rich apparance of the dye. Turkey red is one of the colors of alizarin which can be obtained either from madder (*Rubia tinctorum*) or by an artificial process of manufacture from coal-tar. See Alizarin.

TURKEY STONE. A honestone found in Turkey. See Hones.

TURKISH LANGUAGE AND LITERATURE. The Turkish language belongs to the Finno-Ugrian linguistic group, where it holds a first place for conformity to type as well as for extent of domain. Its territory is a zone averaging about 300 miles in width, extending along the fortieth parallel of latitude from the shores of the Adriatic Sea eastward through one hundred degrees of longitude to the westward border of Manchuria.

The chief structural characteristics of the Turkish language are four: (1) The root of every word is inviolable; (2) the root is emphasized by making its leading vowel dominate the vowels and to some extent the consonants added for purposes of inflection, subjecting them to change under regular rules of euphonic harmony. (3) Grammatical forms, especially in the conjugation of the verb, are abundant, regular, logical, and efficient. (4) Determining or modifying syllables are placed at the end of the root. The Turkish verb begins in simplicity. For instance, *bak* means 'look thou,' and is the root of the verb *bakmak*, to look. Upon this root a series of new verbs may be built: (1) Causative: *bakdirmak*, to cause or allow to look; (2) reciprocal: *bakishmak*, to look at one another; (3) reflexive: *bakinmak*, to look at one's self, i.e. to be perplexed. From these again a further series of new verbs can be made by inserting in each the causative particle; (4) *bakdirtmak*, to make or let one cause another to look; (5) *bakishdirmak*, to cause or allow one to look at another; (6) *bakindirmak*, to cause or allow one to look at himself, i.e. to be perplexed. All of these new verbs can be conjugated in the positive, the negative, and the impossible form (to look; not to look; and not to be able to look), and, if the sense permits, in all the moods and tenses of the active and passive voices. The same is true of the root of every verb in the language, if the sense permits. It has been computed that, counting all the moods and tenses and numbers and persons, the permutations of which each Turkish verb is capable amount to over 25,000. Yet so simple and clear are the rules that the memorizing of forty-four syllables or particles enables one to build and understand the whole series. The efficiency of the system appears on realizing that Turkish grammar has but one conjugation and no irregular verbs except the auxiliary. The scheme of the verb is that of a form which will fit every root and which is yet so transparent that the root is always visible. The same principle of agglutination to the root is followed in making new verbs from nouns or adjectives and in declining nouns and pronouns. There is no gender for noun, pronoun, or adjective. Adjectives are subjected to no change except for comparison. The Turkish syntax is peculiar. The unit of expression is the paragraph, and there is no punctuation. The subject of the ruling verb is placed as near as possible to the beginning of the paragraph. All subordinate sentences and clauses adding particulars have their verbs in participial form, the sense being thus suspended during the process of building the paragraph, until the chief verb coming in at the very end illuminates the whole.

The investigations of Thomsen and Radloff among the so-called 'Runic' inscriptions of the vicinity of Urga and the Orkhon River, south of Lake Baikal, have shown these inscriptions to be Turkish historical records, some of them dating back as far as the sixth century. One of the ancient Turkish alphabets has thus been recovered. But as the Turks became Mohammedans they began to adopt the Arabic alphabet, which is the only one now used by them, except as some of the northern tribes have adopted the Russian alphabet. They have increased the 28 Arabic letters to 33 by the device invented by the Persians of adding dots to five of the Arabic letters. Nevertheless the alphabet is quite unsuited to the Turkish, owing to its lack of proper vowels.

The onrush of the Turks from the Far East into all civilized lands, including China, which continued from the tenth century to the end of the seventeenth, enlarged the meagre Turkish vocabulary. The tribes which invaded India, now known under the name of Moguls, lost their language; but those which conquered Persia and overthrew the Byzantine Empire came under the literary influence of Persian at first, then of Arabic, and finally of Greek and the European languages. The consequence was that the Ottoman Turkish (Osmanli), as the Western branch of the language is called, adopted into its literary vocabulary Persian words for poetry and history, Arabic words for religious and legal writings, Greek words for the winds and currents and fishes of the sea, Italian words for all that relates to sailing vessels, and, later on, English terms for steam, the steamboat and its manœuvres, and French words for many of the terms of diplomacy.

The language of the Turkish tribes left in Central Asia and Persia and Southern Russia after the centre of the Turkish power had been transferred to Constantinople ceased its development at that point. That language is what is now known as Eastern Turkish. What it was at the end of the fifteenth century, that it is now. The dividing line between Eastern and Western Turkish is the Caucasus, the Caspian Sea, and the western frontier of the Persian Province of Azerbaijan. Beyond the Caspian Sea the difference of dialect is so great that a Turk from Bokhara, though able to make his simpler wants known in the streets of Constantinople, requires an interpreter for satisfactory conversation. The general characteristics of the Eastern Turkish, called *Jagatai* by the Turks of Constantinople, are a broader and harsher vocalization, a very confusing substitution of consonants, as *m* for *b*, *b* for *w*, *j* for *y*, etc., and a preservation of those ancient tense and case words which in the Western Turkish have become mere arbitrary particles added to the root to indicate tense or case forms. For this reason study of the Eastern Turkish in its purest form, as found, for instance, in Chinese Turkestan to-day, reveals the processes of evolution of the Turkish grammar. The grammar is practically the same in Turkestan as in Turkey, but in the East its forms have lost little by attrition. At the same time the unity of the two dialects is clear.

Eastern Turkish has many dialects. The language of some of the Kirghizes and that of the Yakuts of the river Lena is strongly tinged with Mongolian, and some Finnish affects the speech of the Tchuvashes of the Upper Volga. On the other hand, the Nogai tribes of the Caucasus and the Crimea use a dialect so nearly like the Ottoman Turkish that newspapers published in the Crimea have regular subscribers at Constantinople. The Kiptchak is the only one of these Eastern Turkish dialects which has literary life at present. It is the one, too, which most nearly approaches to the pure type of old Turkish found in the so-called Jagatai or Uighur of the East.

TURKISH LITERATURE.

Turkish literature is a term which at present implies the literature of the Western or Ottoman Turkish language. It may be regarded as falling into three periods: (1) The early period, when writers were from the region of Central Asia, and when the Persian was the model and often the instrument of their highest expression. (2) The middle period, beginning about the middle of the sixteenth century and extending well into the nineteenth, when Arabic dominated the Turkish literary world, having replaced Persian as model except in poetry. (3) The modern period, dating from about the time of the Crimean War (1853-56). In it the tendency of Turkish writers is to copy French, rather than either Persian or Arabian models, and to bring back into the language half-forgotten Turkish expressions.

The earliest literary remains of Turkish writers are the inscriptions mentioned above, deciphered by Thomsen, collected by Radloff, and their relation to the Chinese pointed out by Hirth. One of the earliest books of the early period, celebrated for its pure Turkish, is a genealogical history of the Tatars by Abul Ghazi of Khwarezm, dating from the twelfth century. The judge Burhaneddin of Sivas, a descendant of Genghiz Khan, an adventurer, ruling over two provinces, who lost his life in trying to conquer another in 1398, has left some poems written in good Turkish, although after the Persian school. Another of the early poets was Suleiman Effendi (died 1410), chaplain to Sultan Bajazet, whom Tamerlane carried off. He wrote a poem in honor of the birth of the Prophet Mohammed which has been read throughout Turkey on public occasions in each year during nearly 500 years, and still retains its power to move its hearers. Another of the poets of the early period was Amudeddin, who wrote under the name Nesimi. Like the others of these early poets, he was under the influence of Sufiism (q.v.), and so incensed the more orthodox Mussulmans that he was flayed alive at Aleppo in 1417. Sheikhi, whose real name was Sinan (died 1420), was a doctor as well as a poet. His fame rests mainly upon his poem, the *Khar-namè*, or Donkey Book, in which he classifies his enemies according to the different types of asses found in the East.

Nevayi, whose real name was Ali Shir (died 1500), is the great representative of Turkish poetry in this period. He was Prime Minister for a time to Sultan Hussein of Herat, but retired early that he might write. He was a master in both Turkish and Persian. The thoroughly human quality of his writings appeared from the fact that one main source of our knowledge of the old Eastern Turkish language is a dictionary written by a Persian in order that Persians might profit by Nevayi's writings. The greatest prose writer of this period was Baber, great-grandson of Tamerlane, and 'Mogul' conqueror of India in 1525-26. His annals of his campaigns are written in plain Turkish, Arabic and Persian words being used to eke out his vocabulary.

Of the middle period of Turkish literature Saadeddin (died 1599) offers a type. He was a warrior of great renown, and afterwards Chief Justice of the Turkish Empire (Sheikh ul-Islam) under Sultan Mohammed III. The work on which his literary fame rests is a history of the Ottoman Empire, called *Taj-et-Tevarikh.* The style is of the most ornate Persian order and there is hardly any Turkish in the book except those auxiliaries essential to the binding of the sentences. Saadeddin followed the principle, which ruled literature throughout the middle period, that Arabic words must be brought into Turkish with all their grammatical rules and appurtenances. The effect is to make the finest Turkish literature of this period a mere mass of macaronics quite unintelligible to those who have not enough knowledge of Arabic and Persian to use dictionaries of those languages. Baki (died 1599), rated by Turkish critics as the 'king of the poets of Osmanli Turkish,' was a contemporary of Saadeddin. He was the son of a mosque servant who became one of the Caziaskers, or judges of the Supreme Court, under Sultan Selim II. His poetry was strongly Persian in flavor, but without slavish imitation. Another great poet of this time was Fuzuli (died 1563), whose real name was Mehmed, of Bagdad. To a foreign taste he offers more of originality than Baki. His poems are warm with the peculiar fire of Sufiism, and in both poetry and prose he loved the strong virile Turkish words. The list of Turkish poets is long, but those mentioned are still the greatest names. To them we may add at some distance Nedim (died 1725), who was buffoon to Sultan Achmet III. The name of Kiani, whose real name was Abu Bekr (died 1791), too, should have a place in the list of notable poets of this period. The simplicity and transparent beauty of his lines are such that had it not been for his inveterate waggishness he would hold very high rank among the Turkish poets. Another of the great poets of this period was Nabi (died 1712), whose *Ghazels* are accounted among the finest. His real name was Yusuf of Urfa. One of his longer poems, the *Khairiyè*, has been translated into French by Pavet de Courteille. We may also mention the poetess Sherif Hanum, who died in 1809, leaving a *Divan* of some merit.

The historians of the middle period make a long list. But their work is blemished, as a rule, by a difficult, stilted style, and the pettiness of the annalist. Among exceptions in the long series we may select Pechevi Ibrahim, who shows some inkling of what a historian should be; Solak Zadè, who died about 1680, and wrote in the graphic style of an eye-witness; and especially Kiatib Tchelebi, sometimes called Hajji Khalfa (q.v.). His real name was Mustafa, and he died in 1658, leaving an enormous mass of extremely valuable writings in history, geography, and bibliography.

To the same period probably belong certain writings of value which are passed over in scorn by the Turkish literary critics because they are not in the mongrel language of the pedants. Hence their authors are unknown. Of this class is the *History of the Forty Viziers*, dedicated to Sultan Mustapha I. (1617-23). It is a cycle of some seventy-five stories grouped about an incident of the Joseph and Potiphar order. The book is directed against the idea of trusting the fair sex and winds up, after all wrongs have been righted, with the quaint prayer, "May the Most High bring us all near to the good and to God, and keep us from the tricks of deceitful woman. Amen." Another of these unconsidered classics of Turkish is the *Life* of Nasr-eddin Hoja, a collection of bulls acted or spoken by a Turk of Asia Minor, who is delightfully humorous. To the same class belongs the story of *Shah Miran*, a collection of fairy-tales, religious in purpose, which is remarkable for its pure Turkish diction.

As a fruit of the Crimean War a revolution took place in the educational system of Turkey. The result has been the appearance of the modern school of writers who are yet to change entirely the character of Turkish literature. The heavy scholastic theologians are seeking to arrest the movement by the censorship, and they have persecuted or imprisoned some of the most powerful writers, like Ebuzzia Tewfik, or sent them to die in exile on a barren island like Kemel Bey. The aim of the new school of writers is to free the Turkish language from the incubus of Arabic grammatical purism. The writers who have perhaps done the most toward accomplishing this object are Ahmed Vefik Pasha (died 1893), whose dictionary of Turkish in two volumes was a revelation to multitudes, and Ahmed Mithad Effendi, noted for his novels, essays, and historical studies. Great as is the linguistic value of Ahmed Mithad's writings, they are too close imitations of French works to have permanent literary value. Of far greater weight was Kemal Bey, who died in 1878. Jevdet Pasha, illustrious as an historian, whose works show a steady development toward the simpler Turkish style; Zia Pasha, a brilliant essayist and poet; and Jevad Pasha, who has written a fine history of the origins of the Turkish military organization, are other examples of this school. Other notable names of this period are Muallim Naji, poet and essayist; Ebuzzia Tevfik, literary critic; Sezayi Bey, Hussein Rahmi, Ahmed Rasim, and Aliyè Hanum, daughter of the historian Jevdet Pasha, all of whom are novelists, dealing with current life in a realistic style entirely new in Turkish literature. The modern period cannot be said to have entirely revealed its qualities while strife with reactionist control continues. But it has at least shown that there is a future before the writers of Turkey, if they ever have freedom to speak and to develop.

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kunst (Pesth, 1836-38). "Turkish Literature," in the *World's Great Classics* (London, 1901), is a convenient collection of translations of typical Turkish works; except in the Ottoman poetry translated by Gibb, however, the articles are not taken directly from the Turkish, and often miss the point of the original. Poole, *The Story of Turkey* (New York, 1888), has some valuable remarks on the characteristics of Turkish literature.

TURKISH MUSIC. See Arabic Music.

TURK ISLANDS. A group of small islands in the Bahamas, connected politically with the Caicos Islands (q.v.).

TUR′KOMANS. A people whose principal home is in the great plains between the Caspian Sea on the west and the Sea of Aral and the Amu Darya on the east—the western part of Turkestan in the broader sense. Some of them are to be found in Persia, Afghanistan, and other regions. They belong by language, and largely by blood, to the Turkic stock. The Turkomans of Turkestan are under Russian rule. See Turkestan.

TURKO-TATARS, tẽr′kô-tä′tärz. A term used by certain ethnologists to designate a group of Ural-Altaic peoples composed of the Turkic and related so-called Tatar tribes and nations. Under Turko-Tatars are included: The Siberian peoples of Turkic stock, such as the Yakuts and Siberian Tatars; the Kirghiz-Cossacks of the Irtish Caspian steppes; the Kara-Kirghizes of the Tian-Shan; the Uigurs, Sarts, Uzbegs, and Turkomans of Central Asia; the Tatars of the Volga; Bashkirs, Tchuvashes, and Meshtcheriaks, in European Russia; the Tatars of the Crimea and the Caucasus, including the Nogai, Karatchai, Kumyks, and Basians; the Azerbaijani; the Yuruks of Anatolia; the Osmanli Turks; and others. Many of these peoples, like the Osmanlis, Starts, Turkomans, Uzbegs, Azerbaijani, and the Turks of Turkestan, are largely Aryanized in blood, with often an added Semitic strain. Except the Yakuts, whose religion is Shamanism, and those Tchuvashes who have become Christian, the Turkic peoples profess Islam. The empires founded by Turko-Tataric peoples have had a rather ephemeral existence, and the realm of the Osmanli Turks in Europe owes its perpetuation not a little to the very mixed physical character of that people. Consult: Vámbéry, *Etymologisches Wörterbuch der turko-tatarischen Sprachen* (Leipzig, 1878); id., *Die primitive Kultur des turko-tatarischen Volkes* (ib., 1879); id., *Das Türkenvolk* (ib., 1885); Radloff, *Ethnologische übersicht der Türkstämme Siberiens und der Mongolei* (ib., 1883); Ujfalvy, *Expédition scientifique française en Russie, en Sibérie et en Turkestan* (Paris, 1878-80); Chantre, *Recherches anthropologiques dans le Caucase* (ib., 1885-87); id., *Recherches anthropologiques dans l'Asie occidentale* (Lyons, 1895).

TURK'S HEAD. A name given to a number of coffee-houses in London, among which that on the Strand, frequented by Dr. Johnson and Boswell, was the most noted. Others of the name were situated in Change Alley, in Soho, and in Westminster.

TURMAIR, to͞or′mīr, Johannes. The real name of the German historian best known as Johannes Aventinus (q.v.).

TURMERIC (Fr. *terre-merite*, Neo-Lat. *terra merita*, turmeric, apparently deserved earth, best earth, but probably a corruption of an Oriental name, perhaps of Ar. *kurkum*, from Skt. *kunkuma*, saffron), *Curcuma longa*. A plant of the natural order Scitamineæ or Zingiberaceæ, a native of the East Indies, much cultivated both in India and in Cochin-China, for its fleshy roots, more than $500,000 worth of which are annually exported from India alone. The lanceolate sheathing leaves and a short leafy spike of small cream-colored flowers spring from the crown of the root. Young roots abound in a kind of arrowroot, but older ones contain a large quantity of a resinous yellow substance called turmeric, which is used mainly for dyeing. The color is not very stable. Some of its other uses are in chemistry as a test for alkalies, their carbonates and phosphates, some of the alkaloids, and boracic acid, which change it to reddish brown, and as a condiment with many kinds of food, especially as a principal ingredient in curry-powder. The plant thrives best in a rich, friable soil, and a situation not liable to be flooded. It is propagated by cuttings of the root, which are planted at distances of eighteen inches or two feet, in April or May. The crop is gathered in December. This kind of turmeric is sometimes distinguished by the name long turmeric; and the name of round turmeric is given to *Kœmpferia pandurata*, a plant of the same order, also a native of the East Indies, the roots of which are shorter and rounder, but otherwise of very similar quality. They are especially valued for the preparation of an artificial gold varnish, as they yield a better color than the former kind. The Arabic name of turmeric is *kurkum*, whence *curcuma*. Turmeric is not cultivated commercially in the United States. See Curcuma.

TURMERIC (*Curcuma longa*).

TURN, to͞orn. A town adjoining Teplitz, in Bohemia, Austria. It has a magnificent park, bathing establishments, and thriving manufactures of many kinds, particularly porcelain. Population, in 1900, 12,408.

TURN′BULL, Laurence (1821-1900). An American physician, born in Sholts, Lanarkshire, Scotland. He graduated at the Philadelphia College of Pharmacy in 1842, and for a while was occupied in the manufacture of chemicals. In 1845 he graduated at the Jefferson Medical College, and was appointed house physician of the Philadelphia Hospital. He lectured on chemistry at the Franklin Institute from 1848 to 1850, and from 1857 to 1887 was attached to the Howard Hospital, in charge of eye and ear diseases, of which he became a well-known specialist. During the Civil War he served as a volunteer surgeon. Among his writings, some of which passed through many editions, are: *Defective and Impaired Vision* (1859); *Hints and Observations on Military Hygiene* (1862); *Imperfect Hearing and Hygiene of the Ear* (1871); *The Nature and Treatment of Nervous Deafness* (1874); *A Clinical Manual of the Diseases of the Ear* (1881); *A Manual of Anæsthetic Agents and Their Employment in the Treatment of Disease* (1885).

TURNBULL, Robert James (1775-1833). An American publicist, born in New Smyrna, Fla., where his father, an English physician, had established a Greek colony. He was educated in England, was admitted to the bar in Charleston in 1794, and practiced there until 1810, when he retired to his plantation. From the beginning he was active in the Nullification movement, and under the signature of 'Brutus' published thirty-one papers in the Charleston *Mercury*, during 1827, which were afterwards collected as the *Crisis*, and had much influence. In 1830 he published *The Tribunal of Dernier Ressort*. He was prominent in the Free Trade Convention at Charleston in 1831, and wrote the report. He was a delegate to the Nullification Convention in 1832, and prepared the address to the people. When the proclamation of President Jackson was read, he was the first to volunteer to resist the general Government.

TURNBULL, William (1800-1857). An American civil engineer. He was born in Philadelphia; graduated at West Point in 1819, and was commissioned in the artillery. He was engaged largely in topographical work, and was promoted to a captaincy in the topographical engineers in 1831, being brevetted colonel in 1847. In the Mexican War he was with General Scott as chief topographical engineer, and took part at Contreras, Cherubusco, and the capture of the City of Mexico. He was superintending topographical engineer on the Potomac Aqueduct for the water supply of Washington, D. C. Among his more important professional works were the building of the New Orleans Custom-House and the Cape Fear River improvements.

TURNBULL, William Barclay David Donald (1811-63). A Scottish antiquary, born at Edinburgh. He was educated for the law, and in 1832 was admitted as advocate at the Scottish bar, but he devoted the greater part of his time to the study of the antiquities and older literature of Great Britain. In 1834 he founded the Abbotsford Club, which did great service by printing works preserved only in manuscripts or old editions. In 1859 he was employed by the Record Commission, and in the course of the next two years published two valuable volumes of calendars of State papers, but on account of his Catholicism he was attacked by the ultra-Protestant party and compelled to resign. He was an industrious and careful editor, who without possessing systematic knowledge of language did excellent service by his editions of Middle English and early modern English poetry. Nor was his work as genealogist and historical editor of small value. Among his publications may be named: *Ancient Mysteries* (1835); *Arthour and Merlin* (1838); *The Romances of Sir Guy of Warwick and Rembrun His Son* (1840); *The Visions of Tundale* (1843); *Letters of Mary Queen of Scots* (1845); and *The Poetical Works of William Drummond of Hawthornden* (1856).

TURNBULL'S BLUE. See Hydro-ferricyanic Acid.

TURNE'BUS, Adrianus (Fr. Adrien Turnèbe) (1512-1565). An eminent French scholar, born at Andelys, famous as one of the leaders of the Renaissance in France. After completing his studies in Paris, he became professor in the University of Toulouse. In 1547 he was called to Paris, where he taught Greek and Latin, and later philosophy, until his death. From 1552 he had charge of all Greek books published by the royal press. Under him appeared the first editions of Philo and Synesius; he himself edited Æschylus, Aristotle's *Ethics*, Cicero's *De Legibus*, Horace and Varro's *De Lingua Latina*, and made many translations. Turnebus's influence extended far beyond the limits of France through his writings and pupils, of whom the most famous was J. J. Scaliger (q.v.). After his death his commentaries, translations, and other writings were published in three volumes (Paris, 1564-80). Consult the *Life* prefixed, and also Mattaire, *Historia Typographorum Aliquot Parisiensium* (London, 1817).

TUR'NER, Charles Tennyson (1808-79). An English poet, brother of Alfred Tennyson (q.v.). He was born at Somersby, in Lincolnshire. Like his more famous brother, he attended the Louth Grammar School, and then studied at home under the direction of his father, the vicar of Somersby. With Alfred, he published *Poems by Two Brothers* (1827; reissued 1893). In 1828 he entered Trinity College, graduating B.A. in 1832. In 1835 he was ordained curate of Tealby, in Lincolnshire, and two years later became vicar of Grasby, in the same county. On inheriting a small estate from a great-uncle, Samuel Turner, he added Turner to his name. His last years were passed at Cheltenham, where he died. After his juvenile verse, he published *Sonnets and Fugitive Pieces* (1830), which were appreciated by Coleridge; and similar volumes in 1864, 1868, and 1873. In 1880 Hallam Tennyson brought together all of his uncle's sonnets and lyrics under the title *Collected Sonnets, Old and New.*

TURNER, Charles Yardley (1850—). An American landscape and figure painter, born in Baltimore, Md. He studied in the National Academy and the Art Students' League of New York City, and afterwards was a pupil of Laurens, Munkácsy, and Bonnat in Paris. He first exhibited at the National Academy in 1882. His pictures include "Nooning" (1882), "The Wedding Procession" (Metropolitan Museum, New York City), and "The Courtship of Miles Standish" (1884).

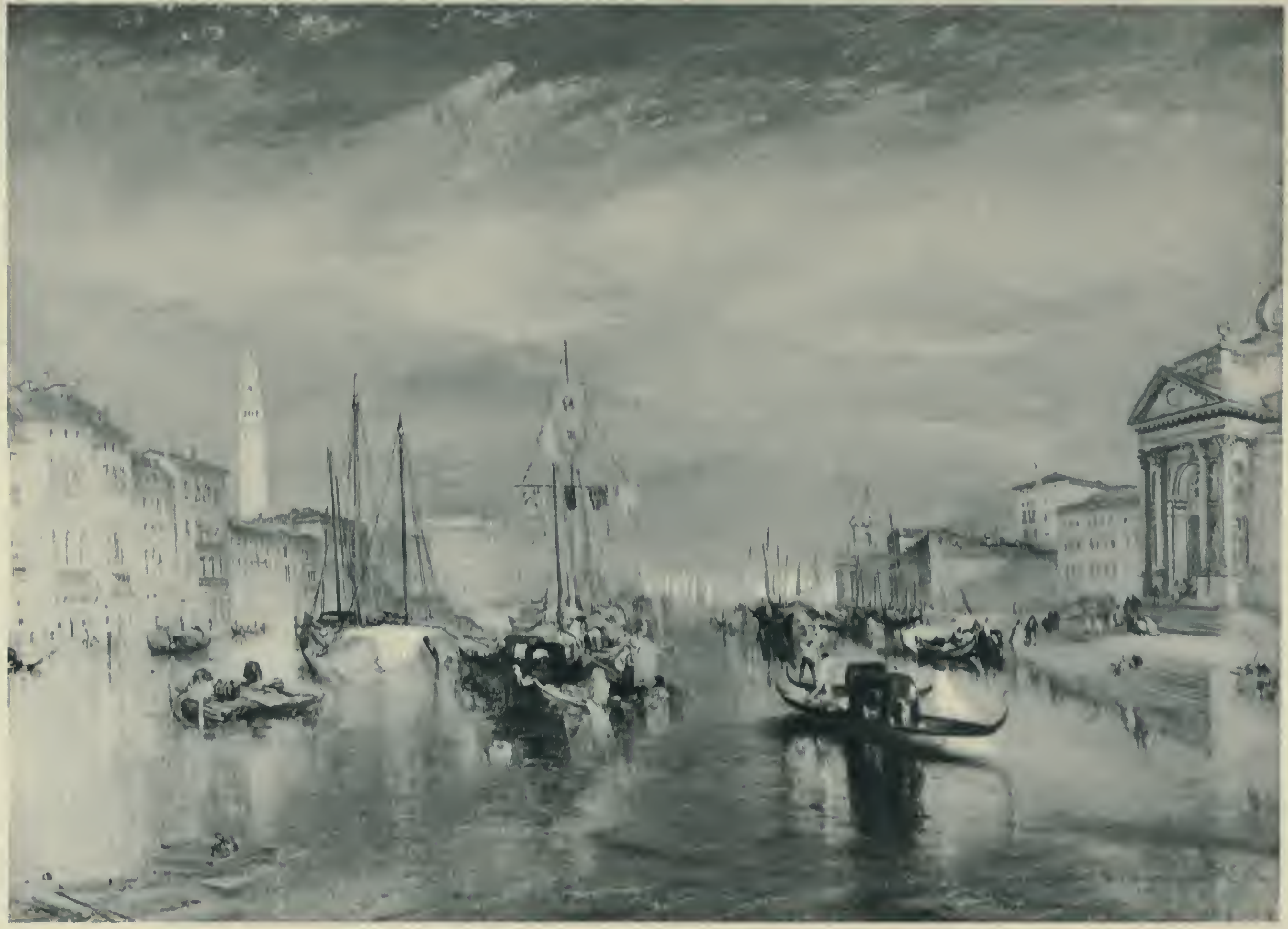
TURNER, Frederick Jackson (1861—). An American historian, born at Portage, Wis. He graduated at the University of Wisconsin in 1884, and after pursuing graduate courses in Johns Hopkins University, returned to the former institution as instructor in American history. Subsequently he became in succession an assistant professor and a professor, and upon its organization in 1901 was made director of the School of History. He has been one of the editors of the *American Historical Magazine*, to which he has contributed largely. He published a number of historical articles in the *Reports* of the American Historical Association and in magazines, and also *The Indian Trade in Wisconsin* (1890), in "Johns Hopkins Studies."

TURNER, Joseph Mallord William (1775-1851). The most celebrated landscape painter of the English school. He was born in Covent Garden, London, April 23, 1775, the son of William Turner, a barber. Almost in his infancy he began to paint and draw. He had but little schooling beyond reading, which he learned from his father, and writing, which was all he acquired at the schools of Brentford and Hargate. During this time he was constantly employed in coloring prints and similar work. His father offered him every facility for artistic education in his power. Before 1789 the lad was placed with Thomas Walton, an architect, to learn perspective, but proved a sorry pupil. Afterwards he studied with Thomas Hardwick, on whose advice he entered the Academy Schools in 1789 to study landscape. He was admitted to the studio of Reynolds, under whom he copied portraits and perhaps learned oil technique; but Sir Joshua had but little influence upon the rising pupil.

His first drawing exhibited at the Academy was a view of Lambeth Palace (1790). During the following years he was much occupied with designs for prints in magazines, which necessitated sketching tours over a great part of England and Wales. He continued his artistic education, however, as one of the coterie of young artists who frequented the hospitable abode of Dr. Thomas Munro, whom Ruskin calls "Turner's real master;" this is only true in the sense that the artist profited by his patronage and more by his encouragement. In Munro's house he had opportunity to copy the early English watercolorists and also the older masters; there, too, he met Girtin and Cozens. He was especially influenced by Girtin, the founder of modern watercolor painting, with whom he sketched much and formed a fast friendship. The success of Girtin's Yorkshire aquarelles moved Turner, in 1797, to make a similar attempt, and his travels in Yorkshire and the north resulted in his forming several important friendships among the northern gentry, like that with Dr. Whitaker, whose works Turner afterwards illustrated with some of his best designs. More than this, it had a marked influence upon his artistic career, as is shown by his exhibit at the Academy in 1798, which proclaimed his genius as a painter of poetic landscape, in such pictures as "Morning on the Comston Fells, Cumberland" (National Gallery), and aquarelles like "Norham Castle," which Turner esteemed of high importance in his development. In 1799 he exhibited several Welsh subjects, in rivalry with Girtin, and his first picture of a naval engagement, the "Battle of the Nile"—works which secured his choice as associate of the Royal Academy.

With this year ceases what Ruskin calls Turner's period of development, and the period of his first style (1800-20) begins. Dropping the topographical subjects which had previously been his chief interest, he introduced historical and mythological motifs into his pictures, deliberately striving to equal or surpass the masters then most celebrated, William van de Velde, Nicolas and Gaspard Poussin, and Claude Lorraine, in their own subjects. He was especially influenced by Claude, the great painter of light, which Turner also considered the chief problem of painting. In 1802 he paid his first visit to the Continent, the results of which appeared in the exhibition in the following year of pictures and drawings of the Savoy Alps, most of which are now in the National Gallery, as well as "Calais Pier," and a "Holy Family" of the same year. The same collection possesses his famous "Shipwreck" (1805); his "Garden of the Hesperides" (1806), painted in the classical style in rivalry with Poussin: and the "Sun Rising Through Vapor" (1807), one of his best and most individual works. From 1807 to 1819 he was engaged in his *Liber Studiorum* (q.v.), in rivalry with Claude's *Liber Veritatis*. His work, however, went further than Claude's, in that it purposed to illustrate all classes of landscape, while Claude's was merely for purposes of identification of his pictures. The etchings for these plates, all of which were supervised or executed by Turner himself, show the master at his very best. During this period he also made travels in Devonshire, in the North of England, in Scotland, and on the Continent. Among other important works of this period are: "Apollo and Python" (1811); "Hannibal and His Army Crossing the Alps" (1812); "Crossing the Brook" (1815); and "Dido Building Carthage" (1815), the best of a Carthage series—all in the National Gallery.

With his visit to Italy in 1819 begins his second style (1820-35), the period of his most perfect works, distinguished by lightness and brilliancy of color. Ceasing to imitate the old masters, he nevertheless clung to the classicist idea of ideal composition. This mature style is well represented by the first of the series of the wonderful Italian pictures upon which his fame chiefly rests—the "Bay of Baiæ, with Apollo and the Sibyl" (1823); also by "Dido Directing the Equipment of the Fleet" (1828); "Ulysses Deriding Polyphemus" (1829); "Caligula's Palace and Bridge" (1831); and "Childe Harold's Pilgrimage" (1832). During 1833-46 he often visited Venice, which for some time exercised a paramount influence upon his art. Of his numerous Venetian subjects the National Gallery possesses a rich collection of watercolors, and the "Grand Canal," in the Metropolitan Museum, New York City, is a fine example of the oils. He found time, however, for other subjects, like "Saint Michael's Mount, Cornwall" (1834), and "The Fighting *Téméraire*" (1838), the best known and most popular of his works. His time was still much occupied with designs for illustrations, like *Rivers of England* and *Ports of England*, in 1824. The drawings for the series *England and Wales*



J. M. W. TURNER

"THE GRAND CANAL, VENICE," FROM THE PAINTING IN THE METROPOLITAN MUSEUM OF ART, NEW YORK

(1827-38), in which several line engravers under Turner's supervision brought this art to a new perfection, are wonderful in color and atmospheric effect. In 1830 appeared the lovely illustrations to Rogers's *Italy;* in 1833 the first of his *Rivers of France,* the drawings for which are among the most perfect of his works. He also illustrated the works of Byron, Scott, Milton, Campbell, Rogers's *Poems,* and Moore's *Epicurean.*

The third period of Turner's art (1835-45) is characterized by the relinquishment of classic composition and a more direct communion with nature, of which he endeavored to render his splendid impressions, foreshadowing the modern Impressionists. Though it tended to become more dreamlike and unreal in character, his work was more wonderful in color than ever. To this period belong many of his greatest works, such as the "Slave Ship" (1840, Boston Museum); "Snow Storm" (1842); "Approach to Venice" (1843); "Rain, Steam, and Speed" (1844)—all in the National Gallery. Here belongs also a series of attempts to represent vague thoughts in color language, like "War—The Exile" (ib., 1842), and many of his pictures of Alpine scenery, the grandeur of which he has rendered as no other painter, in such paintings as "The Splügen." After 1845 his mind and sight began to fail; but though his work was incoherent, it was still good in color. He began a new series, "The Whalers," which he did not live to complete. He died at Chelsea, December 19, 1851, and was buried in Saint Paul's Cathedral. He left a fortune of £140,000, and a splendid collection of his own works, 262 oils, 135 water colors, 1757 studies in color, and almost innumerable sketches. In later life he refused most tempting offers to sell his best works, although the buyers intended to bestow them upon the nation, because he wished to do this himself. Most of these works are in the National Gallery. He intended that his fortune should be devoted to the establishment of pensions for indigent English artists, but his will was broken and most of it fell into the hands of the lawyers and relatives. Though very economical, even sordid in his personal habits, he was generous to others. There has been much useless prattle about his private life and character. Those who knew him best found him infinitely tender, a kind and dutiful son, and a faithful friend. His brusque manner was but a foil of his retiring disposition, which made him inaccessible to society. It is difficult to reconcile these characteristics and the exquisite refinement of Turner's art with the supposed coarse character of his relation to women.

Turner's life was one continuous course of prosperity, and he fully achieved the fame he so ardently desired; in 1802 he was elected Academician, and in 1808 became professor of perspective at the Academy. He easily eclipsed in the public favor all landscapists of his day. In later life his works were attacked, but to atone for this he found in John Ruskin the most eloquent advocate ever possessed by any artist, though these eulogies have created several wrong ideas about Turner's art. The chief characteristic of Turner does not consist, as Ruskin maintains, in his fidelity to Nature. He was indeed one of the profoundest students of Nature that ever lived; but he sought to render her more ideal, beautiful, and sublime than reality, much as was done by Byron and Shelley in literature. His master passions in art were the rendition of light, in which he surpassed even Claude, and that subtle quality which Ruskin calls the "Turnerian mystery," by which objects are rendered with a certain hazy indistinctness of the highest poetical effect. His chief technical quality is not naturalism, but a splendid and brilliant, though sometimes unreal, color. He was as subtle and refined in drawing as in composition. Others have painted more intimate phases of landscape than he, but in range of subject, imagination, and sublimity Turner has never been equaled. Though unsound in oil technique, as is evinced by the ruined state of many of his best works, he was a consummate master of water-color (q.v.), which in his hands became a new art. He was himself an excellent etcher and engraver, trusting to mezzotint to produce the light and shadows; and his designs for illustrations produced a new school of line engraving in England. His facility of execution and diligence were well-nigh incredible, as may be seen from the large number of works in the public and private collections of England. A number of collections in the United States, including the Metropolitan Museum, Lenox Library, and Vanderbilt collection in New York City, possess good examples of his work, both in oil and water-color.

BIBLIOGRAPHY. The most brilliant and sympathetic appreciation of Turner is Ruskin's *Modern Painters* (London, 1843-60), the chief purpose of which is to show his superiority to all painters who preceded. Its value is, however, rather literary than critical, and it should be compared with the more sober judgment of works like Hamerton's *Life of Turner* (ib., 1879). Of the other lives, Thornbury's (ib., 1862) is uncritical, though containing valuable material; far better is that of Cosmo Monkhouse (ib., 1882), who also wrote the good article in the *Dictionary of National Biography.* Consult also the monographs by Burnet (London, 1859) and Dafforne (ib., 1877).

TURNER, NAT (c.1800-31). An American negro slave and insurrectionist, who was born and lived in Southampton County, Va. From his childhood he fancied himself set apart from his fellows for some great purpose, and claimed to hear voices and see visions. In 1828 he declared he had a command to rise and slay his enemies, when a sign should be given. The eclipse of the sun in February, 1831, was accepted as the sign, but nothing was done until after a peculiar solar appearance on August 13th. With four or five companions, he began near Cross Keys, on Sunday night, August 21st, by killing five members of his master's family in their beds. The conspirators proceeded, being joined by recruits until the number reached 53, killing all, even infants, in every house in the neighborhood. On the next morning they killed all the pupils at a school. By noon the news had spread and the band was routed by a party of white men. The excitement was intense. United States troops from Fortress Monroe and the militia from various counties of Virginia and North Carolina gathered and the conspirators were hunted like wild beasts. Turner kept himself concealed for six weeks. When his hiding place was discovered he fled, but was captured near Cross Keys October 30th, was tried and convicted at Jerusalem, and on November 11th was there hanged. In all only 17 negroes were executed, as it was proved that some in the party were there under compulsion. Fifty-seven whites were slaughtered and more would have been killed but for the faithfulness of slaves, who in several instances defended their masters. The results of the massacre were immediate. More stringent slave codes were passed in many States, free negroes were deprived of their privileges, and the Manumission movement, which had considerable strength previously, was effectually checked. Consult: Weeks, "The Slave Insurrection in Virginia," in *Magazine of American History* (New York, June, 1891); Drewry, *The Southampton Insurrection* (Washington, 1900).

TURNER, SAMUEL HULBEART (1790-1861). A Protestant Episcopal theologian. He was born in Philadelphia, and graduated at the University of Pennsylvania in 1807. He was rector of churches in Chestertown, Md., New York, and Brooklyn, and became in 1818 professor of historic theology in the New York General Theological Seminary, and in 1821 professor of biblical learning and Scripture interpretation. He was also professor of Hebrew in Columbia College after 1830. Among his works are commentaries on Romans (1824 to 1853), Hebrews (1852), Ephesians (1856), and Galatians (1856); *Bibliographical Notices to the Most Distinguished Jewish Rabbis* (1847); *Companion to the Book of Genesis* (1841); *Parallel References of the New Testament* (1848); *Thoughts on Scriptural Prophecy* (1852). Consult his autobiography (New York, 1863).

TURNER, SHARON (1768-1847). An English historian. He was born at Pentonville, and at the age of fifteen was articled to an attorney, to whose practice he succeeded six years afterwards. He was a successful practitioner until 1829, when he retired. From an early time his entire leisure had been devoted to a study of the Anglo-Saxon period of English history from the hitherto almost unused Anglo-Saxon manuscripts in the British Museum. These studies culminated in his famous *History of the Anglo-Saxons* (London, 1797-1805; 7th ed. 1852). He continued his narrative in subsequent years under various titles to the end of Elizabeth's reign, but with less happy results. These historical works were finally published in a collective edition under the title *History of England from the Earliest Period to the Death of Elizabeth* (London, 1839). He also wrote *Sacred History of the World as Displayed in Creation and Subsequent Events to the Deluge* (ib., 1832; 8th ed. 1848), and other works.

TURNER, Sir WILLIAM (1832—). An English anatomist and naturalist, born in Lancaster and educated at Saint Bartholomew's Hospital. In 1854 he became a demonstrator of anatomy, and in 1867 professor of anatomy in the University of Edinburgh. Besides these offices, he held various other teaching positions, and for many years represented the University of Edinburgh in the General Council of Medical Education. From 1866 to 1894 he was one of the editors of the *Journal of Anatomy and Physiology.* In 1886 he was made a knight. Among his longer works are *An Introduction to Human Anatomy* (1875); *Lectures on the Comparative Anatomy of the Placenta* (1876); and an *Atlas of Human Anatomy and Physiology.*

TURNER, WILLIAM WADDEN (1810-59). An American philologist, born in London. In 1818 he emigrated to New York, and became a printer's apprentice. He was librarian of the University of New York, instructor in Hebrew in the Union Theological Seminary, and from 1852 librarian of the United States Patent Office. Besides contributions to learned societies and periodicals, he published with Isaac Nordheimer *A Critical Grammar of the Hebrew Language* (1851), and *Grammar and Dictionary of the Yoruba Language* (1858); and translated the greater part of Freund's *Latin-German Lexicon.*

TURNER'S FALLS. A village in the town of Montague (q.v.), Mass.

TURNHOUT, tụr-nout′. A town in the Province of Antwerp, Belgium, 25 miles east by north of the city of Antwerp (Map: Belgium, C 3). It has an old castle, now utilized as a court of justice and a prison, and the Church of Ouel-Turnhout with noteworthy paintings. Turnhout manufactures lace, cloth, leather, and playing cards. Leech-breeding is also an important industry. The town was the scene of a victory of the Dutch, under Maurice of Nassau, over the Spaniards in 1597, and in 1789 the Austrians were defeated here by the Belgians under Van der Mersch. Population, in 1900, 20,945.

TURNING. See METAL-WORKING MACHINERY; WOOD-WORKING MACHINERY.

TURNIP (from *turn* + *nep*, from AS. *næp*, turnip, from Lat. *napus*, sort of turnip), *Brassica campestris* (*rapa* of some botanists). A biennial plant of the natural order Cruciferæ, cultivated in cool climates for its globose, oblong or roundish, swollen and fleshy roots, which are used as a vegetable and for stock-feeding. It is a native of temperate Europe and Asia, growing in fields and waste places. The cultivated varieties are very numerous. Some attain a weight of 20 or 25 pounds. Garden turnips are sown in early spring or even as late as midsummer; field turnips generally in midsummer, so as to avoid the possibility of developing a flower stem in the year they are planted, a development which impairs the quality and impedes the development of the edible part. The varieties both of garden and field turnips are very numerous. The garden turnips are generally of comparatively small size, rapid in growth, and of delicate flavor. The name Swedish turnip or ruta baga is given to a group of varieties cultivated in the same manner and used for the same purpose as the common field and garden turnip.

The cultivated turnip grows best in a rich soil. It is not well suited to clay soils, although it is often grown on them. A complete pulverization of the soil is requisite before the sowing of the seed. On light soils, a crop of turnips generally succeeds wheat or oats. The seed may be sown either in drills 2-2½′ feet apart or broadcast. The young plants are thinned out by hand to 8 inches or more apart, and the ground is stirred and carefully kept clean by cultivation and hoeing. The turnip crop is thus of great use in clearing the land of weeds. In many places part of the crop is eaten on the ground by sheep, which are corralled upon small areas in the field, each third row being left for this purpose, the plants in the other two rows being fed or stored in houses or earth-covered pits or by being covered in the field with earth plowed over them. Swedish turnips are the most hardy varieties.

COMMON TURNIP (*Brassica campestris* or *rapa*).

Both the ordinary turnip and the ruta baga are used for feeding stock, the former less than the latter. Both are classed as coarse fodder, since they are bulky in proportion to their nutritive value. Turnips have the following average percentage composition: Water, 90.5; protein, 1.1; fat, 0.2; nitrogen-free extract, 6.3; crude fibre, 1.1; and ash, 0.8; Swedish turnip.—Water, 88.6; protein, 1.2; fat, 0.2; nitrogen-free extract, 7.7; crude fibre, 1.3; and ash, 1.1. Experiments show that 90 per cent. of the total dry matter, nitrogen-free extract, and crude fibre of turnips is digested. In Great Britain, Northern Europe, and Canada large quantities of turnips are fed, with other roots, replacing grain to a considerable extent. Roots are little fed in the United States, probably because they are less easily cultivated than corn. Turnips are used especially for sheep. Dairy cattle should be milked before being fed turnips even in limited quantities, to avoid the possibility of tainting the milk. Sheep prefer the Swedish turnip to all other roots. Slicing and pulping are commonly practiced. See Plate of CABBAGE AND ALLIES.

TURNIP INSECTS. There are practically no insects specifically attached to the turnip, although this crop frequently suffers from the attacks of several kinds of insects. The foliage is eaten by very many of the insects which are found upon cabbage (see CABBAGE INSECTS), and the cabbage root-maggot sometimes affects the turnip tuber. Several of the root-feeding beet insects also attack turnips. See SUGAR-BEET INSECTS.

TURN-SEVERIN, or **TURNU- SEVERIŃ**, tụrn′sȧ′vȧ-rēn′. A town of Rumania on the Danube just below the Iron Gate, about 175 miles west of Bucharest (Map: Balkan Peninsula, D 2). Near it are the remains of Trajan's Bridge, erected A.D. 103. Population, in 1900, 18,626.

TURNSPIT. A dog. See HOUND.

TURNSTONE. A shore-bird (*Arenaria interpres*), related to the plovers and surf-bird (q.v.), and found in almost every part of the globe. It breeds in the Arctic regions, but occurs on the coasts of the Eastern United States during migrations. It frequents the seashore, and derives its English name from its habit of turning over small stones with its bill in search of food. The eggs, which are four in number, are laid on lonely rocky coasts where there is sparse vegetation. They vary very much in color and markings, and are cunningly concealed. The length of the turnstone is rather more than 9 inches. The plumage varies with the age of the bird and the season, but is always pied black and white, with rufous or brownish ash. (See Colored Plate of SHORE-BIRDS.) On the coasts of the North Pacific is found a turnstone (*Arenaria melanocephala*) which lacks the rufous or brownish ash. These two are the only known species.

TURPENTINE (OF. *turbentine*, *terebentine*, ML. *terebintina*, turpentine, from Lat. *terebinthinus*, relating to the terebinth, from *terebinthus*, from Gk. τερήβινθος, terebinth). The resinous exudations of various species of coniferous trees. When the viscid exudation is distilled, oil or spirit of turpentine passes over, leaving behind a residue of common colophony. The distillation is carried out in copper stills. The mass is gradually heated to 316° F. (158° C.), which is approximately the boiling temperature of oil of turpentine. The resin remaining in the still is drawn off while hot. French turpentine is distilled by means of a current of steam. The oil or spirit of turpentine dissolves camphor, resins, and other organic substances and mixes freely with alcohol, ether, and glacial acetic acid. It does not mix with water. It is a thin colorless liquid readily recognized by its characteristic odor. Chemically it is a mixture of several isomeric hydrocarbons (terpenes) represented by the formula $C_{10}H_{16}$ and converted by oxidation into a camphor having the composition $C_{10}H_{16}O$. Oil of turpentine is largely used in medicine as an irritant and counter-irritant in chronic inflammations. It is an excellent remedy for ringworm, and is given internally also to stop hemorrhages, and as a remedy for gonorrhœa. The administration of turpentine is attended with some danger, as it is likely to produce inflammation of the kidneys. In the arts oil of turpentine is used for the preparation of varnishes and for similar purposes. American turpentine is derived from the Pinus australis and the Pinus tæda; French turpentine from the Pinus maritima; Russian and Swedish turpentine from the Pinus sylvestris and the Pinus Lederbourii. Canada turpentine, or Canada balsam, is obtained from the Abies balsamea, growing in Canada and the Northern United States.

TURPENTINE TREE. See Pistacia.

TUR'PIN or **TULPINUS** (?-c.800). A supposed mediæval chronicler, Archbishop of Reims. He is described as a friend and companion of Charles the Great and an eye-witness of the exploits he relates in a chronicle in Latin prose narrating the expedition of the Frankish Emperor against the Saracens of Spain, and particularly the events that preceded and followed the battle of Roncesvalles (q.v.). Turpin's name became attached to this chronicle, but though there was an Archbishop Turpin of Reims (c.754-c.800), he has no claim to the description given above, and internal evidence leads to the conclusion that the chronicle is a work of the twelfth century. It seems to have sprung out of the epic ballads and traditions of the Carolingian heroes, and was taken from a manuscript composed probably at Compostella. The poems were changed considerably in order to further pilgrimages to Compostella. The book soon acquired a great popularity, was translated into French by 1206, and was made use of by divers chroniclers, as the author or authors of the *Chroniques de Saint-Denis,* Vincent of Beauvais, and others. The chronicle is of great historic value, in spite of all the embellishments it has from time to time received. There have been several editions of the chronicle in Latin; the best, by Casteta, was published at Paris and Montpellier in 1880. It has been translated into many languages, among others into English by Rodd (London, 1812), reprinted in *Mediæval Tales,* in *Morley's Universal Library* (London, 1890). For editions and secondary works, consult Potthast, *Bibliotheca Historica Medii Ævi,* vol. ii. (Berlin, 1896).

TURPIN, Edmund Hart (1835—). An English concert organist, lecturer, and composer. He was born in Nottingham and after studying under local teachers went to London, where he became a pupil of Hullah and Pauer. In 1857 he removed to London and made that city his home. Twelve years later he became organist of Saint George's, Bloomsbury, and removed to Saint Bride's, Fleet Street, in a like capacity in 1888. He was the editor of the *Musical Standard* for several years and enjoyed a wide fame as a musical writer and lecturer. In 1875 he became secretary of the College of Organists and did much to build up the college. In 1891 he became joint editor of the *Musical News.* His works include a mass, a cappella and a mass for soli, chorus, brass drums, and organ; the oratorios *Saint John the Baptist and Hezekiah;* the cantatas *A Song of Faith* and *Jerusalem;* and a symphony, *The Monastery.* Other works are numerous services, string quartets, chamber music, pianoforte pieces, and organ concert music.

TURPIN, Richard, commonly called 'Dick Turpin' (1706-39). An English highwayman. He was born at Hempstead, Essex, where his father was an innkeeper. He was apprenticed to a butcher, and, detected in cattle-stealing, he fled and joined a gang of thieves. They committed several brutal robberies, but disbanded after two of their members were captured and hanged. Turpin then became associated with the highwayman Tom King, whom he fatally shot when trying to prevent King's arrest. Turpin escaped into Yorkshire, where he passed for a gentleman, but was soon suspected, and finally captured with some stolen horses, tried, and executed. Turpin's reputation as a hero, and a man of courage and generosity, together with his marvelous ride from London to York, are fabrications which were enhanced by Ainsworth's vivid and descriptive characterization in the novel *Rookwood* (1834).

TURQUOISE (OF. *turquoise, turques,* Fr. *turquoise,* fem. of *turquois,* Turkish, from *Turc,* Turk). A hydrated aluminum and copper phosphate that is found massive. It is opaque, has a waxy lustre, and occurs in various shades of blue to green. The peculiar bluish-green or robin's-egg tint is the preferred color for the gem varieties. Turquoise is found in narrow seams and irregular patches in igneous and volcanic rocks. The best specimens come from the vicinity of Nishapur, Persia, but the mineral is found also at various localities in Asia Minor, Turkestan, and Siberia. In the United States, the locality in the Los Cerillos Mountains, near Santa Fe, New Mexico, was worked by the ancient Mexicans, and still yields fine gems. Other localities in the United States are in Colorado, Arizona, Nevada, and California. Among the early Mexicans turquoise was regarded as emblematic of success, and was worn to preserve health. The peculiar property of the turquoise, of becoming dirty-green in color as it gives up its moisture, led to a belief that its change in color foretold misfortune, and hence the Oriental proverb that the turquoise pales when the well-being of the giver is in danger. It was believed in the Orient to be a remedy for all diseases of the head and heart, and in cases of poisoning or snake-bite it was given with wine. *Bone turquoise* or *odontolite* is fossil bone colored blue by iron phosphate.

TURRET (OF. *tourette, touret,* little tower, diminutive of *tur, tour,* Fr. *tour,* tower, from Lat. *turris,* Gk. *τύρσις, tyrsis, τύρρις. tyrris,* tower; connected with Lith. *tursa,* bag). This name is now applied to revolving towers of circular or oval section in which naval guns are mounted. Fixed towers are commonly called barbette towers or barbettes, as all gun towers of this class on modern ships are designed to have the guns fire over the tops of their walls.

TURRETIN, tụr'tăɴ', or **TURRETINI,** to͞o'râ-tē'nê, François (1623-87). A Swiss Calvinistic theologian. He was born in Geneva; studied theology first in his native city and afterwards in Holland and France; was pastor at Geneva, 1647; removed to Leyden, 1650; and was recalled to Geneva as professor of theology, 1653. His principal work, *Institutio Theologiæ Elencticæ* (1679-85, new ed., Leyden, 1696, reprinted Edinburgh, 1847-48), ranks high among the strictest expositions of Calvinistic theology. He was one of the authors of the Helvetic Consensus (1675) directed against the milder theology of Saumur. His complete works were published at Geneva in 1688. His son, Jean Alphonse (1671-1737), was born at Geneva, and was professor there of ecclesiastical history, 1697. He followed the Saumur theology as taught by Tronchin, his teacher, and endeavored to unite the Reformed and Lutheran churches. His chief work is *Cogitationes et Dissertationes Theologicæ*

(1711-37). Consult the lives of the elder and the younger Turretin, as they are commonly called, by E. de Bude (Lausanne, 1880).

TURTLE (probably a corruption either of *tortoise*, or of Sp. *tortuga*, Port., It. *tartaruga*, OF. *tortuge*, *tortue*, Fr. *tortue*, tortoise; in either case ultimately from Lat. *tortus*, twisted, so called on account of the crooked feet; probably influenced by popular etymology with Eng. *turtle*, sort of dove). A shell-incased reptile of the order Chelonia. The word 'turtle' is used mainly to indicate the large marine forms, although in the United States it is applied freely to both fresh-water and land forms. 'Tortoise' (q.v.), strictly speaking, refers to land forms.

STRUCTURE. The body of a turtle is invariably short and broad, and is protected both above and below by more or less bony shields, with spaces between them in front and behind into which the head and legs may be drawn. The conical tail is usually simply bent around against the side of the body when the turtle retracts into the shell, and thus covers the circular vent. The armature or 'shell' is composed of an upper part, the 'carapace,' and a lower, the 'plastron.' The carapace is formed from the ribs, of which there are eight pairs; and from the annular parts of the dorsal vertebræ, expanded into plates, which are joined to each other by dentilated sutures, so that the whole acquires great firmness, and the dorsal vertebræ are rendered immovable. The plastron is formed of pieces which represent the sternum or breast-bone, and which are ordinarily nine in number, and have names, as also have the parts of the carapace. The box-tortoise has certain plates movable, so as more completely to inclose its body. The turtles and other aquatic chelonians cannot thus withdraw their head, tail, and limbs from danger, but the greater activity of their movements compensates for this. The above remarks apply to all turtles (Thecophora) except the leatherbacks (Athecæ), whose body is jacketed in a continuous leather-like case composed largely of a mosaic of polygonal bony plates; and the vertebræ and ribs are not fused with, but are free from the carapace. See LEATHERBACK.

Externally the entire shell is covered with horny epidermal plates or shields of various forms and ornamentations, but arranged in all families on a regular plan. Each shield grows individually, the rings visible upon many of them indicating each a year's growth—at least in countries where a winter hibernation and consequent suspension of growth takes place. These plates may be detached by heat, and in the hawksbill are of the beautiful material called 'tortoise-shell' (q.v.). The neck, legs, and tail are often provided with a horny scaled armature. A cuticular layer covers the outside of the armature and is shed in fragments from time to time. The skull agrees fundamentally with that of crocodiles, but has several peculiar features, and is very solid. The mouth is bounded by a more or less horny beak like that of birds. The jaw is toothless, and the food is swallowed whole. There is, therefore, no need of a delicate sense of taste, and this sense is degenerate. In the stomach there are no organs of trituration, and the process of digestion is necessarily very slow, and is dependent on the action of the gastric juice. The heart is short, thick, and has but one ventricle. The lungs are large and are capable of containing much air. The air is drawn into the mouth, the passages to the nares are then stopped by the tongue, and the air is gulped down. This way of getting air into the lungs is required by the rigidity of the armature, which prevents expansion and contraction of the chest. Turtles can remain under water for an hour or so without renewing the lung contents. The eyesight of turtles is very keen. The eye is protected by an upper and a lower lid and in addition by a nictitating membrane, as in birds. The sense of hearing is very acute.

HABITS AND HABITAT. When startled, some turtles, such as the wood-turtle, give a loud snake-like hiss. The males of the large Galapagos tortoises, according to Darwin, bellow or roar at the breeding season. Our common painted turtles utter a piping note, particularly in the spring. Turtles are diurnal except at the breeding season. With the exception of sea-turtles, the habitat of any individual turtle is very local. Certain tortoises and terrapins that have been marked have been observed in the same pasture year after year. Sea turtles return to the same locality to breed. Those in the temperate region hibernate throughout cold weather buried in earth or mud. Marine forms have the legs modified into huge paddles, while amphibious forms have leg-like limbs only partially webbed. The coloration of those that spend considerable time on land simulates very much that of the ground. One form (see MATAMATA) has a fringed or foliaceous neck of much service in hiding it while seeking prey or avoiding foes.

About 250 species of Chelonia are known, the most numerous species being found in fresh water, generally in warm climates. The marine species are the largest. Several kinds occur in the Alleghany region at considerable altitudes, but none live in the Rocky Mountains. Chelonia are not numerous in kinds on the California coast, or in Europe, while on the Asiatic coast they are abundant.

FOOD. Some of the sea-turtles, the land-tortoises (q.v.), and a part of the fresh-water terrapins (q.v.) are herbivorous, and these are the ones commonly eaten by man. Other sea and fresh-water forms feed entirely or in part on animal food, and are usually ferocious. Fresh-water forms, such as the snapping turtles (q.v.), feed on fish, mussels, earthworms, insect larvæ, young ducks, and the like. The box-turtle eats mushrooms and berries, and not infrequently make raids on tomato gardens. Certain pond forms are practically omnivorous.

EGG-LAYING. Aquatic turtles come on land usually on moonlight nights at the breeding time to deposit their eggs. A sandy slope is preferred by most forms. In this soil they dig a hole with the hind feet, let the eggs fall within it, and replace the sand so deftly that the ground seems scarcely disturbed. The female then retreats quickly to the water. Almost any soil will suffice for the American painted turtle, and the same rotten log may be utilized by many musk-turtles until it holds hundreds of eggs. The eggs, if not dug up by some animal, are left to hatch in the warm sand by the aid of the sun's heat alone. The snapping turtle deposits from 18 to 30 eggs in the early morning hours. The wood, painted, and skunk turtles, which lay from three to eight eggs, choose the afternoon for egg-laying. The eggs of snapping turtles are usually spherical and about the size of a walnut. The shell is tough and leathery. Certain other turtles lay oval eggs, and a few eggs having a shell of a fine porcelain texture. The eggs hatch slowly, some kinds only after three or more months. As soon as the young, water-loving turtles hatch they begin to creep about and to travel down inclines until they eventually reach water.

All the species are extremely tenacious of life; they are capable of extraordinary abstinence, and of living long after having sustained injuries which would have been immediately destructive to almost any other animal. They are also remarkable for their longevity, examples of which are mentioned under TORTOISE.

ECONOMIC VALUE. The flesh of those which subsist on animal food is musky and unpleasant; but that of vegetable feeders is much esteemed. The eggs of most species are excellent. Vast quantities of eggs of the large Amazonian 'arrau' (*Podocnemis expansa*) are also pressed to obtain oil of large commercial value. The most highly esteemed for food is the green turtle (q.v.), and its relative the 'edible' turtle of the East Indies. Many smaller kinds are eaten, including the favorite American terrapin (q.v.), the snapping turtle (q.v.), and other fresh-water forms.

CLASSIFICATION. The Chelonia were at first divided according to modifications of the feet. Cope, recognizing the separability of Trionychoidea, also, in 1870, emphasized a division based upon the mode of carrying the neck, one group (Pleurodira) bending it sidewise in withdrawing the head, and the other (Cryptodira), withdrawing it in an S-shaped curve in a vertical plane. A more worthy division is Athecæ for the shell-less Spargidæ, or leatherbacks, and Thecophora for all other kinds. Boulenger's classification is as follows:

CHELONIA	Athecæ		Sphargidæ.
	Thecophora	Pleurodira	Pelomedusidæ. Chelydidæ. Carettochelydidæ.
		Cryptodira	Chelydridæ. Dermatemydidæ. Cinosternidæ. Platysternidæ. Testudinidæ. Chelonidæ.
		Trionychoidea.	Trionychidæ.

The Pelomedusidæ are a small family of African and South American turtles including the large and valuable 'arrau.' The family Chelydidæ includes the curious matamata (q.v.), certain long-necked Australian types (Chelodina), and the South American Hydromedusa. The Carettochelydidæ are a family in which is set a strange small turtle of New Guinea, whose 'shell' is covered with soft skin instead of horny shields. Of the cryptodirous families, the Chelydridæ are represented by the various snapping or 'alligator' turtles (q.v.), and the Dermatemydidæ by a few species of aquatic tortoises of Central America. The Cinosternidæ are the family of the North American 'skunk' or 'stinkpot' turtles. (See MUSK-TURTLE.) Platysternidæ includes only a single Siamese water-tortoise. The Testudinidæ, on the other hand, are the most populous of Chelonian families and nearly cosmopolitan. The shell in this family is always covered with well-developed horny shields, the plastron has nine bones, and the neck is completely retractile. About twenty genera with more than 110 species are now recognized; but the generic distinctions are not easily recognized by external appearances. Here are classified the North American 'mud-turtles' of the genus Chrysemys, which abound in all still waters, as do the 'pond-tortoises' (Emys) of Europe, the terrapins (q.v), and the box-tortoises (Cistudo). The last get their name from the fact that the plastron, which is united with the carapace by ligaments, is divided into two movable lobes, connected by a hinge permitting them to be lifted up against the overhanging carapace, and closing both ends of the shell perfectly after the animal has drawn within its defenses. The common box-tortoise of the United States (*Cistudo Carolina*) is entirely terrestrial, numerous everywhere and very interesting in its habits. In this family, also, fall the various land-tortoises (q.v.) of the type-genus Testudo. Most of the foregoing are terrestrial or fresh-water forms, while the remainder are marine and have the limbs modified into swimming paddles or 'flippers.' The family Chelonidæ contains many great extinct forms, from the Cretaceous to recent times, and a few existing species, of which the green turtle, hawksbill, and loggerhead (qq.v.) are representatives. The order Trionychoidea contains only the family Trionychidæ, which have no rigid plates on the flat carapace, but a soft leathery skin, and the plastron imperfect. See SOFT-SHELLED TURTLE.

FOSSIL TURTLES. The origin of the Chelonia is uncertain. Otocœlus, an armored cotylosaur from the Permian of Texas, has been suggested by Cope as a possible progenitor, but the relationship is extremely doubtful. Certain characters of shoulder-girdle and ventral abdominal ribs in the plesiosaurs indicate that this order may have genetic affinity with the turtles, and the dicynodonts and placodonts of Triassic age resemble turtles remarkably in many structures of the skull and limb-bones. (See THEROMORPHA.) All these groups belong to the synapsid division of Reptilia. Little evolution is demonstrable within the chelonian order from its first appearance in the European Upper Trias to the present, except in the degeneration of the carapace and elongation of the digits in the marine forms. The oldest turtle known is Proganochelys, from the Keuper (Upper Trias) of Germany. A probably primitive character in this genus is the well-developed row of supra-marginal plates. The Lower Jurassic strata have, as yet, yielded no chelonian remains, but in the Upper Jurassic, Cretaceous, and the Tertiary they are abundant, chiefly in the Northern Hemisphere. The existing suborders Cryptodira and Pleurodira appear to be fully differentiated in the Upper Jurassic, the Trionychia in the Upper Cretaceous of North America. As a rule the known Jurassic turtles have a solidly roofed skull like that of the recent green turtle, and a well-developed carapace. Professor Baur's opinion is that the earliest turtles were swamp-turtles, and that the soft-shelled Trionychia and the marine families evolved from these along one line, and the land tortoises along another.

Cryptodira is the suborder most widely represented among fossils, as among recent turtles. Several of the existing families, including the marine Chelonidæ and the 'leather-turtles,' are already differentiated in the Cretaceous, and in the Lower Eocene the highly specialized land-tortoises appear. Of the Cretaceous sea-turtles some attained enormous size; Protosphargis from Italy had a shell nine feet long, and in the North American Archelon the skull alone measures three feet. The suborder Pleurodira is widely distributed as fossils in various Mesozoic systems. Miolania, from the Pleistocene of Queensland, was a huge creature in which the head was armed with bony 'horns.' The third suborder, Trionychia, is known from the North American Cretaceous and the Tertiary of both hemispheres. The group shows scarcely any change from its first appearance to the present.

Bibliography. Consult standard works and authorities cited under Reptile and Tortoise; Boulenger, *Catalogue of Chelonians in British Museum* (London, 1889); Gadow, *Amphibia and Reptiles* (London, 1901); L. Agassiz, *Contributions to the Natural History of the United States* (Boston, 1857). Most of the literature on fossil Chelonia consists of special papers in scientific periodicals. The most important ones are by G. Baur and E. Fraas, in Germany, Boulenger and Gadow in England, and O. P. Hay in America.

TURTLE-DOVE. See Dove; Pigeon.

TUR'TON. A cotton-manufacturing town in Lancashire, England, 4½ miles northeast of Bolton (Map: England, D 3). Population, in 1901, 12,353.

TURVEYDROP, Mr. A dancing-master in Dickens's *Bleak House*, said to have been modeled on George IV. He poses as a 'model of deportment' and is supported by his devoted son.

TUS'CALOO'SA. The county-seat of Tuscaloosa County, Ala., 56 miles southwest of Birmingham, on the Black Warrior River, and on the Alabama Great Southern and the Mobile and Ohio railroads (Map: Alabama, B 2). The University of Alabama, opened in 1831, is a mile north of the city. Other educational institutions are the Tuscaloosa Female College (Methodist Episcopal South), opened in 1860; the Alabama Central Female College; the Verner Military Institute; and Stillman Institute (Presbyterian), a colored theological school, opened in 1870. The State Insane Hospital, the old State Capitol building, and the bridges spanning the Black Warrior also are noteworthy features. The commercial importance of the city has been increased by extensive improvements on the river, adding considerably to the distance open to navigation. Coal is extensively mined in the vicinity, and at Holton, a suburb, there are large iron furnaces, coke ovens, and a by-product plant. Tuscaloosa is the centre of large cotton interests, and its principal industrial establishments are connected with cotton. Under the revised charter of 1878-79, the government is vested in a mayor, chosen biennially, and a common council. Tuscaloosa was settled about 1812, and was first incorporated some four years later. It was the capital of the State from 1826 to 1846. Population, in 1890, 4215; in 1900, 5094.

TUS'CANY (It. *Toscana*). Formerly a sovereign grand duchy, now a district (compartimento) on the west coast of Italy (Map: Italy, F 4). It comprises the maritime provinces Grosseto, Livorno (Leghorn), Lucca, and Pisa, the inland provinces Arezzo, Florence, and Siena, and the Province of Massa e Carrara, extending from the sea northward between Liguria and the Apennines. The greater part of Tuscany is mountainous, the Apuan Alps reaching 6385 feet and Mount Amiata 5655 feet. The principal rivers are the Arno, Cecina, Ombrone, and Serchio, all flowing into the Mediterranean. Except in the Maremma, a large marshy region on the southern coast, the climate is mild and healthful. The leading mineral deposits include iron, mercury, borax, copper, and salt; there are many mineral and thermal springs. Among the important agricultural products are wheat, maize, the vine, the olive, and tobacco. For population, see section on that topic under Italy.

Tuscany corresponds nearly to ancient Etruria (q.v.). The Etrurians or Tuscans were the earliest inhabitants known to history. They were conquered by the Romans, by whom in later times the land was called *Tuscia*. During the period of barbarian migrations Tuscia was possessed in turn by the Ostrogoths, the emperors of Constantinople, and the Lombards. The last were conquered by Charles the Great and a Frankish margrave or duke was established with Lucca as his residence. Tuscia formed a part of the Kingdom of Italy, or of the Lombards. In 1030 Boniface II. of the House of Canossa became Duke of Tuscany. He was also Count of Modena, Reggio, Mantua, and Ferrara. His granddaughter, the Countess Matilda (q.v.), known as 'the Great Countess,' was an ardent friend of Pope Gregory VII., and one of the most powerful supporters of the Papal party during the Investiture struggle. At her death, in 1115, she bequeathed all of her wide dominions to the Papacy; but the German emperors claimed the duchy as an Imperial fief, and for more than a century 'the property of Matilda' was the cause of constant strife between the popes and the emperors. During this period the principal cities became independent and prosperous. Pisa had risen to independence and power long before this, and was now a great maritime republic. At the close of the thirteenth century she succumbed to the power of her rival Genoa. For several centuries the history of Florence is to a great extent the history of Tuscany. At the close of the twelfth century she was at the head of the Tuscan league of cities formed to resist the Hohenstaufen. This brought her into close alliance with the Papacy, and usually Florence remained a firm adherent of the Guelph Party.

In the fourteenth century Dante, Giotto, Petrarch, and Boccaccio made Tuscany preëminent in the revival of letters and arts. The Tuscan dialect became the literary language of Italy. In 1406 Pisa submitted to Florence and soon after she became mistress of Leghorn. Internal dissensions in Florence led to the establishment of the predominance of the Medici (q.v.). Cosimo de' Medici got control of affairs in 1434 and made the supreme power in Florence the hereditary possession of his house. In 1532, through the instrumentality of the Emperor Charles V., Alessandro de' Medici was made Duke of Florence. He was assassinated in 1537 and Cosimo the Great became Duke. The latter added to the territories of the duchy, especially by receiving Siena from Charles V. This gift bound him more closely to Spain and for nearly two hundred years Tuscany was generally under the influence of Spain. In 1569 the Florentine dominions were erected into the Grand Duchy of Tuscany. The House of Medici became extinct in the male line in 1737. By the terms of the Treaty of Vienna, which had been concluded in 1735, the grand duchy was given to Francis of Lorraine, the husband of Maria Theresa of Austria. Grand Duke Ferdinand III. was dispossessed by the French in 1799. By the Treaty of Madrid between France and Spain, in 1801, Tuscany was erected into the Kingdom of Etruria and given to the son of the Duke of Parma. In 1807 Napoleon took possession of the country, which was united with France. Elisa Bocciochi, the sister of Napoleon, received the title of Grand Duchess of Tuscany. In 1814 Ferdinand III. was reinstated and ruled until 1824. His successor, Leopold II., did much to promote the prosperity of Tuscany. In 1847 Lucca was annexed to the grand duchy. In February, 1848, Leopold granted a liberal constitution to his subjects, but the tide of revolution carried everything before it, and early in 1849 the Grand Duke fled from his country. A counter-revolution was soon set on foot by the Moderate Liberal Party and in a few months Leopold was restored to his throne. In 1850 he entered into a convention with Austria by which Austrian troops were to occupy Tuscany, and, thus supported, he reinstituted a régime of absolutism. In 1859, in consequence of his pro-Austrian policy, he was obliged to leave his State, which was occupied by the forces of Victor Emmanuel. On March 15, 1860, the people by a plebiscite voted the union of Tuscany with Italy.

For the early history of Tuscany, consult the histories of Florence, Pisa, and Arezzo, especially Perrens, *Histoire de Florence* (Paris, 1877-90). For the later history, consult Reumont, *Geschichte Toscanas seit dem Ende des florentinischen Freistaates* (Gotha, 1876). For the nineteenth century, Seignobos, *Political History of Europe Since 1814*, translated by Macvane (New York, 1899), gives a convenient summary and furnishes an ample bibliography.

TUS'CARO'RA. An important Southern tribe of Iroquoian stock (q.v.). When first known about the year 1670 they resided along the Neuse River in eastern North Carolina, where in 1700 they occupied fifteen villages with an estimated population of 1200 warriors or about 6000 souls, and held paramount influence over all the smaller tribes of that section. They were hostile to most of the leading Southern tribes, but maintained a close friendship with the Northern Iroquois (q.v.), whom they knew as traditional kinsmen. In consequence of encroachments upon their lands, they rose against the whites in September, 1711. A war of two years ensued, in which both Carolina provinces joined forces, together with a great body of Indian allies, against them. Finally defeated, the Tuscarora abandoned their country and fled north to the Iroquois, who received them as the sixth tribe of their confederacy, henceforth known as the 'Six Nations.' A part of the tribe which had remained friendly during the struggle was settled upon a small reservation on the Lower Roanoke River in North Carolina. Here they lingered for a time, until, weary of the attacks of hostile tribes and the constant encroachments of the whites, they also gradually withdrew to the north. Like the other tribes of the Iroquois confederacy, they were divided in the Revolutionary War, a part joining the English, while the rest adhered to the American side, with the result that they are now about equally divided between New York and Canada. Those in the United States number about 370 on a small reservation near Niagara Falls, and are civilized and fairly prosperous farmers, nearly all Christianized, although retaining their own language and chief system. About as many more are with the other Iroquois on Grand River Reservation, Ontario.

TUSCULAN DISPUTATIONS (Lat. *Tusculanæ Disputationes*). A philosophical work in five books by Cicero (B.C. 44), dedicated to M. Brutus. The conversations are supposed to be held at Cicero's estate at Tusculum. Each book discusses a different question of philosophy and treats of the troubles attending human happiness and their cure.

TUS'CULUM. An ancient city of Latium, about fifteen miles south of Rome, situated on a ridge of hills known as the *Colles Tusculani*, and forming part of the Alban range. Mythically, it derived its origin from Telegonus and Circe; but we catch the first certain glimpse of its historical existence toward the close of the regal period at Rome, when it had attained a high degree of prosperity and power. Octavius Mamilius, ruler of Tusculum, and the foremost prince in Latium, married a daughter of Tarquin the Proud (see TARQUINIUS), and played a conspicuous part in the last of the great struggles made by the banished tyrant to regain his kingdom. As early as B.C. 378 the inhabitants of Tusculum received the Roman franchise. Toward the close of the Republic Tusculum became a famous country residence of the wealthy Romans. Long after the Western Empire had fallen Tusculum continued to flourish. As late as the twelfth century the ancient city continued entire; but in 1191 it was stormed by the Romans and razed to the ground. Many fine remains of ancient Tusculum have been dug up in recent times, the most remarkable, perhaps, being the amphitheatre, theatre, and city walls.

TUSKEGEE (tŭs-kē'gê) **NORMAL AND INDUSTRIAL INSTITUTE.** An institution for the training of young colored men and women at Tuskegee, Ala., established in 1881 by an act of the Legislature under the name of the Tuskegee State Normal School, with an appropriation of $2000. It was opened July 4, 1881. In 1883 the appropriation was increased to $3000 and in 1893 the institution was incorporated under its present name. In 1903 the attendance had grown to 1497, while nearly the same number of applicants were refused for lack of accommodations. At the same time 112 instructors were engaged in the various departments. The library contained 13,000 volumes. The endowment was $1,010,000, including a gift of $600,000 from Mr. Andrew Carnegie, and the total value of the school property, including 62 buildings, land and plant worth $625,000, was $1,635,000. The property immediately belonging to the school consisted, in addition to the buildings, of 2631 acres of land, 1100 head of live stock, and more than 60 vehicles of various kinds.

The object of the institute is to furnish its students, thorough moral, literary, and industrial training, an education fitting them to become the real leaders among the people of their race, and thus to bring about healthier moral and material conditions. The institute also aims, through the Phelps Hall Bible Training School, to fit young men and women for the ministry and other forms of Christian work. Its constant purpose is so to correlate the literary and industrial training that the students may not get the one without the other. Students are admitted on passing an examination in reading, writing, and the fundamental operations of arithmetic. Instruction is given in two sessions. The day school is intended for students able to pay all or the greater part of their expenses in cash. They attend school in the daytime four days each week, and are required to work only six days a month. The night school is designed for students too poor to pay even the small charge made in the day school. Tuition is free. The monthly charge for board and living expenses is $8, of which day-school students may work out from $1.50 to $3 a month, while pupils of the night school are allowed to work out at least all of their board for the first six months. In all cases the labor of the students must be satisfactory in order to be accepted as part payment, and no student is paid more than $12 per month in excess of his board, while no part of the wages is paid in cash.

The discipline is strict, particularly in questions of morals. The studies of the academic department are closely associated with practical work in the field and shops. The department of mechanical industries includes mainly industries for young men. Instruction and practice are given in architectural and mechanical drawing, steam and electrical engineering, blacksmithing, brickmaking, carpentry, canning, founding, harness-making, carriage-trimming, machinery, painting, printing, saw-milling, shoemaking, tinsmithing, tailoring, and wheelwrighting. The industries for girls include sewing, dressmaking, millinery, cooking, laundering, domestic service, mattress-making, basketry, and nursing. So far as possible the product of the students' work is used in the institute and the surplus is sold. Each department is provided with a good equipment for practical work. The printing office, supplied with all needful apparatus, furnishes all the printed matter of the school, and issues a weekly and a monthly newspaper for the institution, beside three others for outside. Many of the school buildings, including the new Carnegie Library, are the product of student labor. In the agricultural department young men are trained to become intelligent and successful farmers by theoretical instruction in scientific principles, and their application in the field, orchard, dairy, and truck garden. To some of the agricultural courses women are admitted. Extension work is carried on through the Tuskegee Annual Conference, for the benefit of farmers of the South, and through the Russell Plantation work, under the direction of Mr. Booker T. Washington (q.v.), who has been the principal of the institute since its foundation.

TUSK-SHELL, or TOOTH-SHELL. A scaphopod mollusk of the genus Dentalium, common in the ocean on muddy bottoms at the depth of from ten to forty fathoms, as well as in very deep water. The shell is shaped like a gently curved elephant's tusk and is open at each end. The animal has no head, eyes, or heart, though it has a small elongated digging foot. Its genus first appears in the Eocene rocks. These shells were formerly extensively used by the Northwest Coast Indians as material for making necklaces and adorning clothing, and were circulated as a shell money (q.v.), called 'hi-qua.'

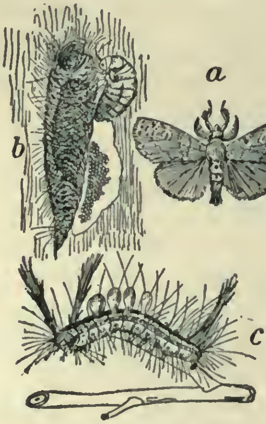
TUSSAUD, tụ'sō', MADAME MARIE (GRESHOLTZ) (1760-1850). Founder of the London waxworks exhibit on Marylebone Road. She was born at Bern, and learned at Paris the art of wax-modeling, in which she subsequently instructed Madame Elisabeth, sister of King Louis XVI. After a three months' imprisonment during the French Revolution, she brought to London her collection, afterwards increased to include about 300 figures. There is connected with it a "Chamber of Horrors," with relics of criminals and a collection of instruments of torture. Consult Hervé, *Memoirs of Madame Tussaud* (London, 1878), which, however, is not altogether reliable.

TUSSEH, or TUSSER. See SILKWORM.

TUS'SER, THOMAS (c.1524-80). An English rhymer, said by himself to be of gentle birth. He was born at Rivenhall, near Witham, in Essex. He was educated at Eton and at Cambridge. For ten years he was a musician in the service of Lord Paget of Beaudesert, and thus lived at Court. He then settled for a time as farmer in Suffolk, and thereafter moved about from place to place, eventually dying in a debtor's prison at London. He is remembered for *Five Hundreth Poyntes of Good Husbandry united to as many of Good Huswifery*, a homely proverbial poem, to which is prefixed an autobiography in verse (1573). Based upon earlier issues, beginning with a *Hundreth Good Pointes of Husbandrie* (1557) and a *Hundreth Poyntes of Good Husserie* (licensed 1557), this poem went through several editions. Consult the reprints, ed. by W. Payne and S. J. Herrtage for the English Dialect Society (London, 1878).

TUS'SILA'GO (Lat., coltsfoot). A genus of plants of the natural order Compositæ. *Tussilago Farfara*, sometimes called coltsfoot, is the only species. It has solitary flower-heads on scaly scapes, appearing before the leaves in early spring. Both disk and ray flowers are yellow, the leaves heart-shaped, angular, downy beneath, somewhat glutinous and subacrid. The leaves of the butter bur (*Petasites officinalis*), which has been naturalized from Europe, resemble those of Tussilago, but are much larger; the pale flesh-colored flowers also appear before the leaves, but are in a dense thyrsus. The flowers of both are much sought after by bees.

TUSSOCK-MOTH. Any moth of the family Liparidæ, a name suggested by the tufts of hairs, often bright-colored, upon the caterpillars. The moths are dull-colored and the females of some species are wingless. Twenty species occur in the United States. The group includes some famous enemies of fruit, shade, and forest trees. Two imported species, the gypsy moth (q.v.) and the browntail moth (*Euproctis chrysorrhœa*), do great damage in New England. The latter species flies during midsummer, when the female lays from 200 to 300 eggs underneath leaves near the tips of branches and covers them with hair. .The larvæ appear in from two to three weeks, and skeletonize the leaves. They also feed on apple and pear fruits. In late September they retire into cases formed of leaves, attached to the twigs by silken threads, and remain there until the leaf-buds open in the spring, feeding upon the young foliage, flowers, and fruit until June, when they pupate. The caterpillars when abundant are annoying to human beings from the mechanical irritation to the skin caused by their barbed hairs.



TUSSOCK-MOTH.

a, Adult male of *Hemerocampa leucostigma*; *b*, cocoon fastened to the wall, and wingless female carrying egg-sac; *c*, caterpillar.

The white-marked tussock-moth (*Hemerocampa leucostigma*) is a well-known enemy of shade and fruit trees in the Eastern United States. The female is wingless, the male small and inconspicuous. The overwintering eggs are laid in a glistening white frothy mass, attached to the outside of the female's cocoon, which is usually placed on a tree trunk. The young caterpillars hatch in the spring and feed upon the leaves. There are two or three generations each year. Winter pruning and burning of the hibernacula of the former species, and summer spraying the larvæ of the latter with arsenites, have been recommended. Consult Holland, *The Moth Book* (New York, 1903).

TUTELO, tōō-tā′lô, or **TOTERO**. An eastern tribe of Siouan stock, calling themselves Yesañ, formerly living on the Upper Roanoke and Dan rivers, in Virginia and North Carolina, in close alliance with the cognate Saponi (q.v.). They were first visited in 1670 by the German traveler John Lederer, who calls them Nahyssan. They were already well acquainted with the Virginia traders, but had then been for ten years at war with the whites. They were visited again the next year by an exploring expedition under Thomas Batts. We hear little of them after this until 1701, when Lawson found them in what is now central North Carolina, preparing to move to the settlements for protection against the Iroquois, who had driven them from their former villages on the Roanoke. They were then so much reduced in number as to be unable any longer to make defense against their enemies. The refugee tribes were soon afterwards settled by Governor Spotswood of Virginia near Fort Christanna, in what is now Brunswick County, Va., where they remained until about 1740, when, peace having at last been made with the Iroquois, they removed to the north, together with the Saponi, and settled on the Susquehanna at Shamokin, now Sunbury, Pa. Later they were adopted by the Cayuga, thus becoming a component part of the Iroquois League. Their village near Cayuga Lake being destroyed by Sullivan in 1779, they fled with the Cayuga to Canada and found their final home with the Iroquois on the Grand River Reservation, in Ontario, locating on Tutelo Heights, near Brantford. Successsive visitations of cholera in 1832 and 1848 exterminated the remnant, and in 1870 there survived but one fullblood.

TUT′ICOR′IN. A seaport in the District of Tinnevelli, Madras, India, 443 miles by rail south by west of the city of Madras, on the Gulf of Manar (Map: India, C 7). The manufacturing establishments are chiefly connected with the cotton industry. Pearl-fishing, formerly the principal industry, has greatly declined in importance. Population, in 1901, 28,048.

TUT′TIETT, M. G. An English novelist, better known under her pen-name, Maxwell Gray (q.v.).

TUTTLE, tŭt′'l, HERBERT (1846-94). An American historian, born at Bennington, Vt. He graduated in 1869 at the University of Vermont, and for some time was a journalist in Boston, Paris, and Berlin. From 1880 to 1881 he was a lecturer on international law at the University of Michigan, and in the latter year was appointed to the chair of politics and international law in Cornell University. He was subsequently transferred to the chair of modern European history, which he held until his death. He published: *German Political Leaders* (1876); *History of Prussia to the Accession of Frederick the Great* (1884); and a *History of Prussia Under Frederick the Great* (1888). There is a biographical sketch by Prof. H. B. Adams in the fourth volume of the *History of Prussia.*

TUTTLINGEN, tōōt′lĭng-*e*n. A town of the Kingdom of Württemberg, Germany, on the right bank of the Danube, 64 miles southeast of Strassburg (Map: Germany, C 4). It has shoe factories, tanneries, and manufactures of surgical instruments, cutlery, leather, and woolen goods. Population, in 1900, 13,465. Tuttlingen is historically notable as the scene of a battle in 1643, during the Thirty Years' War, in which an Austro-Bavarian force, under Hatzfeld and Mercy, defeated the French.

TUTUILA, tōō′tōō-ē′lȧ. An island of the Samoan group belonging to the United States, and situated 46 miles southeast of Upolu (Map: Guam, D 3). Area, 54 square miles. Its surface is mountainous and picturesque with luxuriant forests and there are numerous signs of volcanic activity. Tutuila contains the best harbor of the Samoan group, Pago Pago (q.v.) or Pango Pango. The exports from the island in 1901, consisting chiefly of copra, amounted to $22,308, while the imports were valued at $82,165. The population is estimated at 3800, chiefly Samoans. Tutuila, together with the Manua group and a few other islands belonging to the United States, is administered by a naval Governor. The chief town is Leone, on the southern coast. See SAMOA.

TUXTLA GUTIERREZ, to͞os′tlȧ go͞o′tê-ȧr′rȧs. The capital of the State of Chiapas, Mexico, 270 miles southeast of Vera Cruz (Map: Mexico, M 9). The principal building is the Government palace. The main industries are tanning, indigo preparations, and general commerce. Population of the municipality, in 1895, 10,982.

TÚY, to͞o′ē. A Spanish frontier town of the Province of Pontevedra, in Galicia, on the right bank of the Miño, 63 miles north of Oporto, Portugal (Map: Spain, A 1). The cathedral is a fortress-like structure. The international iron bridge spanning the Miño is worthy of note. The town is in the midst of the fertile Vega del Oro, celebrated for the culture of fruits, vegetables, and silks. Tanneries and soap factories, with a brisk trade with Portugal, form the chief industries of the town. The population of the ayuntamiento in 1900 was 11,631.

TUY. A town of Luzon, Philippines, in the western part of the Province of Batangas. It lies about 24 miles northwest of Batangas (Map: Luzon, D 11). Population, 10,150.

TVASHTAR, tväsh′tȧr (Skt. *tvaṣṭṛ*, creator, from *tvakṣ*, *takṣ*, to fashion; connected with Av. *θwaxš*, to create, Gk. τέκτων, *tektōn*, carpenter, τίκτειν, *tiktein*, to beget, Lat. *texere*, to weave, OChurch Slav. *tesla*, OHG. *dehsala*, axe). A divinity of Vedic Hindu mythology. He is especially the divine artificer, and among his chief works are the thunderbolt of Indra (q.v.) and a cup for the beverage of the gods. Similarly he is the deity who fashions all living forms, both of men and of animals, so that in later texts he is said to have produced the whole world, and he was the ancestor of all mankind. He is also a creator of gods, particularly of Brihaspati (q.v.), Agni (q.v.), and, probably, Indra, although this god caused his sire to tremble. The mythological basis of Tvashtar is very doubtful. Of the numerous explanations proposed, that which makes him the creative aspect of the sun, with the moon as his cup, is perhaps the most plausible. Consult Macdonell, *Vedic Mythology* (Strassburg, 1897).

TVER, tvĕr. A government of Central Russia. Area, about 25,000 square miles (Map: Russia, E 3). The surface is largely an elevated plain intersected by deep river valleys. The northwestern part is hilly. The government is watered chiefly by the Upper Volga with its tributaries and the Dvina. The soil is not fertile and the supply of grain is insufficient to meet the domestic demand. The household industry is well developed, entire sections of the government being engaged in the production of footwear, felt goods, linen, nails, axes, agricultural implements, etc. The local manufactures in 1898 yielded an output of $16,000,000, chiefly cotton goods, flour, leather, spirits, etc. Population, in 1897, 1,812,825.

TVER. The capital of the Government of Tver, situated on the Volga, 298 miles southeast of Saint Petersburg (Map: Russia, E. 3). It has a thirteenth-century monastery and an Imperial palace occupied by the Governor. Tver is one of the chief cotton-manufacturing centres of Russia. There are also flour mills, wagon factories, saw mills, etc. Population, in 1897, 53,477. Tver dates from 1180 and was the capital of an independent principality from the thirteenth century to the end of the fifteenth, when it was annexed to Moscow.

TWACHTMAN, JOHN HENRY (1853-1902). An American landscape painter, born in Cincinnati, Ohio. He was a pupil at the Cincinnati School of Design, and of Frank Duveneck, and studied in Munich under Löffts, and with Boulanger and Lefebvre in Paris. He has been considered one of the most consistent of American impressionists. Some of his later landscapes show many subtle effects of light, and sensitive gradations of tone. In delicate elusive color schemes he is more successful than in pretentious paintings, such as the Niagara and Yellowstone Park series. His sketches in pastel, such as "Wild Flowers," "Meadow Flowers," and "The Old Gate," are among the most personal and delightful of his productions. His other works include: "Snow Storm;" "Melting Snow;" "Hemlocks;" "The Poplars;" "Willows and Golden Rod;" "Inner Harbor, Gloucester;" and "Drying Sails."

TWAIN, MARK. See CLEMENS, SAMUEL L.

TWAITE. A poor sort of European shad (*Clupea finta*). See ALLICE.

TWEED. A river of southern Scotland. It rises 15 miles southwest of Edinburgh and flows in a generally eastward direction, emptying into the North Sea at Berwick (Map: Scotland, F 4). It is 97 miles long, but unnavigable. For 18 miles of its lower course it forms the boundary between England and Scotland, and it flows through one of the most historic regions of Great Britain, the celebrated 'Borders.'

TWEED. A twilled woolen fabric (see WEAVING), often woven in two colors, the yarn being dyed before weaving. It is a soft, flexible, durable material, unmixed with shoddy or cotton. Its name is derived from the locality where it was first manufactured—in villages along the Tweed, in Scotland.

TWEED, WILLIAM MARCY (1823-78). A notorious American politician, leader of the so-called 'Tweed Ring,' born in New York City. He was the son of a chair-maker, was prepared for the same occupation, receiving slight education, and early entered politics, becoming an alderman of New York City, and taking a seat in Congress in 1853. Subsequently he was a School Commissioner; became a member of the Board of Supervisors of New York County, and was president of the board for four successive terms. From 1867 to 1871 he was a State Senator. A member of the Tammany Society for many years, he was grand sachem in 1869-71. He was appointed Deputy Street Commissioner in 1861, and when in 1870 that department was changed to the Department of Public Works, he was the Commissioner at its head, a position which enabled him to initiate, as is generally believed, the formation of the combination known as the 'Tammany Ring,' or the 'Tweed Ring.' The 'ring,' having placated the Mozart Hall faction of Fernando Wood (q.v.), elected its candidate for Mayor in 1865, and its candidate for Governor in 1868, and so controlled the Legislature as to secure such a modification of the city's charter as greatly to increase the power of the offices held by the 'ring.' Legislators and judges were bribed, and bills were passed and decisions rendered in favor of the members of the 'ring.' Gigantic schemes of city improvement were organized and carried out successfully, though accompanied generally with much peculation. Fraudulent bills were audited, and their sum divided among the thieves. Probably no other such complete plan of public spoliation was ever devised and executed in any country. The exposure of this vast system of peculation was made largely by the New York *Times*, through the intervention of a disappointed enemy of the 'ring,' in July, 1871; a vigorous investigation and prosecution was undertaken by a committee of seventy citizens, under the lead of Samuel J. Tilden (q.v.); and Tweed was indicted in 1872 for forgery and grand larceny. Two trials were held, and in 1873 Tweed was convicted, and sentenced to twelve years' confinement in the penitentiary, and to pay a fine of $12,300.18. He was confined on Blackwell's Island from November, 1873, until June, 1875, when he was released by a decision of the Court of Appeals, on a legal technicality. He was immediately rearrested on a warrant issued in a civil suit for $6,198,957.85, and sent to Ludlow Street Jail. Being permitted to go out to drive with an officer, he made his escape, and fled to Spain. He was returned in November, 1876, and again incarcerated in Ludlow Street Jail until April 12, 1878, when he died. Much material relative to Tweed is to be found in Myers's *History of Tammany Hall* (New York), and in Breen's *Thirty Years of New York Politics* (ib., 1899). See also chapter 88 of James Bryce, *The American Commonwealth* (ib., 1889), on "The Tweed Ring," by F. J. Goodnow.

TWEED′DALE, John Hay, Marquis of (1626-97). A Scotch soldier and statesman, second Earl of Tweeddale (1654). After serving in the King's army (1642) he fought against Charles, at Marston Moor (1644), and, four years later, commanded at Preston in the King's army again. He was sent to Parliament in 1654; became Privy Councilor on the Restoration and president of the Council in 1663; and in the next year was appointed High Commissioner on Ecclesiastical Affairs. In this post he labored for a more lenient attitude toward Covenanters; and from it he was removed in 1674, by the influence of Lauderdale. He was restored to some of his old posts in 1680 and 1682; held office under James II., but, disliking his Scotch policy, joined the Revolution; and, in 1689, became Privy Councilor under William and Mary. He was a commissioner on the Glencoe massacre and was dismissed by the King in 1696 for assenting to the Colonization Act and Paterson's schemes in Darien.

TWEEDLEDUM AND TWEEDLEDEE. An expression denoting an inappreciable difference between unimportant points. The phrase was used by Byron in a satire on the feud between the partisans of Handel and Buononcini.

TWEEDMOUTH, twēd′mŭth, Edward Marjoribanks, second Baron (1849—). An English statesman, born in London. He was educated at Harrow and Oxford, became a barrister in 1874, and was a Liberal member of Parliament for Berwick in 1880-94. In 1886 he was made Comptroller to the Household, and in 1892-94 he was Parliamentary Secretary to the Treasury and chief Liberal whip. In 1894-95 he was Lord Privy Seal and Chancellor of the Duchy of Lancaster.

TWELFTH NIGHT, or What You Will. A comedy by Shakespeare, played at Middle Temple Hall, Twelfth Night, 1602, according to J. Manningham's diary. The principal plot was taken from Bandello's tale, perhaps through Belleforest's *Histoires Tragiques*, or B. Rich's *Apollonius and Silla*, adapted from Ciuttico's *Hecatommithi*. A similar plot is found in two Italian plays, *Gl'Ingannati* (1537), and *Gl'Inganni* (1592). The comic parts, Malvolio, Sir Toby, Sir Andrew, and the clown, are all Shakespeare's.

TWELVE, Gospel of the. See Apocrypha.

TWELVE TABLES, Law of the. The earlier systematic written statement, or code, of Roman law. According to the Roman tradition, this code was drawn up to appease the plebeians, who complained that the unwritten customary law, as interpreted by patrician priests and applied by patrician judges, gave no adequate protection to their liberties. In B.C. 452 ten magistrates were elected "to write laws" (*decemviri legibus scribendis*), and before the end of the following year ten tables of laws were submitted to and accepted by the popular assembly. In B.C. 450 two supplementary tables were similarly adopted. The decemvirs claimed that they had made the law equal for all, high and low; and there is no doubt that the Roman people regarded the XII. Tables with great veneration, as a bulwark of personal liberty.

This code seems to have introduced little if any new law, being substantially a re-statement of the older custom. Its rules were simple, and were tersely and clearly expressed. It contained no constitutional law, and it dealt mainly with the law of family, property, crimes, torts, and civil procedure. It did not state the law fully even in these matters, for (as in other early codes) rules that were so well settled as to be indisputable were not included.

The XII. Tables have come down to us in fragments only. In Roman legal, historical, and grammatical writings, a couple of score of passages are directly cited, and it is sometimes stated in which of the tables the rule stood. Other rules are paraphrased or indicated by allusions. Attempts to reconstruct the code have been made by Gothofredus (1616), Dirksen (1824), Schoell (1866), and Voigt (1883). The text commonly given in works on Roman law is that of Schoell, and citations of table and law by number are regularly based on his reconstruction.

The credibility of the Roman tradition concerning the origin of the XII. Tables has been energetically attacked by recent writers, who assert that the tradition is of late origin and that the XII. Tables are a private compilation made, probably, in the third century B.C.

Consult: Voigt, *Geschichte und System des Rechts der XII. Tafeln* (Leipzig, 1883). Appleton, *Le testament Romain et l'authenticité des XII. Tables* (Paris, 1903); Lambert, *L'Histoire traditionelle des XII. Tables* (Lyons, 1903). See CIVIL LAW.

TWES′TEN, AUGUST DETLEV CHRISTIAN (1789-1876). A German Protestant theologian. He was born at Glückstadt, studied at Kiel and Berlin, and became professor of theology at Kiel, 1814. In 1835 he succeeded Schleiermacher, whose views he had adopted at Berlin. He was a member of the new supreme ecclesiastical council of the United Evangelical Church until his death. He published *Vorlesungen über die Dogmatik der evangelisch-lutherischen Kirche* (1826-37); *Grundriss der analytischen Logik* (1834); *Matthias Flacius Illyricus* (1844); and edited Schleiermacher's *Ethik* (1841). Consult Heinrici, *August Twesten nach Tagebüchern und Briefen* (Berlin, 1889), and *Life* by G. Heinrici (ib., 1889).

TWICH′ELL, JOSEPH HOPKINS (1838—). An American Congregational clergyman, born in Southington, Conn. He gradated at Yale in 1859, was chaplain of the 71st Regiment, New York State Volunteers, during the Civil War, and in 1865 became pastor of the Asylum Hill Congregational Church, at Hartford, Conn. His writings include *John Winthrop* (1891) and *Some Old Puritan Love Letters* (1893).

TWICK′ENHAM. A town in Middlesex, England, on the Thames, connected with Richmond, on the opposite bank, by a substantial bridge, 10 miles southwest of Saint Paul's, London (Map: London, F 4). It has interesting historic dwellings, and is a favorite holiday resort of Londoners. It contains the great Church of Saint Stephen's, completed in 1874; the estate of Alexander Pope, where the grotto is all that remains (Pope's monument is in the church); Walpole's villa, called Strawberry hill; and the Orleans villa, temporarily occupied by Louis Philippe, and still owned by his descendants. Population, in 1891, 16,000; in 1901, 21,000. Consult Cobbett, *Memorials of Twickenham* (London, 1872).

TWIG-GIRDLER. See GIRDLER.

TWIGGS, DAVID EMMANUEL (1790-1862). An American soldier. He was born in Richmond County, Ga., and was the son of General John Twiggs, a soldier in the Revolution. In March, 1812, he was appointed captain in the Eighth Infantry. He served in the War of 1812, and was promoted major in September, 1814. He later fought against the Seminole Indians, and then in the Black Hawk War, and was commissioned colonel of the Second Dragoons in June, 1836. For services at Palo Alto and Resaca de la Palma, where he commanded the right wing of General Taylor's army, he was brevetted brigadier-general. In the attack on Monterey he commanded a division; was brevetted a major-general; and after a short term as Governor of Monterey was sent to join General Scott at Vera Cruz. In the advance on the City of Mexico he commanded the Second Division; led the main attack at Cerro Gordo; and performed important services at Contreras and Churubusco, and in the attack on the gates of Mexico. After the war ended he was for some years in charge of the Department of the West, and then of that of Texas. On the outbreak of the Civil War he surrendered, without resistance, the United States property under his charge to the Confederates, and in the North was generally regarded as a traitor. He was made a major-general in the Confederate service, and for a time commanded in Louisiana, but age and infirmities led him to resign from the service near the close of 1861.

TWIG-PRUNER. Any of several species of longicorn beetles of the genus Elaphidion, the females of which lay their eggs in the twigs of several kinds of trees. The eggs hatch and the larva when nearly full-grown severs the twig in which it is working, transforming to pupa within the twig after it has fallen to the ground. The common oak-pruner (*Elaphidion villosum*) is a rather slender long-horned beetle, dark brown in color, and covered with grayish pubescence. It feeds in the twigs of oak, hickory, chestnut, maple, apple, plum, peach, and other trees. The purpose of the amputation of the twig by the larva seems not primarily to be for the purpose of making the twig fall, but to penetrate through the wood to the bark in order that the beetle may have an easy exit. *Elaphidion subpubescens* works in the same way in the shoots of white oak, while *Elaphidion mucronatum* is found in the twigs of live oak and other trees. The larva of *Elaphidion unicolor* amputates the twigs of the redbud (*Cercis Canadensis*). A few other insects have somewhat similar habits. For example, certain horn-tails, notably the willow-shoot horn-tail (*Phyllœcus integer*), live, in the larval stage, in twigs of willow, which they cause to wilt, and easily to break from the branch.

TWILIGHT (from *twi-*, combining-form of *two* + *light*). A phenomenon caused by atmospheric refraction. (See REFRACTION.) When the sun sets below our horizon, we are not immediately plunged into the darkness of night. There is an intermediate period of partial and slowly increasing darkness which we call twilight. The cause is a simple one. Although the sun is below our horizon, rays of solar light are bent or 'refracted' by the terrestrial atmosphere, and continue to furnish some slight illumination. The process continues, with diminishing intensity, until the sun is so far below the horizon that the refracting power of the atmosphere is no longer able to bend the rays enough to produce a visible effect. This occurs when the sun is 18° below the horizon; and the time after sunset when the sun reaches such a position varies with the latitude of the place, and with the time of year.

TWIL′LINGATE or **TOULINGUET,** tōō′lăɴ′gā′. A port of entry on the Twillingate Islands in Notre Dame Bay, on the northeast coast of Newfoundland, 232 miles by steamer from Saint Johns (Map: Newfoundland, F 3). It is a prosperous fishing centre. Population, in 1891, 3585; in 1901, 3542.

TWIN-FLOWER. A hardy, trailing evergreen plant of the natural order Caprifoliaceæ. It is a favorite in rockeries on account of its dainty, bell-shaped, nodding, pink or white, fragrant flowers, which appear during midsummer in pairs upon erect, slender stems. It thrives best in open, peaty soil and in shade. In the woods it may be found as far south as Maryland and the mountains of California, but is more common northward.

TWIN FLOWER (*Linnæa borealis*).

TWI'NING, KINSLEY (1832—). An American clergyman and editor, born at West Point, N. Y. He graduated at Yale in 1853, at Yale Theological Seminary in 1856, was a resident licentiate at the Andover Theological Seminary in 1857, and from 1857 to 1876 occupied various Congregational pulpits. In 1880-98 he was literary editor of the New York *Independent,* and in 1898 became literary editor there of the *Evangelist.* He was a founder of the Reform Club of New York City.

TWINING PLANTS. Plants whose axes are coiled about slender supports, e.g. common morning-glory and hop. In most cases the support must be slender (less than 15 centimeters in diameter), though some tropical plants coil about thick tree trunks, and others climb in a somewhat similar fashion by partial twining. (See LIANAS.) The direction of twining varies with different plants, being either clockwise or counter-clockwise. While the direction of twining is usually constant in the same species, some twiners coil in either direction. The direction is not constant, however, among members of the same family, nor even among different species of the same genus.

The cause of twining has long been a problem of great difficulty. The most satisfactory explanation seems to be the following: Twining stems are endowed with a sensitiveness to the action of gravity, which may be distinguished as lateral geotropism (q.v.). The stem at first grows erect (on account of negative geotropism), but through unequal growth, causing nutation (q.v.), soon inclines to one side. At this period of its development, the flanks (i.e. the sides of the stem now on the right and left as distinguished from the upper and lower) are sensitive to their changed relation to gravity (on account of the new horizontal position), which thus becomes a stimulus. The response of the stem to this stimulus is an accelerated growth on one flank, the right or left, as the case may be. The acceleration of growth there swings the horizontal tip toward a new point of the compass, and at the same time, from mechanical necessity, partially rotates the stem on its longitudinal axis, so that a new side is brought into the flank position and therefore under stimulation. It then responds likewise with accelerated growth; this swings the tip still farther around, and again brings a new region under stimulation. By this continued action each side of the stem is successively stimulated, and the tip is therefore swung in a circle. At the same time it is elongating. If, in the course of its twining, the nearly horizontal tip strikes a support, only the part beyond the support continues to swing, and therefore begins to wrap around the support, forming coils which are at first low and loose. At a later period negative geotropism again asserts itself in this part of the stem, which grows so that it straightens, if possible, the actual effect being to steepen the coils and make them hug the support more closely. The slenderer the support, as a rule, the steeper are the completed coils. This explanation receives its strongest support from the fact that when the action of gravity is equalized, as it can be by rotating a seedling twiner on a clinostat (q.v.), no coiling takes place. There are various phenomena of twining, experimentally induced, of which no full explanation can yet be given. There is, however, no mere mechanical stoppage of the swinging tip which permits coiling, because it has no momentum, and because many twiners will coil about a loose cord. It is further probable that twiners are susceptible to the continued contact and pressure of the support, and that this plays some part in the method of climbing which they have adopted.

Twining plants are characterized by unusually long growing regions, and by the retarded development of foliage leaves. Thus, while in erect stems from 10 to 20 centimeters (4 to 8 inches) of the apex are still capable of elongation, in twining plants the elongating region is 30 to 50 centimeters (12-20 inches) long, or in some cases as much as 80 centimeters (32 inches). The slow development of the foliage leaves seems both to be correlated with this long maintenance of the power of growth, and to be necessary for twining, because the presence of fully developed foliage would interfere seriously with the free movements of the tip.

TWISS, Sir TRAVERS (1809-97). An English jurist and scholar. He was born in Marylebone, London, graduated from University College, Oxford, with distinction, and published in 1836 his *Epitome of Niebuhr's History of Rome.* In 1840 he was called to the bar. From 1842 to 1847 he was professor of political economy at Oxford, from 1852 to 1855 professor of international law at King's College, London, and from 1855 to 1870 held the regius professorship of civil law at Oxford. He also held several ecclesiastico-legal positions, and in 1858 became chancellor of the diocese of London, the same year having been created

Queen's counsel. In 1867 he was appointed Queen's Advocate-General and was knighted. Owing to a scandalous libel of which he and his wife were the victims, in 1872 he retired to private life and devoted himself to juridical science and literature. In 1884 he drafted for the King of Belgium a constitution for the Congo Free State, and in 1884-85 was counsel extraordinary to the British embassy during the Congress of Berlin. His chief works are: *View of the Progress of Political Economy in Europe Since the Sixteenth Century* (London, 1847); *The Oregon Territory; Its History and Discovery* (New York, 1846); but his fame rests principally on his treatise, *The Law of Nations* (1861-63), which, in the French edition, *Le droit des gens ou des nations* (Paris, 1887-89), is a standard work.

TWITCH'ER, Jemmy. A highwayman in Gay's *Beggar's Opera*, noted for treachery. This name became the popular nickname for Lord Sandwich, who turned against his former companion, John Wilkes.

TWITTER. A peculiar deformation of carnation plants, produced possibly by several kinds of insects: a plant-louse or green fly of the genus Siphonophora, a true thrips, and possibly the larva of some anthomyiid fly. The chances are that carnation twitter can be produced by any cause which checks the growth of the plant; hence any one of several insects may be involved.

TWO GENTLEMEN OF VERO'NA, The. A comedy by Shakespeare, probably produced in the original form in 1591, and in the present form in 1595; first printed in the folio of 1623. It may have been adapted from the lost play *Felix and Philomena*, acted in 1584, though the same story is told of the shepherdess Filismena in Montemayor's Spanish romance *Diana*, translated by B. Young and known in manuscript in 1583, and is also found in Rich's version of Bandello's *Apollonius and Silla*.

TWO NOBLE KINSMEN. A play produced in 1625 and published in 1634 as the work of Fletcher and Shakespeare. The latter's part, if any, was unimportant, and it was probably written by Massinger and Fletcher with Rowley. The story is that of Chaucer's *Knight's Tale*, taken from Boccaccio's *Teseide*.

TWO-SEED-IN-THE-SPIRIT BAPTISTS. See Baptists.

TWO SICILIES, Kingdom of the. The name commonly given to a former kingdom embracing Sicily and Southern Italy, and known often as the Kingdom of Naples. In the Middle Ages the southern part of the Italian mainland came to be known as 'Sicily on this side of the Faro' (the Strait of Messina). From the earliest times both the island and the mainland were subject to settlement and conquest by peoples of widely different stock, producing a complicated admixture of races. At the dawn of history the Phœnicians had trading settlements there. In the eighth century B.C. numerous Greek colonies were founded in both Sicily and Southern Italy and became powerful and wealthy States. A new Phœnician element was introduced when Carthage disputed the supremacy of Sicily with the Greeks. The Roman conquest followed. In the middle of the fifth century, at the time of the fall of the Roman Empire, Sicily was ravaged by the Vandals. Toward the close of the century the Ostrogoths made themselves masters of Italy and Sicily. In the sixth century their realm was conquered by the Byzantines. Soon after the Lombards established their sway over part of Southern Italy. The Lombard Duchy of Benevento was founded, out of which in the ninth century arose the three principalities of Benevento, Salerno, and Capua. By the side of these was the Duchy of Naples, a Byzantine creation. Apulia and Calabria were held by the Byzantines until the eleventh century. In the years from 827 to 878 the island of Sicily was conquered by the Saracens. Owing to dissensions among the Christians of Southern Italy, the Saracens likewise obtained a foothold on the mainland.

About 1037 the sons of a Norman knight, Tancred de Hauteville, setting out with a few followers to win their fortunes, entered Southern Italy in the service of the Byzantine Governor, but soon seized and divided Apulia and were able to hold the country against every effort of the Greeks to dislodge them. Robert Guiscard, one of these brothers, became Count of Apulia in 1057, and in 1059 he was recognized by Pope Nicholas II. as Duke of Apulia and Calabria. In 1061 his younger brother, Roger, with a few hundred Norman knights, began the conquest of the island of Sicily, which was made a county and a fief of Robert's duchy, though the total subjugation of the island was not accomplished till 1090, after Robert's death. In 1127 Roger II., son of the first Roger, united Apulia, Calabria, and Sicily, and in 1130 he assumed the title of King of Sicily. He extended his sway over the Abruzzi, made himself master of Capua, and received the submission of Naples. The marriage of Frederick Barbarossa's son, the later Emperor Henry VI., to Constance, heiress of the Two Sicilies, in 1186, united the destinies of the Norman kingdom with those of the House of Hohenstaufen, whose rule began in 1194. The child of this marriage, the Emperor Frederick II. (q.v.), was the most remarkable prince in the Europe of his day. He reorganized the government of the Sicilian kingdom on essentially modern lines, founded the University of Naples, and made his Court the brilliant centre of the highest culture and learning of his time. His death in 1250 was followed by the speedy downfall of the House of Hohenstaufen. In 1266 Charles of Anjou, brother of Louis IX. of France, at the instance of the Pope, undertook the conquest of the Two Sicilies. He vanquished Manfred, son of Frederick II., at Benevento, and in 1268 he defeated, captured, and executed Conradin, the last of the Hohenstaufen. Charles of Anjou made Naples his residence.

The year 1282 witnessed the fearful popular uprising against the French in Sicily known as the Sicilian Vespers (q.v.). The people shook off the yoke of Anjou and placed their island under the rule of Pedro III. of Aragon. The House of Anjou continued to rule in South Italy, which thus became the Kingdom of Naples. In 1296 Sicily was separated from Aragon, but continued under the rule of the Aragonese house, and in 1412 was reunited with that kingdom. Robert I. of Naples (1309-43) made himself the champion of the Guelph Party and extended his influence throughout Italy. He was succeeded by his granddaughter Joanna I. (q.v.), and an anarchic period began and continued for many years, the heirs of the elder Neapolitan line, which had also acquired the throne of Hungary, contending with new aspirants from Anjou. In 1399 the Neapolitan line triumphed in the person of the crafty and unprincipled Ladislas (q.v.). He died in 1414, leaving the kingdom to his sister, Joanna II. (q.v.). She was given up to sensuality, and the disorder was renewed. After her death in 1435 Alfonso V., King of Aragon and Sicily, undertook the conquest of Naples, of which he secured possession in 1442, reigning until his death in 1458. He left Aragon and Sicily to his eldest son, John, and Naples to his illegitimate son, Ferdinand, under whose rapacious and cruel rule new troubles arose. In 1495 Charles VIII. of France invaded Naples, and although he was compelled to withdraw in the same year, his successor, Louis XII., jointly with Ferdinand of Spain, conquered the country in 1501. Two years afterwards the Spaniards under Gonsalvo de Córdova (q.v.) drove out the French and made Naples a Spanish province.

The country was now subjected to the oppressive tyranny of Spanish viceroys. A formidable rebellion at Naples broke out in 1647 under Masaniello (q.v.). In 1707 the Neapolitan dominions were wrested from Spain by Austria during the War of the Spanish Succession. (See Succession Wars.) Naples was confirmed to Austria by the Treaty of Utrecht (1713) and Sicily was given to Savoy. In 1720 Sicily was transferred by Savoy to Austria in exchange for Sardinia. In 1734 Don Carlos, second son of Philip V. of Spain, of the House of Bourbon, and Elizabeth Farnese invaded the Two Sicilies, and in 1735 he was crowned and was recognized by the Treaty of Vienna as King Charles III. (See Charles III., King of Spain.) After the Peace of Aix-la-Chapelle (1748) Italy enjoyed nearly a half century of peace, and these years witnessed in the Two Sicilies progress along many lines, but the upheaval of the French Revolution brought new troubles upon the country. The coalition against the French Republic was joined by Ferdinand, the second Bourbon King of the Two Sicilies. (See Ferdinand I.) In December, 1798, the Neapolitans attempted to drive the French out of the Papal States. They were thrown back, Naples was taken (January, 1799), and the Parthenopean Republic was created. In the same year Ferdinand was reinstated with the assistance of the English fleet. In 1896 Napoleon conquered the Kingdom of Naples and placed his brother Joseph Bonaparte on the throne, Ferdinand continuing to reign in Sicily. In 1808 Joseph was succeeded by Joachim Murat (q.v.). After the fall of Murat in 1815 Ferdinand was restored in Naples. At the close of 1816 Ferdinand united the kingdoms of Naples and Sicily into the single kingdom of the Two Sicilies and changed his title from Ferdinand IV. to Ferdinand I.

In 1820 there was a military rising in the Neapolitan dominions, joined by the Carbonari (q.v.), under the leadership of General Pepe, to secure a constitutional government. The King yielded to the demand, notwithstanding his agreement with Austria to make no constitutional concessions. At the same time a revolutionary movement aiming at autonomy for the island took place in Sicily. The congress of the Great Powers at Laibach (1821) charged Austria with the restoration of Ferdinand's absolute power. The patriots made an ineffectual resistance and Ferdinand resumed his tyrannical sway under the protection of Austrian bayonets. Ferdinand died in 1825 and was succeeded by his son, Francis I. (q.v.), who in 1830 was succeeded by his son Ferdinand II. (q.v.). The change of rulers brought about no change in the despotic policy of the Government. After 1843 the republican propaganda of Mazzini took a strong hold in Southern Italy. At the beginning of 1848 Sicily rose in insurrection to secure an autonomous and constitutional government. Ferdinand II. saw himself forced to grant a representative constitution to his subjects. This did not satisfy the Sicilians. The deposition of King Ferdinand was declared, a provisional Government was organized, and the Duke of Genoa, son of the King of Sardinia, was elected King of the Sicilians (June, 1848), a dignity which he declined. In his Neapolitan dominions Ferdinand, with the aid of the reactionary elements, was enabled successfully to combat the revolutionary movement which was now sweeping through Italy. In September, 1848, his forces entered upon a campaign against the Sicilians. In May, 1849, Palermo capitulated and the revolution in the island came to an end. Ferdinand, once more the despot that he had been, wreaked a fearful vengeance upon the champions of liberty in his dominions. His atrocities were finally checked by the intervention of England. In 1859 Ferdinand II. was succeeded by his son, Francis II. The emancipation of Northern Italy (except Venetia) from the rule of Austria and the tyrants upheld by her (1859-60) was speedily followed by the liberation of the Two Sicilies from the Bourbons, accomplished through the efforts of Garibaldi, and by their incorporation in the new Kingdom of Italy (1860-61). See Garibaldi; Victor Emanuel II.; Italy.

Bibliography. Freeman, *The History of Sicily from the Earliest Times* (Oxford, 1891); id., *The Story of Sicily* (New York, 1892); Von Schack, *Geschichte der Normannen in Sicilien* (Stuttgart, 1889); Amari, *Storia dei Musulmani di Sicilia* (Florence, 1854-72); Colletta, *Storia del reame di Napoli dal 1734 al 1825* (Capolago, 1854); Gemelli, *Storia della rivoluzione siciliana 1848-49* (Bologna, 1868).

TYA'NA, Apollonius of. See Apollonius of Tyana.

TYBEE, tĭ-bē'. An island at the mouth of the Savannah River, Georgia. It is historically noted as the site of the batteries erected by General Gilmore in 1861 for the reduction of Fort Pulaski, which capitulated April 11, 1862. At the north end of the island stands a lighthouse of the first order, 134 feet high, lighting the Tybee Roads, from which a channel protected by jetties leads up to Savannah.

TY'BURN. The chief place of execution in London prior to 1783, and frequently mentioned in English history and literature. It was situated near the northeast corner of Hyde Park, at the western extremity of Oxford Street, and at the point where the Edgeware and Uxbridge roads unite, almost where the Marble Arch now stands. It took its name from a small stream which ran from Hampstead to the Thames through Saint James's Park, but which has long since disappeared. The gallows was a permanent erection, resting on three posts. Wooden galleries were erected near it for the accommodation of spectators. The criminal was conveyed from Newgate (q.v.) to Tyburn, a distance of about two miles, by Holborn and the Tyburn Road, now Oxford Street. As Oxford Street and London generally spread westward, the long procession became inconvenient, and the place of execution was, in 1783, removed to the Old Bailey, or Newgate. Under a Parliamentary statute prosecutors who secured a capital conviction against a criminal were exempted from all manner of parish and ward "offices within the parish in which the felony had been committed," and obtained what was called a 'Tyburn ticket,' which was enrolled with the clerk of the peace, and sold like any other property. The privileges the tickets conferred were greatly valued, as they sold at a high price.

TYCHO BRAHE, tē′kô brä′ĕ *or* brä. See Brahe.

TYCHO′NIUS (?-c.400). A Donatist writer. He was born in Africa, headed a party among the Donatists, and defended their position. Of his writings those of most interest are his biblical works, a commentary on the Revelation and especially his *Liber Regularum.* The latter has been edited by F. C. Burkitt, *The Book of Rules of Tychonius* (Cambridge, 1894), and has great interest as the first attempt at a system of hermeneutics.

TYCHSEN, tĭK′sen, Olaus Gerhard (1734-1815). A German Semitic scholar. He was born at Tondern, Schleswig, studied at Halle, and taught in the orphan asylum there. In 1759-60 he traveled through Germany and Denmark as a missionary to the Jews. In 1760 he went to the newly founded University of Bützow, where he was professor of Oriental languages from 1763 till the university was closed in 1789. He then became librarian at Rostock. Tychsen is especially noted for his knowledge of Rabbinic literature and Jewish history and for his work in Arabic paleography; he also attempted to decipher the cuneiform inscriptions. He published *Bützowische Nebenstunden* (1766-69); *Physiologus Syrus* (1795); *Historia Monetæ Arabicæ* (1797); and *Tractatus de Legalibus Arabum Ponderibus ac Mensuris* (1800), the treatise of Makrizi. For his biography, consult Hartmann (Bremen, 1818-20).

TYCOON, or **TAIKUN**, tī′ko͞on′ (Jap. *taikun*, great prince, from Chin. *ta*, great + *kiun*, prince). A title formerly applied to the Shogun of Japan by foreigners. It dates from the early days of Occidental intercourse with the Japanese people.

TYD′EUS (Lat., from Gk. Τυδεύς). In Greek mythology, son of Œneus and Peribœa. As a result of a murder he was forced to flee from his father's kingdom of Calydon and married Deipyle, daughter of Adrastus, King of Argos. He went with Adrastus against Thebes, where he slew Melanippus, who had wounded him. When Athena came to him with a remedy which would have made him immortal, Amphiarus brought him the head of Melanippus. Tydeus devoured a part of it, and the goddess, in disgust, abandoned him.

TYE, Christopher (c.1497-1572). An English organist and composer of considerable note in the sixteenth century. He became a chorister, and in 1536 a gentleman of the Chapel Royal, and attained so high a reputation that he was chosen as instructor in music to Edward VI. before his accession, and probably to the other children of Henry VIII. He received the degree of Doc. Mus. from Cambridge in 1545, while probably organist of Ely Cathedral. Under Elizabeth he was organist of the Chapel Royal, and produced many services and anthems, some of which continue to be sung in England. Some of them show a marked originality and variety of treatment, especially the anthem which is considered his best work; "I Will Exalt Thee." The mass, "Euge bone," is an admirable piece of contrapuntal writing. He also translated the first half of the Acts of the Apostles into English verse, and then set it to music of generally excellent quality. He seems to have taken orders and to have held two or three parishes in the neighborhood of Cambridge.

TY′ERMAN, Luke (1820-89). An English Wesleyan minister and author. He was born at Osmotherly, Yorkshire, England, entered the ministry in 1842, and continued to preach until 1864, when he retired and devoted himself to literary work. He published: *The Life and Times of Rev. Samuel Wesley* (1866); *The Life and Times of Rev. John Wesley* (1870); *The Oxford Methodists* (1873); *The Life of Rev. George Whitefield* (1876); *Wesley's Designated Successor; the Life, Letters, and Literary Labors of Rev. John William Fletcher* (1883).

TYLDESLEY (tĭlz′lĭ) **WITH SHAKERLEY**, shăk′ẽr-lĭ. A town in Lancashire, England, 10 miles northwest of Manchester. Its modern growth is due to its cotton manufactures and neighboring collieries. Population, in 1891, 12,891; in 1901, 14,843.

TY′LER. The county-seat of Smith County, Tex., 105 miles east by south of Dallas; on the Saint Louis Southwestern and the International and Great Northern railroads (Map: Texas, G 3). It has Tyler College, a commercial and literary institution, and Texas College (Methodist) for colored youths. Noteworthy are the city hall, the Federal court and post-office building, the Court of Criminal Appeals building, and the Saint Louis Southwestern Railroad Hospital. There are two parks, Bellevue and Lakewood. Tyler derives considerable importance from its situation in a fertile section producing large quantities of fruit, vegetables, and cotton. A box and crate factory, a fruit and vegetable cannery, a pottery, and railway shops are the leading industrial establishments. There are several wholesale houses. Under the charter of 1876 the government is vested in a mayor, chosen biennially, and a unicameral council. Tyler was settled about 1844, and was first incorporated about 1850. Population, in 1890, 6908; in 1900, 8069.

TYLER, Bennet (1783-1858). A Congregational minister. He was born at Middlebury, Conn., graduated at Yale College 1804, and was ordained pastor of the Congregational Church, South Britain, Conn., 1808; he was president of Dartmouth College, 1822-28; and pastor of Second Church, Portland, Me., 1828-33. In the following year he became president and professor of theology in a theological seminary at East Windsor (removed to Hartford, 1865). This position he held until his death. He published: *History of the New Haven Theology* (1837); *Memoir of Rev. Asahel Nettleton* (1844); *Treatise on the Sufferings of Christ* (1845); *A Treatise on New England Revivals* (1846); *Letters to Dr. H. Bushnell on Christian Nurture* (1847-48, 2 series); *Lectures on Theology* (posthumous, with memoirs by his son-in-law, Rev. Dr. Nahum Eale, Boston, 1859).

TYLER, Daniel (1799-1882). An American engineer and soldier, born at Brooklyn, Conn. He graduated in 1819 at the United States Military Academy, and in 1824-26 served at the Fortress Monroe School of Artillery Practice. In 1828-29 he was in France, studying artillery methods, in 1830-34 was on ordnance duty, and in the latter year resigned. He was contracting engineer and president of several railways until the Civil War, when he became colonel of the First Connecticut Volunteers, and was soon afterwards commissioned brigadier-general. Having been mustered out, he was in 1862 reappointed with rank of brigadier-general, and participated in the Mississippi campaign and the siege of Corinth. In 1863 he commanded the Union forces at Harper's Ferry and Maryland Heights.

TYLER, John (1790-1862). The tenth President of the United States. He was born at Greenway, in Charles City County, Virginia, March 29, 1790. He was the son of Judge John Tyler, who was Speaker of the Virginia House of Delegates, Governor of Virginia, and at different times a judge of the State and Federal courts. The son graduated at William and Mary College in 1807; was admitted to the bar in 1809; and became a member of the Legislature in 1811, where he acted with the Republicans and supported the war with Great Britain. He was continuously elected to the Legislature five times in succession until 1816, when he was chosen to Congress. In the House of Representatives, during the Fourteenth and Fifteenth Congresses, he acted with the States-Rights Republicans, condemned General Jackson's course in Florida, and opposed the United States Bank and the Missouri Compromise. In 1825 he was elected Governor of Virginia by the Legislature, and was unanimously reëlected the following year. At the close of his second term as Governor he was elected over John Randolph to the United States Senate, in which he opposed the tariff measures of 1828 and 1832, opposed nullification, but condemned Jackson's nullification proclamation, although he supported Jackson for the Presidency in 1832 and stood alone among the Senators in voting against the 'Force Bill' of 1833. He was reëlected to the Senate for a second term, and in 1834 made a report censuring President Jackson for removing the deposits from the United States Bank, and voted for Clay's resolution of censure against the President. Having subsequently been instructed by the Legislature of Virginia to vote for the expunging of the resolution of censure, he refused to obey the instructions, and in February, 1836, resigned his seat and retired to private life. Tyler was one of the leading members of the new Whig Party, and was one of the unsuccessful candidates for the Vice-Presidency in 1836. In 1840 he was elected Vice-President on the Whig ticket with General W. H. Harrison (q.v.). President Harrison died April 4, 1841, one month after his inauguration, and was succeeded by Tyler, who completely broke with the party that had elected him. He vetoed the bill to recharter the Bank of the United States, and when it was modified partly in accordance with his suggestions and repassed he vetoed it again. The bill to revise the tariff met a similar fate. Thereupon, on September 11, 1841, all the members of the Cabinet except Webster, who was then engaged in negotiations with Great Britain concerning the boundary between the United States and Canada, resigned, and a year later Webster followed. Shortly thereafter some of the leading Whigs issued a public address declaring that "all political connection with them and John Tyler was at an end from that day henceforth." The chief events of Tyler's administration were the conclusion of the Webster-Ashburton Treaty (q.v.) with Great Britain and the annexation of Texas. At the close of his term Tyler retired to his estate in Charles City County, Va., where he remained until 1861, when he was called out to preside over the Peace Convention at Washington. Failing in his efforts at compromise, he gave his adhesion to the Confederate cause, voted for secession in the Virginia convention, served in the Confederate Provisional Congress, and was elected to the Confederate House of Representatives, but died at Richmond, January 18, 1862, before he could take his seat. For his biography and that of his father, consult: *The Letters and Times of the Tylers* (Richmond, 1884-85), written by his son, Lyon G. Tyler. For a more detailed account of the events of his administration, see the section on *History* in the article United States.

TYLER, Lyon Gardiner (1853—). An American educator, son of President Tyler, born at Sherwood Forest, Va. He graduated in 1875 at the University of Virginia, studied law, and from 1877 to 1879 was professor of belles-lettres at William and Mary College. In 1879-82 he was principal of Memphis Institute, in 1882-88 practiced law at Richmond, Va., and in 1887 was a member of the Virginia House of Delegates. In 1888 he became president of William and Mary College. His publications include *The Letters and Times of the Tylers* (1884-85) and *Parties and Patronage in the United States* (1890).

TYLER, Moses Coit (1835-1900). An American literary historian and educator, born at Griswold, Conn. His parents removed to Michigan, where he began his education. He graduated at Yale in 1857 and, after studying theology there and at Andover, took charge of Congregational churches at Owego and then at Poughkeepsie, N. Y. Broken down by over-study, he resigned the latter charge in 1862 and went to England, where he spent four years recuperating, studying, lecturing, and writing letters to the New York *Independent* and the New York *Nation*. In 1867 he accepted the chair of English at the University of Michigan, and in 1881 he was called to the chair of American history at Cornell, a position which he held until his death. In 1881 he was ordained deacon in the Protestant Episcopal Church, and was advanced to the priesthood in 1883. Meanwhile he had published his *History of American Literature During the Colonial Time* (2 vols., 1878) and had won a wide reputation for scholarship. This history, which was continued in the two volumes entitled *A Literary History of the American Revolution* (1897) and in the essays entitled *Three Men of Letters* (Bishop Berkeley, President Dwight, and Joel Barlow, 1895), constitutes Professor Tyler's chief claim to remembrance. It hardly carries the story of our literature beyond the year 1783, but within its limits is characterized by such accuracy and breadth of scholarship, such genial sympathy and attractiveness of style, that it is not likely to be superseded, and fully entitles its author to rank with the great literary historians of the world. Its chief defects are diffuseness and a failure to apply standards rigorously. Besides this history, Tyler's most important work is a biography of Patrick Henry in the American Statesmen series (1887). He also published *The Brawnville Papers* (1869), devoted to the claims of physical culture; a revision of H. Morley's *Manual of English Literature* (1879); *Memorial of E. K. Apgar* (privately printed, 1886); and *Glimpses of England* (1898), a collection of his letters from England mentioned above. Consult a paper by W. P. Trent in the *Forum* for August, 1901, and one by G. L. Burr in *Report of the American Historical Association* for 1901 (vol. i.).

TYLER, Ransom Hebbard (1813-81). An American author, born in Leyden, Mass. He studied law, and was admitted to the New York bar. He was elected to numerous local offices, including those of district attorney and county judge for Oswego County. An extensive traveler, he was also editor of the Oswego *Gazette*, and contributed widely to periodicals. He published *The Bible and Social Reform* (1863); *American Ecclesiastical Law* (1866); *On Usury, Pawns, and Loans* (1873), and several other works.

TYLER, Royall (1757-1826). An American jurist and author, born in Boston. He graduated at Harvard College in 1776, studied law under John Adams, and was for a time aide to General Benjamin Lincoln, serving in the Revolution and in Shays's Rebellion in 1786. In 1790 he removed to Vermont, became a judge of the Supreme Court in 1794, and was Chief Justice from 1800 to 1806. His chief legal work was *Reports of Cases in the Supreme Court of Vermont* (1809-10). He wrote several clever and successful plays, of which one, *The Contrast*, a comedy partly in Yankee dialect, presented in New York in 1787, was the first American comedy produced by a regular professional dramatic company. Other plays were *May Day, or New York in an Uproar* (1787), and *The Georgia Spec., or Land in the Moon* (1797). He also contributed light, witty verse to periodicals and wrote a picaresque story, *The Algerine Captive, or the Life and Adventures of Dr. Updike Underhill, Six Years a Prisoner Among the Algerines* (1797); *Moral Tales for American Youths* (1800); and *The Yankey in London* (1809). Tyler's *Contrast* was published in 1790 and reissued in 1887 by the Dunlap Society, with an introduction by T. J. McKee. Some of his work may be found in *The Spirit of the Farmer's Museum* (1801), for he helped Joseph Dennie (q.v.) to make *The Farmer's Museum* a success, and also in Dennie's late newspaper, *The Portfolio*, of which Tyler's sane literary criticism was an important feature.

TYLER, Wat (?-1381). The principal leader of the English social revolt of 1381. Owing to the fact that he was captain of the Kentish insurgents, he is generally supposed to have been a Kentishman; but Kentish jury indictments recently published, and the best contemporary evidence, show that he was from Colchester in Essex. He should not be confounded with his colleague, Jack Straw, captain of Essex. The usual supposition drawn from his name, that he was a tiler by trade, is by no means certain, since a surname in the fourteenth century does not necessarily indicate the bearer's trade. Nothing is known of his life previous to the revolt. The usual unfavorable estimates of his character are based upon the hostile and unreliable testimony of Walsingham and Froissart. Even hostile sources are agreed as to his ability. His part in the organization of the revolt was second only to that of John Ball, and he was certainly the chief factor in conducting it. The peasants' levies were summoned in his name, and important questions were submitted to his personal decision. On special occasions he acted as spokesman of the insurgents, presenting their demand to the King. We are told on good authority that he was very eloquent. The extent of his importance as a leader is shown by the entire collapse of the revolt after his murder at Smithfield. For his part of this movement, resulting in his death, see Tyler's Rebellion.

TYLER'S REBELLION. The name usually applied to the English Social Revolt in 1381, from Wat Tyler, its chief leader. It had been prepared for years by the teaching of a priest, John Ball (q.v.), in Southern and Eastern England, and from his home at Colchester it was silently organized throughout Essex, and thence in the adjoining counties, especially Middlesex, Sussex, and Kent. The brutal collection of an oppressive poll-tax greatly incensed the people, and gave occasion for the outbreak in Essex in the early part of June, 1381. The country was soon aflame, and a division under Wat Tyler and Jack Straw crossed the Thames at Erith. After capturing the Castle of Dartford, where Tyler was chosen leader, and securing the allegiance of the Mayor and Council of Canterbury, they marched, in irresistible force, on London. On June 12 they camped at Blackheath, a southeastern suburb, while the Essex men, under Jack Straw, gathered at Mile End. From all sides bands of insurgents, from the most distant counties, marched on London, Corpus Christi (June 13) being the day of reckoning chosen.

Disappointed in a promised conference at Blackheath with the young Richard II., whom the Council would not permit to land from his barge in the Thames, the insurgents on June 13 marched on London. The London populace and the powerful Fishmongers' Company sided with them, and both the southern and northern armies were admitted into the city. The former straightway invested the Tower of London, in which the King, his Council, and many of the nobility had taken refuge. In vain did Richard try to calm them from a turret; yielding to their threats, the Council agreed to the King's meeting them on the following morning at Mile End.

The traditional account of this conference, based on Froissart, represents the boy King by his cool courage calming the raging insurgents and inducing them to disperse. In reality it was a conference between the timid lad and the leaders, with Tyler as spokesman, in presence of the entire rebel army. The King listened to Tyler's harangues, graciously granted all their demands, and then retired to the Tower Royal, another London fortress. The insurgents' demands included the abolition of serfdom, a maximum rent of fourpence the acre for lands thus freed, the right to buy and sell free of toll all over England, and the abolition of the Statutes of Laborers, by which wages had been fixed in the interests of the landlords and master craftsmen. The King also agreed to the execution of his ministers by the insurgents, and promised in future to choose his councilors from among them.

By virtue of this grant, the commons marched straightway to the Tower, seized and beheaded such of the ministers as they could secure—the Archbishop of Canterbury, who was Chancellor, and the Treasurer, Sir Robert Hales, besides a few others, among whom were four collectors of the poll-tax. Meanwhile a large number of the insurgents returned home, satisfied with the abolition of villeinage. But the most formidable division, under Tyler, Straw, and Ball, remained, demanding further economic concessions, and above all the reformation of the Church, in accordance with Ball's ideals. The King agreed to meet them at Smithfield at vespers of June 15. Here, too, the traditional account has thrown unnecessary glamor about the heroism of Walworthe, Mayor of London, and the boy King. In reality, Tyler was lured out of sight of his men, and after his demands had been granted, a pretext was found to arrest him, in resisting which he was dispatched by Walworthe and others of the royal retinue. Their demands having been granted, the rebels were induced to go to Saint John's Field, as they supposed, at Tyler's command. When they learned the truth, and saw the royal forces approaching, they were glad to disperse, retaining the charters of freedom granted at Mile End.

The demands of the insurgents at Smithfield include two legal requirements directed especially against the Statutes of Laborers, one against serfdom, and a fourth demanding free use of woods, hunting and fishing to all tenants of manors. Their demands for the reformation of the Church differ from others of a later period in that the confiscation of church property accrues to the benefit of the common people, instead of King or nobility, by enfranchising the tenants of clerical domains and decreasing clerical taxes. The reforms were the most democratic ever demanded.

Though the political and economic aspirations of the peasantry formed the backbone of the revolt of 1381, there were other important factors. The lower classes of the towns sympathized with the insurgents. In some cases the city governments, like Canterbury and Bridgewater in the south and York, Scarborough, and Beverley in the north, were implicated. A very important factor was a general uprising against the monasteries, both of tenants and especially of mesne towns. At Saint Albans, both townsmen and peasants extorted charters of liberties. There were similar movements at Reading, Dunstable, and many other smaller foundations; at Cambridge the movement took the form of an uprising against the university. In Sussex it centred in a fierce revolt against Abbey Saint Edmunds, the prior of which was beheaded, John Wrawe, the captain of the county, was a priest, as were several others of the leaders. In Norfolk the plundering was especially severe; under the leadership of Geoffrey Lister and Sir Roger Bacon, ambassadors with a large sum of money were sent to the King to obtain the liberties desired. All of these local outbreaks were more or less connected with the central movement. There was rather less plundering than might have been expected, and violence was usually directed against persons connected with the Government or local oppressions, and especially those known as adherents of John of Gaunt. After the rebels had retired, the remnants of the revolt were stamped out with great severity; the liberties granted were everywhere revoked, and the reaction was far bloodier than the revolt. The effect of the movement was to abolish for the time the poll-taxes, to do away practically with the Statute of Laborers, and to hasten the general tendency toward the abolition of villeinage.

Consult Kriehn, in *American Historical Review*, vol. vii. (New York, 1902); also Powell, *The Rising in East Anglia in 1381* (Cambridge, 1896); Réville, *Soulèvement des travailleurs d'Angleterre en 1381* (Paris, 1898); Trevelyan, *England in the Age of Wycliffe* (London, 1899); id., *The Peasant Rising and the Lollards* (ib., 1899).

TYLOP'ODA (Neo-Lat. nom. pl., from Gk. *τύλος*, *tylos*, knob, knot, callus + *πούς*, *pous*, foot). A section of the Ruminantia, which embraces the Camelidæ, distinguished by the padded character of the soles of the feet. See CAMELIDÆ.

TY'LOR, EDWARD BURNETT (1832—). An English anthropologist, born in London. He was educated at the Grove House School, Tottenham. He entered his father's brass foundry in 1848, but his health forced him to abandon the work. After a year's travel in the United States, he went to Mexico in 1856 with Henry Christy and in 1859 published the results of his observation in a volume entitled *Anahuac, or Mexico and the Mexicans*, which shows great accuracy of description. In 1865 his *Researches into the Early History of Mankind* appeared; in 1871 he published his *Primitive Culture*, in 1881 his *Anthropology*, and in 1900 *The Natural History of Religion*. These works immediately became popular and have exerted a profound influence on the development of anthropological science. Tylor's most important scientific contribution is his treatment and development of the doctrine of animism as the fundamental and universal factor in primitive religions. (See Religion, Comparative.) In 1896 he was made first professor of anthropology at Oxford.

TYLOSIS (from Gk. τύλος, *tylos*, knob, knot, callus). A protrusion of a living cell through a pit in a large pitted vessel, due to the pressure in the cell. Often the nucleus and some of the protoplasm passes through the pit into the tylosis, and in this case cell division may take place until the cavity of the vessel is entirely filled with the growing tissue. Tyloses are found in both monocotyledons and dicotyledons. Sections of the stem of the Virginia creeper (*Ampelopsis quinquefolia*) show tyloses in which cell division has taken place until the cavities of the vessels are nearly closed.

TYMPANITES, tĭm'pan-ī'tēz. A disease of horses. See Bloat.

TYMPANUM (Lat., from Gk. τύμπανον, drum). In anatomy, the middle ear. (See Ear.) In architecture, the flat space left within the sloping and horizontal cornices of the pediment of classical architecture, usually filled with sculpture; also, the space between the arch and lintel of doorways in Gothic architecture, which is frequently enriched with sculpture.

TY'NAN, Katharine. An English novelist. See Hinkson, Mrs. Katharine.

TYNDALE, tĭn'dal, William (?-1536). An English translator of the Bible. He was born on the borders of Wales, between 1490 and 1495, and was educated at Oxford and Cambridge. After leaving Cambridge (about 1522) he became tutor and chaplain in the home of Sir John Walsh, a knight of Gloucestershire. He preached frequently and, his opinions differing from those of the clergy of the neighborhood, he became involved in religious dispute, and an accusation was made against him before William of Malvern, chancellor of the diocese, who censured him for his boldness and indiscretion. As a result of his experience, Tyndale became determined to translate the New Testament into English. He went to London in 1523, but, failing to obtain help, he retired to Germany the following year. The New Testament was printed at Worms in 1525 and carried to England, and, though denounced by the Government, several reprints were produced within the next few years. Tyndale remained on the Continent writing tracts in advocacy of the reformed doctrines. His chief original work, *The Obedience of a Christian Man and How Christian Rulers Ought to Govern*, appeared in 1528. In 1530 he published a translation of the Pentateuch, and in 1531 one of the Prophet Jonah. He engaged in a controversy with Sir Thomas More (q.v.) concerning the supreme authority of the Church on the Scripture. During this period Tyndale associated with Luther, John Frith, Patrick Hamilton, John Rogers (qq. v.), and other leading reformers. He adopted the Zwinglian doctrine of the Lord's Supper, and separated himself from the other English reformers by opposing the divorce of Henry VIII. from Catharine of Aragon. He was the subject of much annoyance from the authorities and changed his abode from time to time. In 1535 he was treacherously arrested at Antwerp, and, after a confinement of sixteen months in the Castle of Vilvorde, near Brussels, the State prison of the Low Countries, he was publicly strangled and burned as a heretic August 6, 1536. Tyndale was a man of both learning and talent; his translations were made directly from the Hebrew and Greek. He had a good style and was devoted to his work. His New Testament has been frequently reprinted (in facsimile by Francis Fry, London, 1862); his Pentateuch was edited by Mombert (New York, 1884); and his miscellaneous writings were published by the Parker Society (London, 1848-50). The best biography is by Demaus (London, 1871; 2d ed. 1886).

TYNDALL, tĭn'dal, John (1820-93). An English physicist, born at Leighlin Bridge, County Carlow, Ireland. He found employment at first in one of the subordinate grades of the Ordnance Survey, and later as a railroad engineer. He was appointed teacher of mathematics and surveying at Queenwood College, Stockbridge, in 1847. He then went to Marburg, where he studied for two years, returning to Queenwood in 1851. In January, 1853, Tyndall communicated his first paper to the Royal Society, *On Molecular Influences—Transmission of Heat Through Organic Structures.* In the following month a lecture *On the Influence of Material Aggregation upon the Manifestations of Force*, before the Royal Institution, widely extended his fame, and inaugurated his reputation as a brilliant lecturer. A few months later he was appointed professor of natural philosophy in the Royal Institution, thus becoming a colleague of Faraday, succeeding as director on the latter's death in 1867. Tyndall early undertook researches on diamagnetism at Marburg in conjunction with Knoblauch, which resulted in a publication entitled *On the Magneto-optic Properties of Crystals and the Relation of Magnetism and Diamagnetism to Molecular Arrangement.* These and later researches were published under the title of *Researches on Diamagnetism and Magno-crystallic Action, Including the Question of Diamagnetic Polarity* (1870). Tyndall spent much time in the Alps, where he combined mountain-climbing with scientific research, making numerous careful observations on the great Swiss glaciers. These were published in popular form and in scientific contributions to the *Philosophical Transactions.* In connection with his study of the glaciers, Tyndall became interested in atmospheric phenomena, particularly the study of vapors. This led to researches on radiant heat and its transmission, radiation, and absorption by vapors and gases. These investigations involved a controversy with Magnus, but Tyndall was able to demonstrate the correctness of his views. These researches were later collected and published under the title *Contributions to Molecular Physics in the Domain of Radiant Heat* (1872). In his study of radiant energy Tyndall analyzed various kinds of light in order to determine the proportion of luminous and non-luminous rays and their effect on various substances. He also discovered that in 'optically pure air,' that is, air free from dust or other particles, a luminous beam is invisible. These discoveries led to improved methods of sterilization, which are described in his *Essays on Floating Matter of the Air in Relation to Putrefaction and Infection.*

The British Government availed itself of Tyndall's scientific ability and he succeeded Faraday as a scientific adviser to Trinity House (in charge of the lighthouse service) and the Board of Trade, in which capacity he carried on a number of scientific experiments with direct practical ends. Tyndall also achieved a reputation as a lecturer and did much valuable work in the popularizing of science. Few scientific lecturers have been able to present the principles and facts of physics to the general public so successfully as Tyndall. He visited the United States in 1872-73, on a lecture tour, and a few years after he gave the proceeds to forward the cause of original research in the United States. He wrote many popular treatises on scientific subjects, which have been translated into foreign languages. Among his works are: *Heat Considered as a Mode of Motion* (1863 and subsequent editions); *On Sound* (1867 and subsequent editions); *Fragments of Science for Unscientific People* (1871 and subsequent editions); *Six Lectures on Light Delivered in America in 1872-3* (1873 and later editions); *New Fragments* (1892 and 1897); *Notes on Light* (1870); *Notes on Electrical Phenomena and Theories* (1870). His works on the glaciers and the Alps include *The Glaciers of the Alps* (1860 and 1896); *Mountaineering in 1861* (1862); and *Hours of Exercise in the Alps* (1871 and later editions).

TYNDAREUS, tĭn-dā′rē-ŭs (Lat., from Gk. Τυνδάρευς). A King of Sparta. Having been driven out by his half-brother, Hippocoon, he fled to Ætolia and became an ally of Thestius, whose daughter Leda he married. Hercules restored him to Sparta. Leda bore him Castor and Clytemnestra, and at the same time by Zeus became the mother of Pollux and Helena. After the death of Castor and Pollux and their reception among the gods, Tyndareus surrendered the kingship of Sparta to Menelaus.

TYNE, tīn. A river of Northern England (Map: England, E 2). It is formed by the North and the South Tyne, which rise, respectively, in the Cheviot and the Pennine Hills. It flows eastward, partly on the boundary between Northumberland and Durham, till it empties into the North Sea at Tynemouth. It passes through one of the principal coal-mining and manufacturing regions of England, and the cities of Newcastle, Gateshead, and South Shields lie on its banks. Length, 80 miles; navigable to Blaydon, about 18 miles. Consult: Guthrie, *The River Tyne* (Newcastle-upon-Tyne, 1880); Palmer, *The Tyne and Its Tributaries* (London, 1881).

TYNEMOUTH, tīn′mŭth *or* tīn′-. A market town and seaport, the chief watering place of Northumberland, England, at the mouth of the Tyne, 8 miles east of Newcastle (Map: England, E 1). It includes the townships of North Shields, Chirton, Preston, and Cullercoats. Shipbuilding is carried on and there are rope and sail works, besides important fisheries. The sands, about a mile in length, are overlooked by picturesque cliffs. Noteworthy are the gateway of the old castle, the fine ruins of a priory and lady chapel, the master mariners' asylum, the aquarium, and assembly rooms. The municipal borough buildings are in North Shields. Incorporated in 1849, the town owns and operates the water and electric lighting works. Tynemouth was a Saxon fortress. Population, in 1891, 46,588; in 1901, 51,514. Consult: Gibson, *Monastery of Tynemouth* (London, 1846); Adamson, "Tynemouth Priory and Castle," in *Archæologia Ælina*, vol. xxiii. (London, 1901).

TYNG, tĭng, Stephen Higginson (1800-85). A Protestant Episcopal clergyman. He was born at Newburyport, Mass.; graduated at Harvard college, 1817; engaged in mercantile pursuits for two years; studied theology, and was ordained in 1821; preached at Georgetown, D. C., 1821-23; at Queen Anne's Parish, Prince George Co., Md., 1823-29; was rector of Saint Paul's Church, Philadelphia, 1829; of the Church of the Epiphany, Philadelphia, 1833; and of Saint George's Church, New York, 1845, which charge he resigned in 1879. Dr. Ting was a pronounced evangelical and low churchman and a leading opponent of ritualism. He was widely noted for his fervid eloquence as a preacher, and he zealously advocated total abstinence and other reforms. He published, aside from discourses, Memoirs of Rev. Gregory T. Bedell (1835), and those of Dudley Atkins Tyng (1866); *Recollections of England* (1847); *Forty Years' Experience in Sunday-Schools* (1860); *The Prayer Book Illustrated by Scriptures* (8 vols., 1863-67); and *The Office and Duty of the Christian Pastor* (1874). He was editor of *The Episcopal Recorder, The Theological Repository,* and *The Protestant Churchman.* Consult his *Life* by his son, C. R. Tyng (New York, 1891).

TYPE (Lat. *typus*, from Gk. τύπος, type, figure, impress, blow, from τύπτειν, *typtein*, to strike; probably connected with στυπάζειν, *stypazein*, to push, Skt. *tup*, *sthump*, to destroy, Lat. *stuprum*, violation). In zoölogy: (1) The name applied by De Blainville to the four branches of Cuvier. These 'types' were founded on what were then considered as four fundamental 'plans' of organization. (See Classification of Animals.) Cuvier and his successors, notably Von Bael and L. Agassiz, taught that these types existed, as it were, side by side, the Vertebrata the highest, but with no genetic connection, and that each type was characterized by a distinct plan of structure—a view now superseded by that of the doctrine of descent. See Evolution; Phylogeny.

(2) The 'type' or 'typical species' of a genus is the one first described, or regarded as the most typical, and about which the other species were clustered. A 'type specimen' is that individual, or the several individuals, which served as the basis for the description of a new species. The careful preservation of an author's type specimen is all-important in systematic zoölogy and botany, as it is the ultimate source of appeal in unraveling complicated cases of synonymy.

TYPE. In theology, an image or representation of some object which is called the antitype (q.v.). It is applied chiefly, although not exclusively, to those prophetic prefigurings of the persons and things of the new dispensation which are found in the ritual, and even in the history of the Old Testament. Saint Paul and other sacred writers speak of the ancient types of things to come. Of the types of the Old Testament, many are directly pointed out as such in their very institution; many also are distinctly applied in the

New Testament. There is a large class, however, which more properly fall under the mystical sense of Scripture, and which are called indirect, that is to say, 'adaptive' or 'applied' types.

TYPE FOUNDING. The art of founding or casting printers' types. (See PRINTING.) In the early times printers made their own type, but about the middle of the sixteenth century the necessity arose for a division of labor and type founding became a business distinct from printing. The art was first developed in France and from that country spread to Italy, Germany, England, and the United States. The first type cast in America was made by Christopher Saur, at Germantown, Pa., about 1735. In 1796 the Scotch type founders Binny and Ronaldson established a type foundry in Philadelphia, Pa., which after many struggles succeeded. Between 1735 and 1796 several persons, among whom was Benjamin Franklin, attempted to found type, but they all failed to make a business success of their attempts. In 1810 Elihu White established a successful type-founding business in New York, and in 1813 the firm of D. & G. Bruce began business as type founders in the same city. These early type founders all cast their type by hand, after much the same methods, probably, as had been practiced since metal types were first used. Indeed, it was well on toward the middle of the nineteenth century before type was successfully founded by machine to any considerable extent.

HAND FOUNDING. The first step in the process of type founding by hand is the cutting of a punch or die resembling the required letter. The punch is of hardened steel, with the figure of the letter cut, the reverse way, upon its point. On this die being finished, it is struck into a piece of copper about an inch and a quarter long, one-eighth of an inch deep, and of a width proportionate to the size of the type to be cast. This copper, being so impressed with the representation of the letter, requires to be adjusted to the mold, so that the 'face' or impression of the punch (in the copper) may be brought into such relation with the metal which forms the 'body' or stalk of the type, that when the types are 'set up' they may stand at the proper distance from each other, and be in 'line' or range, and also square to the page; this work is termed 'justifying,' and the copper is now a 'matrix.' The matrix is now fixed into a small instrument or frame called the mold, which is composed of two parts. The external surface is of wood, the internal of steel. At the top is a shelving orifice, into which the metal is poured. The space within is of the size of the required body of the letter, and is made exactly true. The melted metal, being poured into this space, sinks down to the bottom in the matrix, and, instantly cooling, the mold is opened, and the type is cast out by the workman. This process of casting types is executed with great celerity. Of course, every separate letter in the alphabet, every figure, point, or mark, must have its own punch and matrix. After being cast the types have to be dressed, and this work is performed by hand. It consists first in removing the projection or 'jet' of superfluous metal that clings to the end which is toward the top of the mold while the type is being cast; second, in rubbing smooth the sides of the types on grit-stones; and, finally in cutting a groove in the foot of each type and examining the type with a magnifying glass to discover imperfections. Considering the nature of the operation, type casting by hand is performed, by an expert, with remarkable rapidity, about 400 types per hour being produced ready for the finishing process.

MACHINE FOUNDING. Various attempts were made during the early part of the nineteenth century to cast types by machinery. The first successful machine for this purpose was devised by David Bruce, Jr., of New York, and was patented in 1838. As subsequently improved, this machine was extensively used in American type foundries and was introduced into Europe. Briefly described, the Bruce type-casting machine consists, first, of a small melting-pot, which contains the molten metal, and is placed over a small furnace. In the interior of the pot is arranged a forcing-pump and valve for admitting the metal under the piston, and also for preventing the return of the metal into the mass in the pot when the piston is depressed, and thus securing the full force exerted upon the piston being transmitted to the molten metal under the piston, and forcing it through a narrow channel leading from the bottom of the chamber in which the piston works to the outside of the pot, where a nipple is inserted, with a small hole through it, communicating with this narrow channel. Against this nipple the mold in which the type is formed is pressed at the moment at which the piston descends, and so receives the molten metal that forms the type.

The second part of the machine is that which carries the mold, and to which the mold is firmly bolted. The mold is similar to the old hand-mold, but modified to suit the machine; it is much stronger; the 'jets' are shorter, and the orifice by which the metal enters is smaller, so that it may be brought exactly coincident with the small hole in the nipple in front of the pot. The mold—as the old hand-mold—is made in halves; one of the halves is firmly bolted to an arm which, by cams and levers, is made to oscillate, and carry the mold to and from the nipple in front of and above the pot; the other half of the mold is bolted to another arm, which, by a peculiarly formed hinge, is attached to the first arm, so that the two halves of the mold may be made to open and shut upon each other like the lid of a snuff-box; and so both sides of the mold oscillate together to and from the nipple in the pot from which they receive the molten metal. The operation of the machine is as follows: The piston being raised in the chamber of the pump, and the chamber being supplied with metal through the valve, the mold is brought against the nipple; the valve closes to prevent the metal being forced back into the pot; the piston descends, and forces the metal through the narrow channel into the mold; the mold then recedes from the nipple, and in receding the two halves separate from each other and eject the type; the mold again approaches the nipple, and in approaching the two halves close together, and are ready for another operation. A blast of cold air is directed upon each mold to keep it cool.

The types produced by the Bruce machine as built previous to 1868 had to be dressed by hand, but in that year Mr. Bruce invented an apparatus for dressing the type mechanically which could be applied to his casting machine. Bruce's improved machine was followed by one designed by Henry Barth, of Cincinnati, O., in 1888. This machine casts the types, finishes them, and produces them set up in lines ready for inspection. The output of the most recent type-casting machines varies from 100 to 140 types per minute, according to the size of the letter. In conclusion, mention should be made of the type punch cutting machine, invented by L. B. Benton, which operates on the principle of the pantograph and produces from one pattern letters of any size desired.

For the history of English type founding, consult Reed, *History of the Old English Letter Founders* (London, 1887), and De Vinne, *Historic Printing Types* (New York, 1886). See TYPESETTING MACHINES.

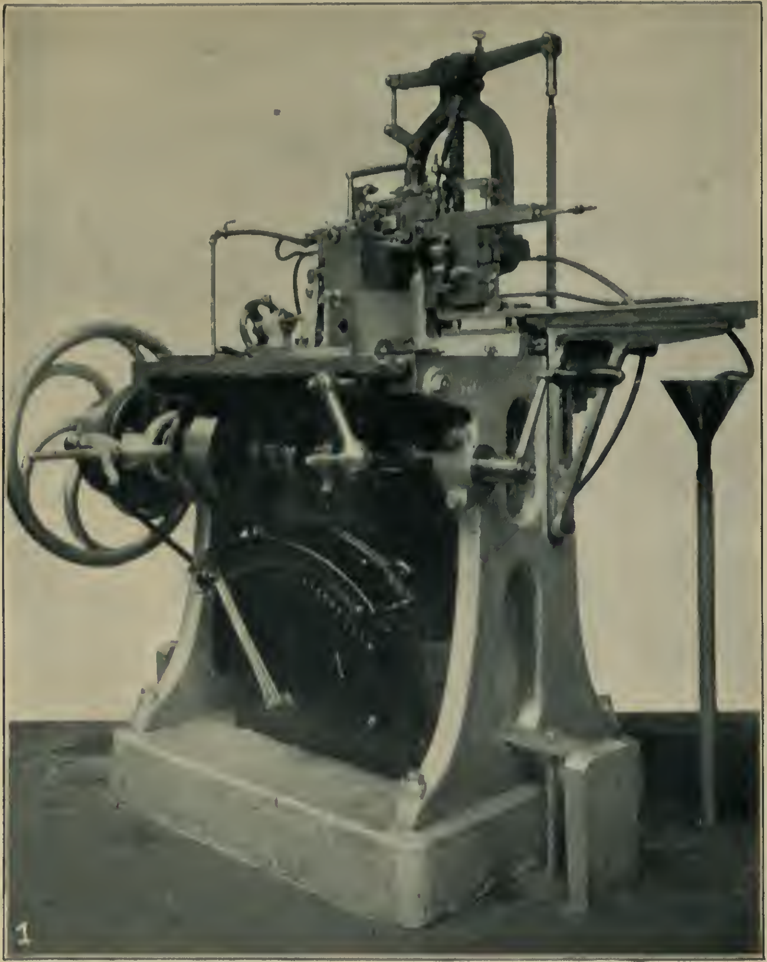
TYPES, THEORY OF. See CHEMISTRY.

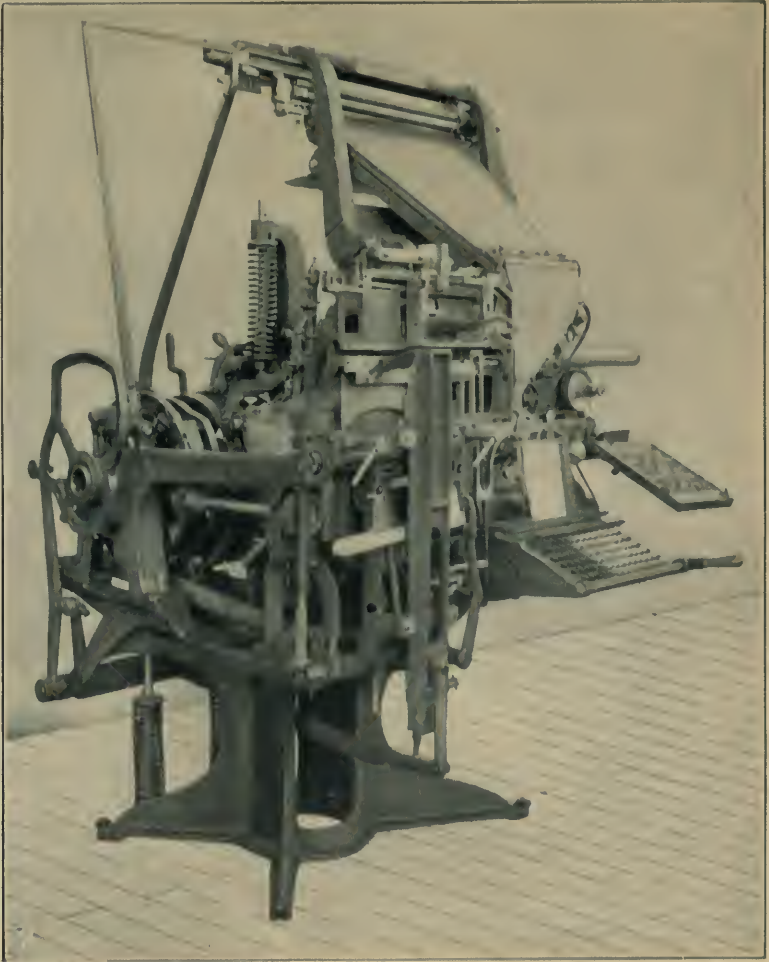
TYPESETTING MACHINES. Machines devised to set or compose printers' types automatically and mechanically. In hand composition the types are picked one at a time from a wooden case and then set one after another in the proper order to form the words which it is desired to print. After the set types have been printed from, they are distributed, i.e. returned to their proper compartments in the case. (See PRINTING.) The processes of composition and distribution by hand are tedious and expensive, and from quite early times efforts have been made to devise a machine which would perform these tasks more speedily and economically. Until within recent years, however, these attempts were not commercially successful. Perhaps the first serious attempt to design a machine to do away with hand composition of types was made by Dr. William Church, whose device was patented in England in 1822. His machine was designed to cast types and leave them in reservoirs, and they were set from these reservoirs by pressing keys arranged much like the keys of a piano. After use the types were remelted, the inventor in this way getting around the problem of distribution. Evidently Church was a man ahead of his times, for it was not until a score of years had elapsed that the issuing of patents for typesetting machines began to be frequent. In 1840 James H. Young, of England, completed a machine, which is said to have set types at the rate of 13,000 per hour, but the types had to be arranged in lines, distributed, and, presumably, placed in the magazines by hand, which required three persons besides the machine operator. The first distributing machine patented in America was invented by Frederick Rosenberg, in 1843, and the first English patent on a distributor was taken out by Etienne Robert Gaudens, in 1840. After this among prominent American inventors follow the names of Mitchell, Alden, Felt, Brown, Westcott, Kastenbein, Paige, Richards, Burr, and in recent years Thorne, MacMillan, and Mergenthaler. Among the prominent foreign inventors who achieved more or less success were Hattersley, Mackie, and Fraser, in England; Sörensen, of Denmark; Fischer and Von Langen, of Germany; and Delcambre, of France. At present only the Thorne, MacMillan, Mergenthaler, and Lanston machines are much used, but the commercial success reached by some of the earlier machines was quite remarkable. The Alden machine was at one time used in the New York *Tribune* office. Ten of the Mitchell machines, invented in 1853, are said to have been used at one time in a single office. In 1872 the London *Times* began to use the Kastenbein machines, and finally set the whole paper by them. In 1880 the Burr machine was tried in the New York *Tribune* office, and three of these machines were in use there for some years. In 1884 the Fischer and Von Langen machine was used in the office of the Cologne *Gazette*. All these successes, however, have been so far outdone by the Thorne, MacMillan, Mergenthaler, and Lanston machines that only these four need be mentioned further.

The Thorne machine, a combined setting and distributing machine, consists of an upright cylinder with vertical channels around a periphery, each channel holding a line or column of types, one channel holding *a*'s, another *h*'s, and so on. The lower half of the cylinder is stationary, and its channels contain the distributed types. The upper half of the cylinder turns with a step by step motion, and its channels contain the lines of type to be distributed. The motion of the upper cylinder is such as to bring its channels opposite those of the lower, when an instant's pause occurs, permitting any type which is opposite a channel in the lower cylinder, whose projections correspond to its own nicks, to drop down. Then the upper cylinder is rotated one step, bringing the channels again in coincidence. The type is set from the channels in the lower cylinder, the lowest type being pressed out radially when the operator depresses the key which governs it. A rapidly revolving plate whirls the type around and delivers it to an endless belt, which carries it to a setting-up mechanism. Here the type is turned upright and added to the continuous line of types, which is slowly pushed along, as type after type is added, toward the justifier, which divides it into lines of column or page length. The machine described is an excellent example of combined setting and distributing machine. In the MacMillan machine the setting and the distributing are done by separate machines. The magazines of the setting machine are removable, being exchanged for full ones as fast as they become empty. The operator ejects the types from the magazines by pressing suitable keys, and they are set up in long lines to be justified by hand. The distributor consists of a horizontal wheel with radial channels, in which the types to be distributed are placed. The frame surrounding the wheel contains other radial channels having projections corresponding to the nicks in the types. The movable magazines are placed radially in connection with these outer channels. When the wheel slowly revolves, the types pass from the channels of the wheel into the outer channels whenever a type comes opposite one whose projections correspond to its nicks. The MacMillan machine is a fairly typical example of the separate setting and distributing machine. Both the Thorne and the MacMillan machines set types which are previously made by the regular type-founding process. (See TYPE FOUNDING.) This is a distinction which should be noted before proceeding further, since the Mergenthaler and Lanston machines, instead of composing previously cast types, themselves cast the types as they are desired by the operator.

The Mergenthaler 'Linotype' machine was invented by Ottmar Mergenthaler, and the first ma-

TYPE-CASTING AND TYPE-SETTING MACHINES





1. AUTOMATIC TYPE-CASTING MACHINE OF AMERICAN TYPE FOUNDERS COMPANY.

2. MERGENTHALER LINOTYPE MACHINE.

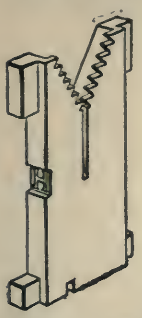


FIG. 1. MATRIX FOR MERGENTHALER MACHINE.

chine was completed in 1884. This machine takes its name from the fact that it sets up a line of molds, and casts a line of type, or rather a solid metal bar with raised letters on one edge, which is known as a 'slug' and is the same as if a line of types were fused solid. These molds or matrices are small pieces of sheet metal, each with a letter impressed on its edge, as shown in Fig. 1. They are placed in magazine tubes, as shown in the illustration, Fig. 2, all the *a*'s in one tube, all the *b*'s in another, and so on, the tubes being arranged vertically in a continuous line. The machine has a keyboard like a typewriter, and the depression of a key as D, connected by a rod, C, with the escapement, B, causes a matrix to drop into an inclined channel, E, down which it falls to the inclined traveling belt, F, by which it is carried to the assembler, or stick, G, where it takes its place in line. The spaces, I, between words are simply duplex wedges, dropped into position from a box, H, in the same way as the matrices when the finger key, J, is pressed. When the compositor has set all that will go into a line, the duplex wedges are slid one upon another, thus 'spacing out' the line, and the line so formed is carried over in front of a slot on the wheel K, where automatically the line of type is cast with metal from the reservoir, M, shown in detail in Fig. 3, and its sides and base planed, after which the mold wheel, K, makes a quarter of a revolution and the slug is deposited on a galley. The matrices meanwhile are released and passed overhead to the bar, R, where thin teeth engage on its horizontal ribs. This bar rises as shown by the dotted line, and the matrices are carried up to the distributor, T, whence they find their way to the appropriate magazine tubes, each matrix being released at the proper point. A speed of 4000 ems an hour is the average rate of a good Linotype operator, while those unusually expert attain as high a speed as 5000 to 6000 ems. The advantages of this machine are, among others, that it gives constantly a new type-face to print from, and also that there is no distributing to be done, the slugs being remelted after they have been used. The 'spacing out' device is another and a very decided advantage. The Linotype machine has become the most extensively used of any machine ever devised for the mechanical composition of types, and in its latest form performs successfully the most intricate kinds of composition, including tabular matter and the use of several classes of characters.

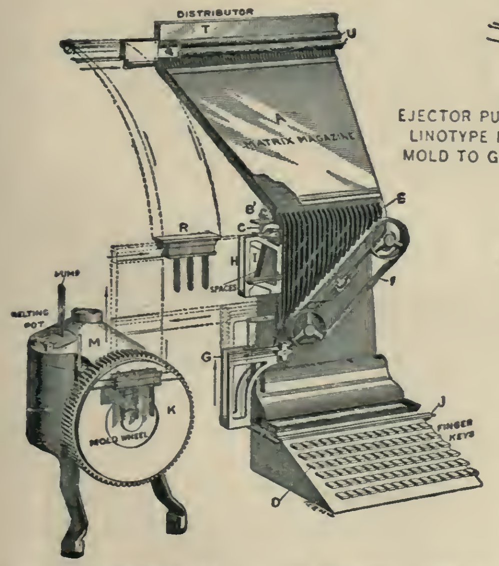


FIG. 2. MERGENTHALER LINOTYPE MACHINE SHOWING ESSENTIAL PARTS.

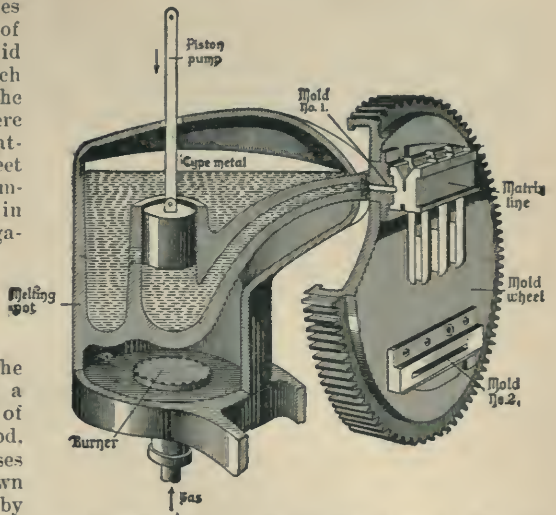


FIG. 3. MELTING POT, MOLD WHEEL, ETC., OF LINOTYPE MACHINE.

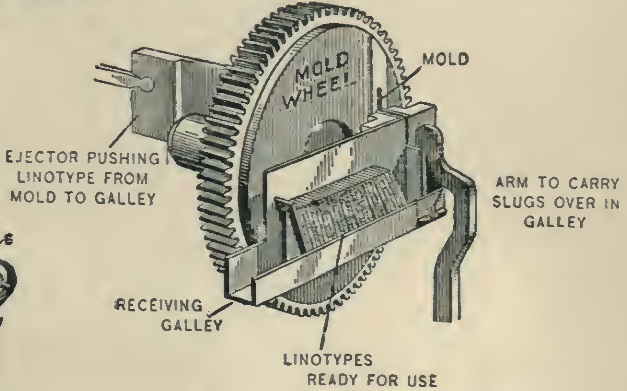

MOLD WHEEL
MOLD
EJECTOR PUSHING LINOTYPE FROM MOLD TO GALLEY
ARM TO CARRY SLUGS OVER IN GALLEY
RECEIVING GALLEY
LINOTYPES READY FOR USE

FIG. 4. MOLD WHEEL OF LINOTYPE MACHINE.

The Lanston 'Monotype' machine, like the Mergenthaler 'Linotype,' is primarily a type-casting machine, but with the radical distinction that it casts separately each letter, point, and sign, including the spaces. The machine is constructed in two parts, viz. a keyboard and a type-casting machine. The function of the keyboard is to punch a series of holes in a moving strip or ribbon of paper, which is unwound from one spool to another, passing under a series of punches in its journey. These punches are operated by striking the keys on the keyboard. The result of the keyboard operation is, therefore, a roll of perforated ribbon. This ribbon, when fed to the casting machine, initiates and controls all the operations which produce the cast type set in column width ready to take printed proofs from. See PRINTING.

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